10/1/06-02550

Final

No Further Action Report for Nine Sites

Former U.S. Naval Ammunition Support Detachment

Vieques, Puerto Rico

NAVFAC

Prepared for

Department of the Navy

Atlantic Division

Naval Facilities Engineering Command

Prepared by

CH2MHILL

October 2006

ES102006004TPA

Final

No Further Action Report for Nine Sites

Former U.S. Naval Ammunition Support Detachment Vieques, Puerto Rico

NAVFAC

Naval Facilities Engineering Command

Prepared for

Department of the Navy

Atlantic Division

Naval Facilities Engineering Command

Contract No. N62470-02-D-3052

CTO-007

Prepared by

CH2MHILL

October 2006

Final

No Further Action Report for Nine Sites

Former U.S. Naval Ammunition Support Detachment
Vieques, Puerto Rico

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Contract No. N62470-02-D-3052
CTO-007

Prepared by

CH2MHILL

October 2006

ES102006004TPA

Contents

Volume 1

Section **Page**

Acronyms and Abbreviations ..... **xii**

Executive Summary **ES-1**
Introduction ES-1
Purpose of the NFA Report ES-1
Risk-Based Criteria Screening Procedure ES-2
Data Analysis and COPC Selection ES-2
Human Health Risk Assessment ES-3
Exposure Assessment ES-3
Toxicity Assessment ES-4
Risk Characterization ES-4
Summary and Recommendations by Site ES-4
SWMU 5 — Former IRFNA/MAF-4 Disposal Site ES-5
SWMU 10 — Former Waste Paint and Solvents Disposal Ground ES-5
SWMU 14 — Former Wash Rack ES-5
SWMU 15 — Former Waste Transportation Vehicle Parking Area ES-6
AOC B — Former Wastewater Treatment Plant ES-7
AOC C — Drainage Ditch at the Former Transportation Shop ES-7
AOC F — Former UIC Septic Tank ES-7
AOC K — Former Water Well ES-8
AOC L — Abandoned Septic Tank ES-8
Areawide Groundwater Evaluation – Former Public Works Area ES-8
Conclusions ES-9

1 Introduction **1-1**
1.1 Site Background 1-1
1.2 Site History 1-2
1.3 Purpose of the NFA Report 1-3
1.4 Report Organization 1-3
1.5 Former NASD Location and Description 1-5
1.5.1 Location 1-5
1.5.2 Structures, Roads, and Other Site Features 1-5
1.5.3 Vicinity Characteristics 1-5
1.5.4 Climate 1-5
1.5.5 Topography and Surface Water 1-5
1.5.6 Regional and Site-Specific Geology 1-6
1.5.7 Regional and Site-Specific Hydrogeology 1-7
1.5.8 Conceptual Site Model 1-7
1.5.9 Current and Future Land Use 1-8

1.5.10 Background Study of the Former NASD 1-8
1.5.11 Data Quality Evaluation 1-9
1.5.12 Ecological Characterization 1-11
1.5.13 Unexploded Ordnance Assessment 1-11
1.6 Risk-Based Screening Process 1-12
1.6.1 Data Analysis Introduction 1-12
1.6.2 Groundwater Turbidity vs. Metals Concentrations 1-12
1.6.3 Summary of Sample Collection and Analysis 1-12
1.6.4 COPC Selection 1-13
1.6.4 Risk Assessment 1-14
1.6.5 COPC Identification Summary 1-14
1.6.6 Exposure Assessment 1-15
1.6.7 Exposure Route Factors 1-18
1.6.8 Exposure Quantitation 1-19
1.6.9 Toxicity Assessment 1-20
1.6.10 Risk Characterization 1-21

2 Site-Specific Decision Summary for SWMU 5 – Former IRFNA/MAF-4 Disposal Site 2-1
2.1 Description 2-1
2.1.1 Topography and Surface Water Conditions 2-1
2.1.2 Geological Conditions 2-2
2.1.3 Groundwater Conditions 2-2
2.2 Site Characterization 2-2
2.2.1 Nature and Extent of Contamination 2-2
2.2.2 Contaminant Fate and Transport 2-4
2.2.3 Summary of Data Evaluation 2-4
2.2.4 Conceptual Site Model 2-5
2.3 Ecological Assessment at the Former NASD 2-5
2.4 Human Health Risk Assessment 2-6
2.5 Conclusions and Recommendations 2-7

3 Site-Specific Decision Summary for SWMU 10 – Former Waste Paint and Solvents Disposal Ground 3-1
3.1 Description 3-1
3.2 Site Characterization 3-1
3.2.1 Nature and Extent of Contamination 3-1
3.2.2 Contaminant Fate and Transport 3-3
3.2.3 Summary of Data Evaluation 3-3
3.2.4 Conceptual Site Model 3-4
3.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMU s10, 14, 15, AOCs C and F 3-4
3.4 Human Health Risk Assessment 3-5
3.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 3-6
3.6 Summary of Site Risks 3-7
3.5 Conclusions and Recommendations 3-7

4 Site-Specific Decision Summary for SWMU 14 – Former Wash Rack 4-1
4.1 Description 4-1
4.2 Site Characterization 4-2
4.2.1 Nature and Extent of Contamination 4-2
4.2.2 Contaminant Fate and Transport 4-4
4.2.3 Summary of Data Evaluation 4-5
4.2.4 Conceptual Site Model 4-5
4.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F 4-6
4.4 Human Health Risk Assessment 4-6
4.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 4-8
4.6 Summary of Site Risks 4-9
4.5 Conclusions and Recommendations 4-9

5 Site-Specific Decision Summary for SWMU 15 – Former Waste Transportation Vehicle Parking Area 5-1
5.1 Description 5-1
5.2 Site Characterization 5-2
5.2.1 Nature and Extent of Contamination 5-2
5.2.2 Contaminant Fate and Transport 5-3
5.2.3 Summary of Data Evaluation 5-4
5.2.4 Conceptual Site Model 5-4
5.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F 5-5
5.4 Human Health Risk Assessment 5-5
5.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 5-7
5.4 Summary of Site Risks 5-7
5.5 Conclusions and Recommendations 5-8

6 Site-Specific Decision Summary for AOC B – Former Wastewater Treatment Plant 6-1
6.1 Description 6-1
6.2 Site Characterization 6-1
6.2.1 Nature and Extent of Contamination 6-1
6.2.2 Contaminant Fate and Transport 6-2
6.2.3 Summary of Data Evaluation 6-3
6.2.4 Conceptual Site Model 6-3
6.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F 6-4
6.4 Human Health Risk Assessment 6-5
6.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 6-6
6.6 Summary of Site Risks 6-6
6.7 Conclusions and Recommendations 6-6

7 Site-Specific Decision Summary for AOC C – Drainage Ditches at the Former Transportation Shop 7-1
7.1 Description 7-1
7.2 Site Characterization 7-2
7.2.1 Nature and Extent of Contamination 7-2
7.2.2 Contaminant Fate and Transport 7-3
7.2.3 Summary of Data Evaluation 7-4
7.2.4 Conceptual Site Model 7-4
7.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F 7-5
7.4 Human Health Risk Assessment 7-6
7.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 7-7
7.6 Summary of Site Risks 7-8
7.7 Conclusions and Recommendations 7-8

8 Site-Specific Decision Summary for AOC F– Former UIC Septic Tank 8-1
8.1 Description 8-1
8.2 Site Characterization 8-1
8.2.1. Nature and Extent of Contamination 8-1
8.2.2 Contaminant Fate and Transport 8-3
8.2.3 Summary of Data Evaluation 8-4
8.2.4 Conceptual Site Model 8-4
8.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F 8-4
8.4 Human Health Risk Assessment 8-5
8.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 8-6
8.4 Summary of Site Risks 8-7
8.5 Conclusions and Recommendations 8-8

9 Site-Specific Decision Summary for AOC K – Former Water Well 9-1
9.1 Description 9-1
9.2 Site Characterization 9-1
9.2.1 Nature and Extent of Contamination 9-1
9.2.2 Contaminant Fate and Transport 9-2
9.2.3 Summary of Data Evaluation 9-2
9.2.4 Conceptual Site Model 9-2
9.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F 9-3
9.4 Human Health Risk Assessment 9-4
9.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 9-5
9.4 Summary of Site Risks 9-5
9.5 Conclusions and Recommendations 9-6

10 Site-Specific Decision Summary for AOC L – Abandoned Septic Tank.....10-1
10.1 Description 10-1
10.2 Site Characterization 10-1
10.2.1 Nature and Extent of Contamination 10-1
10.2.2 Contaminant Fate and Transport 10-2
10.2.3 Data Evaluation Summary 10-2
10.2.4 Conceptual Site Model.....10-3
10.3 Ecological Assessment Summary for AOC L 10-3
10.4 Human Health Risk Assessment.....10-4
10.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 10-5
10.6 Summary of Site Risks 10-5
10.7 Conclusions and Recommendations.....10-5

11 Areawide Groundwater Evaluation for Former Main Operations Area.....11-1
11.1 Groundwater Data Description.....11-1
11.2 Groundwater Characterization 11-1
11.2.1 Nature and Extent of Contamination 11-2
11.3 Human Health Risk Assessment.....11-3
11.4 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations 11-3
11.5 Summary of Site Risks 11-4
11.6 Conclusions and Recommendations.....11-4

12 Summary and Recommendations by Site.....12-1
12.1 SWMU 5 – Former IRFNA/MAF-4 Disposal Site.....12-1
12.2 SWMU 10 – Former Waste Paint and Solvents Disposal Ground 12-2
12.3 SWMU 14 – Former Wash Rack 12-2
12.4 SWMU 15 – Former Waste Transportation Vehicle Parking Area 12-3
12.5 AOC B – Former Wastewater Treatment Plant.....12-3
12.6 AOC C – Drainage Ditch at Former Transportation Shop 12-4
12.7 AOC F– Former UIC Septic Tank.....12-4
12.8 AOC K – Former Water Well.....12-4
12.9 AOC L – Abandoned Septic Tank.....12-5
12.10 Areawide Groundwater Evaluation – Former Public Works Area.....12-5

13 References.....13-1

Volume 2

Appendices

A Responses to Comments from USEPA and PREQB
B Data Screening Tables
C Statistical Evaluations Summary
D Risk Assessment Data Tables (RAGS Part D Guidance)
E Detailed Risk Assessments for Each Site
F Analytical Resampling Data for AOC K
G Toxicity Profiles for Chemicals with Provisional Toxicity Factors
H UCL_{95} Calculation Methods and Comparisons with ProUCL Tool
I Screening Criteria (PRGs and MCLs) and Background Information

Tables **Page**

ES-1 Potentially Complete Exposure Pathways, Media, Routes and Receptors for Various Sites at the Former NASD ES-10
ES-2 COPCs Selected for Nine NFA Sites ES-11
ES-3 Risk Summary ES-12

2-1 SWMU 5 COPC Selection for Surface Soil 2-8
2-2 SWMU 5 Potentially Complete Exposure Pathways and Receptors 2-9
2-3 SWMU 5 Risk Summary 2-10

3-1 SWMU 10 COPC Selection for Surface Soils 3-8
3-2 SWMU 10 COPC Selection for Subsurface Soils 3-9
3-3 SWMU 10 Potentially Complete Exposure Pathways and Receptors 3-10
3-4 SWMU 10 Risk Summary 3-11
3-5 Background Range of Concentrations for Soil Compared to Site Concentrations 3-12

4-1 SWMU 14 COPC Selection for Surface Soils 4-10
4-2 SWMU 14 COPC Selection for Subsurface Soils 4-11
4-3 SWMU 14 COPC Selection for Groundwater 4-12
4-4 SWMU 14 Potentially Complete Exposure Pathways and Receptors 4-13
4-5 SWMU 14 Risk Summary 4-14
4-6 Background Range of Concentrations for Site Media Compared to Site Concentrations 4-15
4-7 SWMU 14 Summary of Metals Concentrations in Groundwater Wells 4-16

5-1 SWMU 15 COPC Selection for Surface Soils 5-9
5-2 SWMU 15 COPC Selection for Groundwater 5-10
5-3 SWMU 15 Potentially Complete Exposure Pathways and Receptors 5-11
5-4 SWMU 15 Risk Summary 5-12
5-5 Background Concentrations in Site Media Compared to Site Concentrations 5-13

6-1 AOC B COPC Selection for Surface Soils 6-7
6-2 AOC B COPC Selection for Subsurface Soils 6-8
6-3 AOC B Potentially Complete Exposure Pathways and Receptors 6-9
6-4 AOC B Risk Summary 6-10
6-5 Background Concentrations in Site Soils Compared to Site Concentrations 6-11

7-1 AOC C COPC Selection for Surface Soils 7-9
7-2 AOC C COPC Selection for Subsurface Soils 7-10
7-3 AOC C COPC Selection for Groundwater 7-11
7-4 AOC C Potentially Complete Exposure Pathways and Receptors 7-12
7-5 AOC C Risk Summary 7-13
7-6 Background Concentrations in Site Media Compared to Site Concentrations 7-14

8-1 AOC F COPC Selection for Subsurface Soils 8-9
8-2 AOC F COPC Selection for Groundwater 8-10
8-3 AOC F Potentially Complete Exposure Pathways and Receptors 8-11
8-4 AOC F Risk Summary 8-12
8-5 Background Concentrations in Site Media Compared to Site Concentrations 8-13

9-1 AOC K COPC Selection for Groundwater 9-7
9-2 AOC K Potentially Complete Exposure Pathways and Receptors for Groundwater 9-8
9-3 AOC K Risk Summary 9-9
9-4 Background Concentrations in Groundwater Compared to Site Concentrations 9-10

10-1 AOC L COPC Selection for Surface Soils 10-6
10-2 AOC L COPC Selection for Subsurface Soils 10-7
10-3 AOC L Potentially Complete Exposure Pathways and Receptors 10-8
10-4 AOC L Risk Summary 10-9
10-5 Background Range of Concentrations for Soils Compared to Site Concentrations 10-10

11-1 COPC Selection for Areawide Groundwater 11-5
11-2 Potentially Complete Exposure Pathways and Receptors for Areawide Groundwater at the Former Main Operations Area 11-6
11-3 Areawide Groundwater Risk Summary 11-7
11-4 Background Range of Concentrations for Groundwater Compared to Areawide Well Concentrations 11-8

12-1 Recommendations for Nine Sites 12-7
12-2 Risk Summary 12-8

Figures **Page**

ES-1 Location of NFA Sites ES-13
ES-2 Site Risk Management Process for All Sites Identified ES-14

1-1 Site Location Map 1-22
1-2 Location of NFA Sites 1-23
1-3 Aerial Photograph of SWMU 5 1-24
1-4 Aerial Photograph of SWMUs 10, 14, and 15 and AOCs B, C, F, K, and L 1-25
1-5 NASD Timeline 1-26
1-6 Site Topography 1-27
1-7 Location of Geologic Cross Sections 1-28
1-8 Geologic Cross-Section A-A' 1-29
1-9 Geologic Cross-Section B-B' 1-30
1-10 Generic Conceptual Site Model for Groundwater and Surface Water Flow 1-31
1-11 Site Risk Management Process for All Sites Identified 1-32

2-1 Ditch at SWMU 5, Facing Northeast 2-11
2-2 Ditch at SWMU 5, Facing Southwest 2-11
2-3 SWMU 5 and Cattle Cooperative Well 3PW01 Site Location 2-12
2-4 SWMU 5 Soil Sample Locations 2-13
2-5 SWMU 5 Surface Soil Detections Above Screening Criteria 2-14
2-6 Conceptual Site Model for SWMU 5 2-15

3-1 SWMU 10 Waste Paint and Solvents Disposal Ground (2000), Facing North 3-13
3-2 SWMU 10 Waste Paint and Solvents Disposal Ground (2002), Facing North 3-13
3-3 SWMU 10 Soil Sample Locations 3-14
3-4 SWMU 10 Soil Detections Above Screening Criteria 3-15
3-5 Conceptual Site Model for SWMU 10 3-16

4-1 SWMU 14 Former Wash Rack (2000), Facing South 4-17
4-2 SWMU 14 Former Wash Rack (2002), Facing South 4-17
4-3 SWMU 14 Soil and Groundwater Sample Locations 4-18
4-4 SWMU 14 Surface Soil Detections Above Screening Criteria 4-19
4-5 SWMU 14 Subsurface Soil and Groundwater Detections Above Screening Criteria 4-20
4-6 Conceptual Site Model for SWMU 14 4-21

5-1/5-2 SWMU 15 Former Waste Transportation Vehicle Parking Area 5-14
5-3 SWMU 15 Soil and Groundwater Sample Locations 5-15
5-4 SWMU 15 Soil and Groundwater Detections Above Screening Criteria 5-16
5-5 Conceptual Site Model for SWMU 15 5-17

6-1 AOC B Former Wastewater Treatment Plant Equipment (2002) 6-12
6-2 AOC B Former Wastewater Treatment Plant Showing the Fence (2002) 6-12
6-3 AOC B Soil Sample Locations 6-13
6-4 AOC B Surface Soil Detections Above Screening Criteria 6-14
6-5 Conceptual Site Model for AOC B 6-15

7-1 AOC C Drainage Ditch Looking North (2000) 7-15
7-2 AOC C Drainage Ditch Looking North (2002) 7-15
7-3 AOC C Soil and Groundwater Sample Locations 7-16
7-4 AOC C Soil and Groundwater Detections Above Screening Criteria 7-17
7-5 Conceptual Site Model for AOC C 7-18

8-1 AOC F Former Septic Tank Area (Facing West) 8-14
8-2 AOC F Former Septic Tank Area (Facing North) 8-14
8-3 AOC F Soil and Groundwater Sample Locations 8-15
8-4 AOC F Soil and Groundwater Detections Above Screening Criteria 8-16
8-5 Conceptual Site Model for AOC F 8-17

9-1 AOC K Former Water Well Area (Well is Behind the Coconut Palms Across the Street) 9-11
9-2 AOC K Former Water Well (Closer View of Well Location) 9-11
9-3 AOC K Groundwater Sample Locations 9-12
9-4 AOC K Groundwater Detections Above Screening Criteria 9-13
9-5 Conceptual Site Model for AOC K 9-14

10-1 AOC L Abandoned Septic Tank Area (Facing North to Caribbean) 10-11
10-2 AOC L Abandoned Septic Tank Area (Vines Covering the Vault Grates and Adjacent Offsite Brush) 10-11
10-3 AOC L Soil Sample Locations 10-12
10-4 AOC L Soil Detections Above Screening Criteria 10-13
10-5 Conceptual Site Model for AOC L 10-14

11-1 Monitoring Well Locations in the Public Works Area 11-9
11-2 Groundwater Detections Above Screening Criteria 11-10

Acronyms and Abbreviations

AOC	Area of Concern
AST	Aboveground Storage Tank
AT	averaging time
ATSDR	Agency for Toxic Substance and Disease Registry
BEHP	Bis(2-ethylhexyl)phthalate
BEQ	benzo(a)pyrene equivalents
bls	below land surface
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethylbenzene, and xylene
BW	body weight
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CRDL	Contract Required Detection Limits
CFR	Code of Federal Regulations
COPC	Chemical of Potential Concern
CSM	conceptual site model
DAF	Dilution Attenuation Factor
DOE	Department of Energy
DOI	Department of Interior
EBS	Environmental Baseline Survey
ECAO	Environmental Criteria and Assessments Office
ECOSD	Ecological Comparison Criteria for Sediment
ED	exposure duration
EF	exposure frequency
ELCR	excess lifetime cancer risk
EPA	Environmental Protection Agency
EPC	Exposure point concentration
EOD	Explosive Ordnance Demolition
ERB	Equipment Rinsate Blank
°F	degrees Fahrenheit
FDEP	Florida Department of Environmental Protection
FOSET	Finding of Suitability for Early Transfer
ft	foot (feet)
gal	gallon

HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
ICR	Incremental lifetime cancer risk
IDL	Instrument Detection Limit
IR	Installation Restoration
IRFNA	inhibited red fuming nitric acid
IRIS	Integrated Risk Information System
km	kilometer
L	liter
LANTDIV	Atlantic Division of the Navy
lb	pound
LCS	Laboratory Control Sample
m3	cubic meter
µg/L	micrograms per liter
MAF	mixed amine fuels
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOV	Municipality of Vieques
msl	mean sea level
N	north
NAF	Naval Ammunition Facility
NASD	Naval Ammunition Support Detachment
NCP	National Oil and Hazardous Contingency Plan
NFA	no further action
NPL	National Priority List
NSRR	Naval Station Roosevelt Roads
OB/OD	Open Burn/Open Detonation
O/E	Ordnance/Explosives
OSWER	Office of Solid Waste and Emergency Response
OWS	oil/water separator
PAHs	polycyclic aromatic hydrocarbon
PA/SI	Preliminary Assessment/Site Investigation
PC	permeability constant
PCB	polychlorinated biphenyl

PEF	particulate emission factor
PMC	Program Management Company
ppm	parts per million
PQL	Practical Quantitation Limit
PRCT	Puerto Rico Conservation Trust
PRE	Preliminary Risk Evaluation
PRG	Preliminary Remediation Goal
PREQB	Puerto Rico Environmental Quality Board
QA/QC	quality assurance/quality control
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RBC	Risk-Based Criteria
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
sf	square feet (foot)
SSL	Soil Screening Level
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAPP	Technical Assistance for Public Participation
TCL	target chemical list
TEF	toxicity equivalent factor
TPH	total petroleum hydrocarbon
UIC	Underground Injection Control
UCL	upper confidence limit
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground storage tank
UXO	Unexploded ordnance
VOC	volatile organic compound
W	west
WWTP	wastewater treatment plant
yr	year

Executive Summary

Introduction

The former Naval Ammunition Support Detachment (NASD) property, located on Vieques Island, Puerto Rico, was transferred to the Municipality of Vieques and the U.S. Department of Interior (DOI) on April 30, 2001. As part of the transfer, seven Solid Waste Management Units (SWMUs) and ten Areas of Concern (AOCs) were investigated through the U.S. Environmental Protection Agency's (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Figure ES-1 shows the former NASD and the sites.

Expanded Preliminary Assessment/Site Investigations (PA/SIs) were conducted in two phases at these 17 sites, which are located within the former NASD, to characterize the site soils, groundwater, sediment, and surface water for possible hazardous waste releases. If the risk-based evaluation of the data collected during the two phases of the PA/SI indicated that a site's conditions do not present human health or ecological concerns, then the site was recommended for No Further Action (NFA). Of the 17 sites investigated, eight sites were recommended for a Remedial Investigation/Feasibility Study (RI/FS), and nine sites were recommended for NFA. Details of the previously conducted studies can be found in the *Final Expanded Preliminary Assessment/Site Investigation Report, U.S. NASD, Vieques Island, Puerto Rico* (CH2M HILL, October 2000) and the *Final Expanded Preliminary Assessment/Site Investigation Report, Phase II, U.S. NASD, Vieques Island, Puerto Rico* (CH2M HILL, November 2002). This NFA report includes a risk assessment for only the sites that were determined not to present excessive risks due to site contamination. The remaining eight sites were included for further evaluation according to the risk management process, which is presented in Figure ES-2. The following nine sites are recommended for NFA and are the focus of this report:

- SWMU 05 — Former IRFNA/MAF-4 Disposal Site (Section 2.0)
- SWMU 10 — Former Waste Paint and Solvents Disposal Ground (Section 3.0)
- SWMU 14 — Former Wash Rack (Section 4.0)
- SWMU 15 — Former Waste Transportation Vehicle Parking Area (Section 5.0)
- AOC B — Former Wastewater Treatment Plant (WWTP) (Section 6.0)
- AOC C — Drainage Ditch at Former Transportation Shop (Section 7.0)
- AOC F — Former UIC Septic Tank (Section 8.0)
- AOC K — Former Water Well (Section 9.0)
- AOC L — Abandoned Septic Tank (Section 10.0)

Purpose of the NFA Report

The purpose of this NFA report is to present the supporting documentation that led to the recommended NFA status for the nine sites located within the former NASD. As part of the NFA documentation for each site, a brief site history and an evaluation of the previous

investigations is presented in the site-specific decision summaries (Sections 2.0 through 10.0). The analytical results of the samples collected to date are included to demonstrate that the nature and extent of chemical concentrations at each NFA site have been sufficiently characterized. In addition, this report presents risk assessments for each site, which were not presented in the Expanded PA/SI Reports. In accordance with the latest guidance on background evaluations, no chemicals were eliminated from risk estimations, even if they were detected at similar concentrations to background levels. Each site-specific decision summary presents a comparison of the chemicals detected in the background with the site concentrations; a site disposition recommendation is then made based upon whether a chemical is present at the site due to background conditions or not. This draft final NFA report document was revised according to the comments received by the Atlantic Division of the Navy (LANTDIV), from EPA Region 2, and the Puerto Rico Environmental Quality Board (PREQB) on the draft version of the document (*Draft NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico* [CH2M HILL, November 2002]).

Based on the comments received from EPA and PREQB, this draft final report was revised to include a revised risk assessment according to the RAGS Part D Guidance, and to update all the screening criteria to 2002 PRGs and MCLs. Additionally, Section 1.0 includes a summary of the past studies that reported the absence of UXO/OE items within the Public Works Area where eight of the nine NFA site were located. A summary of the sampling and analysis and the data quality evaluation (DQE) conducted as part of the past two phases of the PA/SIs was also included in this revised report. EPA, PREQB, and DOI requested that a sitewide groundwater evaluation be included as part of this report, which is provided in Section 11.0. Each site-specific decision summary section also includes a summary of ecological survey and impact assessment conducted during the two phases of the expanded PA/SI.

Risk-Based Criteria Screening Procedure

An ecological survey and qualitative impacts assessment was previously conducted and documented in the Expanded PA/SI Reports. A summary of the survey findings are included in each site-specific evaluation section. A human health risk assessment was conducted according to the EPA and PREQB recommendations, and formatted according to EPA RAGS Part D guidance.

Data Analysis and COPC Selection

The screening evaluation of the data for each site is based on validated analytical results obtained from previous investigations conducted from April through December 2000. For the first Expanded PA/SI Report (i.e., Phase I) (CH2M HILL, October 2000), the analytical results were screened against EPA Region 3 Risk-Based Criteria (RBCs). For the Final Expanded PA/SI Report - Phase II (CH2M HILL, November 2002), analytical results were screened against the EPA Region 9 Preliminary Remediation Goals (PRGs).

The maximum detected concentrations of chemicals at each site were rescreened in this NFA report by comparing against the most current EPA Region 9 screening criteria for each matrix: residential and industrial risk-based concentrations (i.e, PRGs) and leachability criteria for soil (i.e., soil screening levels [SSLs] based on a dilution attenuation factor

[DAF]=20); tap water PRGs; and drinking water Maximum Contaminant Levels (MCLs) for groundwater. The PRGs for the noncarcinogenic chemicals were divided by 10 to represent a hazard index (HI) level of 0.1 for data screening.

Any constituents with concentrations below the PRGs were eliminated. Any constituents with concentrations above the PRGs were retained as chemicals of potential concern (COPCs). All identified COPCs were evaluated through a focused human risk evaluation at each of the nine sites according to EPA's *Risk Assessment Guidance for Superfund; Volume 1, Human Health Evaluation Manual (Part A*) (EPA, 1989) and other relevant EPA guidance. The screening evaluation results were used to define the nature and extent of soil and groundwater contamination at each site. Although several of the inorganic chemicals were detected above the PRGs but below background concentrations, no chemicals were eliminated based on occurrence in the background, as recommended by the reviewing agencies and EPA background guidance.

Human Health Risk Assessment

A human health risk assessment was conducted for each of the nine sites at the former NASD to assess potential human health risks and hazards. This assessment was conducted according to the procedures and assumptions provided in EPA's *Risk Assessment Guidance for Superfund; Volume 1, Human Health Evaluation Manual (Part A*); all risk estimation tables were formatted according to the EPA's *Risk Assessment Guidance for Superfund; Volume 1, Human Health Evaluation Manual (Part D*) (EPA, 2001), which is referred to as RAGS Part D in this document. The detailed risk assessments for each site are provided as Appendix D to this report, and a summary of the risk assessment is included in the text for each site. The general approach to the risk assessment is included in Section 1.0, and a detailed risk assessment and uncertainty discussion were included in Appendix E.

Figure ES-2 shows the risk assessment process, which includes COPC identification, an exposure assessment, a toxicity assessment, and a risk characterization. Risk assessment results and background comparisons are used as the basis for the NFA recommendation at each of the nine sites.

A conceptual site model (CSM) was developed to provide an overview of site conditions and to identify potential migration pathways, receptors, and exposure routes. This model serves as the basis for the exposure pathway evaluations in the focused human health risk assessment. The site-specific CSM is presented at the end of the site-specific decision summaries.

Exposure Assessment

An exposure assessment was used to evaluate the potential exposure of the site media to the human receptors, which were identified for each site based on current or anticipated future land use. The exposure assessment included potential exposure pathways for human receptors, potential routes of exposure, assumed exposure factors, and estimated exposure point concentrations (EPCs). The following exposure routes were evaluated: ingestion, dermal contact, and inhalation. These exposure routes included in Appendix D, which have been updated according to the review comments from EPA and PREQB. Table ES-1 presents a list of all the potential receptors identified for various exposure pathways. Based on the

presence of COPCs in each medium, the corresponding receptor was evaluated using conservative exposure assumptions. Subsurface soil was evaluated for direct exposure to future construction workers, and soils up to 10 feet below land surface (ft bls) were used for exposures during excavation as explained in Section 1.0.

Toxicity Assessment

The human health risk assessment includes a toxicity assessment that contains the toxicity criteria for use in cancer risk and hazard index estimates. The toxicity criteria were obtained from the Integrated Risk Information System (IRIS), a database that is available on the Internet (see References Section 13.0 for website address). Provisional toxicity factors for chemicals with no values on IRIS were obtained from the EPA Region 2 risk assessor. The reference doses (RfDs) for non-cancer toxicity end-point based criteria are included in Table 5 of Appendix D of each site, and cancer slope factors and weight of evidence classification for each of the COPCs identified in the site media are listed in Table 6 of Appendix D for each site.

Risk Characterization

Information from the exposure and toxicity assessments was integrated to estimate the potential cancer risks and non-cancer HI according to the EPA guidance. The cumulative risks and HIs were then compared against the acceptable risk ranges. The conservative nature of the analysis and uncertainties inherent in the risk assessment were considered when interpreting results.

While no chemicals were eliminated from the risk calculation based on their occurrence in background, at the end of the risk assessment a comparison of site inorganic chemical levels with background levels was made for a risk management decision. Chemicals that occur in background conditions were included as they attribute risks to a site, even though these chemicals are not likely to be related to specific activities at a site. Following the EPA's recommendation to keep the background chemicals in risk calculations, the site risk management assessment included the evaluation of the background chemical concentrations for chemicals that are commonly found in natural soils and groundwater. The uncertainty analysis included at the end of each site-specific risk assessment section, and which is presented in Appendix E, qualitatively discusses the uncertainty associated with the estimated risks.

Summary and Recommendations by Site

Sections 2.0 through 10.0 of this report provide detailed recommendations for each site; these recommendations are summarized in this section. An areawide risk assessment for the shallow water table aquifer monitored during site investigations is evaluated as a single exposure unit as recommended by EPA and PREQB, and is presented in Section 11.0. Table ES-2 lists the COPCs selected for each site. As can be noted from this table, the majority of the chemicals identified as COPCs are inorganic chemicals. Table ES-3 summarizes the risks for the various exposure scenarios.

The cancer risks at all nine sites proposed for NFA in this report were within acceptable limits. The HI was above the target value of 1.0 from inorganic chemicals in site

groundwater. The groundwater samples had high turbidity during sampling, and the dissolved metals measurements from the same wells did not have elevated metals. Only the total metals were included in the risk and hazard estimations, according to the EPA Region 2 risk assessment guidance for a conservative risk analysis. Where site-specific upgradient wells were available, the elevated metals in groundwater are also observed in these upgradient wells. A risk assessment summary in the form of a table is included for each site included in this report.

SWMU 5 — Former IRFNA/MAF-4 Disposal Site

SWMU 5 is located near Magazine Building 422. In 1975, approximately 7,000 pounds (lbs) of fuel were emptied from leaking AQM-37A target drones into a low spot in a road near Building 422. The fuel contained 5,275 lbs of inhibited red fuming nitric acid (IRNFA) and 1,775 lbs of mixed amine fuels (MAF)-4, which were emptied into an intermittent stream. No COPCs related to the disposal of IRFNA/MAF-4 were identified in surface or subsurface soil. The only COPC identified at SWMU 5 is benzo[a]pyrene, which is a constituent of burned oils and asphalt material (this material was not identified as part of the original spill/release). There is an asphalt-paved road within the site; thus, the COPC could be from a fuel oil spill/release or from runoff associated with the asphalt road. The risks from exposure to benzo[a]pyrene were estimated for future maintenance workers, industrial workers, recreational adults and children, and residential adults and children. All the risks were well within the acceptable risk limits between 1 and 100 in a million (10-6 to 10-4). SWMU 5 does not present a health risk to current or future receptors. No COPCs were identified in subsurface soil, therefore, the exposure pathway for future construction workers is incomplete.

SWMU 10 — Former Waste Paint and Solvents Disposal Ground

SWMU 10 consists of an area of soil outside the Paint Locker, Building 4001, in the former Main Operations Area of the former NASD. SWMU 10 was used from the mid-1970s until approximately 1990. Small quantities (less than 1 gallon) of paints, solvents, and thinners were allegedly disposed of on the ground outside Building 4001 during this time. Signs were posted at SWMU 10 to restrict access until the CERCLA process is completed in the surrounding area.

Five metals (arsenic, manganese, thallium, aluminum, and iron) were selected as COPCs based on their exceedance of the screening criteria. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential adult exposure. For a residential child, the HI exceeds the acceptable limit, primarily from iron in surface soils (see Table ES-3); however, the target organ-specific HI is below a value of 1.0. Iron concentrations in surface soils are within the range of background concentrations found in the unimpacted soils at the former NASD. Therefore, any health hazard that may be present in SWMU 10 soils from iron is not specific to the site.

SWMU 14 — Former Wash Rack

SWMU 14 is immediately west of the former Transportation Shop (Building 2016) in the Main Operations Area, and was in use from the late 1970s until December 2000. The area is a

concrete driveway with 4-inch-high curbs on each side and ramps on each end, measuring approximately 20-ft long by 10-ft wide. The area was used primarily for cleaning Navy vehicles. The concrete bermed area drained into an oil/water separator (OWS) prior to discharge to an open ditch. A swale at the end of the unit facilitates the discharge of runoff water to the ditch, which eventually discharges to the Atlantic Ocean. The OWS associated with SWMU 14 was removed in December 2000. Field testing of soils for volatiles using Organic Vapor Meter (OVM) measurements during the removal activities indicated no evidence of volatile chemical contamination. A chain-link fence and signs were installed around SWMU 14 and other sites within the proximity, including SWMU 15 and AOC E, and will remain in place until the CERCLA process is completed for the surrounding area.

The COPCs selected for SWMU 14 are listed in Table ES-2. They include six metals (aluminum, arsenic, iron, manganese, thallium, and vanadium) in surface soils, one metal (thallium) in subsurface soil, and arsenic and dieldrin in groundwater. None of these COPCs appear to be associated with the former vehicle washing activities at SWMU 14. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, recreational receptors, and residential adult receptors. Of the two monitoring wells installed at SWMU 14, one is upgradient of the site, and one is immediately downgradient of the site. The upgradient well is used for comparison with groundwater for this site and other sites downgradient of SWMU 14. There are no carcinogenic risks above acceptable limits from ingestion of site groundwater. The health hazard associated with the ingestion of groundwater by a residential child is slightly above 1.0; however, no individual target organ-specific HI exceeded a value of 1.0. Site downgradient well chemicals are well below inorganic chemicals in the upgradient well levels. This site does not present an excessive risk or hazard to human health.

SWMU 15 — Former Waste Transportation Vehicle Parking Area

SWMU 15 was a Navy truck storage area located near the former Transportation Shop in the Main Operations Area. The truck was reported to have contained drums of a waste labeled as caustic D002 (EPA code for corrosive waste). The drums allegedly contained napalm from NSRR. The truck contained 55-gallon metal drums and overpacked drums. The waste drums and transport vehicles were removed from SWMU 15. A chain-link fence and signs were installed around SWMU 15 and will remain until the CERCLA process is completed for the surrounding area.

Seven metals (aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium) and one semivolatile organic compound (SVOC) (benzo[a]pyrene) were selected as COPCs for surface soil; six metals (aluminum, antimony, chromium, iron, manganese, and vanadium) were selected as COPCs for groundwater. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential adult receptors. For a residential child, the HI exceeds the acceptable limit, primarily from iron in surface soils and groundwater. The wells had high turbidity during sampling, though sampling procedures were conducted according the EPA protocol. The cancer risks were within the acceptable limits for all the receptors including maintenance workers, industrial workers, recreational adults and children, and residential receptors. The non-cancer HIs were also below a target value of 1.0 for all the receptors, except for residential adults and children. The health hazard effects are above a

target level of 1.0, due to iron levels in groundwater for future groundwater potable use from the shallow water table. However, the water table in the shallow aquifer at the site is of low yield capacity, and the wells ran dry during sampling. Iron concentrations in surface soils and groundwater are within the range of background concentrations found at the former NASD. Therefore, any health hazard that may be present in SWMU 15 groundwater is likely from suspended particle-bound metals. Dissolved metals from these wells were much lower in concentration, thereby supporting this assumption.

AOC B — Former Wastewater Treatment Plant

AOC B is at the former NASD WWTP in the Main Operations Area. The WWTP, operated from 1983 until 2000, served as the primary treatment system for municipal discharge from the former Main Operations Area within the former NASD. The WWTP consisted of one aeration tank and one separation tank with two blowers to supply air for biological treatment. The effluent from the WWTP drained into a series of four lagoons, which had no discharge point.

Six metals (aluminum, arsenic, iron, manganese, thallium, and vanadium) were identified as COPCs in the surface soil. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential adult receptors. For a residential child, the HI slightly exceeds the target value of 1.0, primarily from iron in surface soils. However, no single target organ-specific HI was above 1.0. In addition, the iron concentrations in surface soils are within the range of background soil iron concentrations at the former NASD. Therefore, any health hazards are not specific to AOC B.

AOC C — Drainage Ditch at the Former Transportation Shop

AOC C is located in the Main Operations Area near the former Transportation Shop. Located on each side of the entrance road near the shop, two parallel drainage ditches routinely handled storm water runoff during rain events. An oily sheen was observed in one of the ditches during a visual site inspection in 1988. Also located in this area is a septic tank that collects wastewater from one sink inside the former Transportation Shop.

Only metals were selected as COPCs in surface soil (aluminum, arsenic, iron, manganese, thallium, and vanadium), subsurface soil (aluminum, iron, and thallium), and groundwater (aluminum, chromium, iron, manganese, and vanadium). The cancer risks and HI values for these metals are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential adult receptors. For a residential child, the HI exceeds the acceptable limit, primarily from iron in groundwater. The iron levels in soil and groundwater at the site are similar to those detected in background. Therefore, any health hazard that may be present at the site are not specific to the site.

AOC F — Former UIC Septic Tank

AOC F is near the Enlisted Men's Club in the former Main Operations Area. The septic tank has a capacity of 1,500 gallons and was closed in 1997. A preliminary investigation in July 1997 detected several metals present at concentrations that exceeded the applicable screening criteria. This site was further investigated during the Expanded PA/SI.

Metals selected as COPCs included aluminum, arsenic and iron in subsurface soils and aluminum, antimony, chromium, iron, manganese, and vanadium in groundwater. The cancer risks are within acceptable limits for all receptors. HIs are within acceptable limits for an industrial worker and residential adult receptor. However, the target HI of 1.0 was exceeded for future potable use under a residential child scenario. The exceedance of the target HI of 2.0 is due to the presence of aluminum and iron in groundwater. Iron and other metals are due to suspended soil particles in groundwater samples.

AOC K — Former Water Well

AOC K consists of one 8-inch-diameter well completed to 69 ft bls northeast of the barracks in the former Main Operations Area. The well was used for potable water supply between 1941 and 1979, but has since been abandoned. The AOC K well was rehabilitated in 1997 as part of a water well investigation conducted by the U.S. Geological Survey (USGS) at the former NASD.

Six metals (aluminum, barium, iron, manganese, thallium, and vanadium) were selected as COPCs for groundwater. The health hazard effects are within acceptable limits for an industrial worker. There is a slightly elevated HI associated with residential adult exposure to thallium in groundwater, but it is within the range of acceptable health effects. For a residential child, the HI exceeds the acceptable limit, primarily from thallium and iron in groundwater. The thallium levels are highest in the two upgradient wells at the site. Iron and thallium concentrations in groundwater are within the range of concentrations found across presumably uncontaminated areas of the former NASD and may be the result of a widespread presence of this and other inorganic metals in Vieques Island soils. The detected metals at this site all others is likely due to low-yield, poor quality shallow aquifer water that is reported to have high turbidity during sampling. Therefore, any health hazard that may be present in AOC K groundwater from iron or thallium is not likely site-related.

AOC L — Abandoned Septic Tank

AOC L consists of a 25-ft by 40-ft concrete septic vault with separate compartments near the beach north of the Main Operations Area. It is suspected that the vault was used in 1941 for treatment and disposal of installation sewage. The vault has been out of service since 1942, and there are no indications that the vault was used for industrial purposes.

Four metals (aluminum, arsenic, iron, and manganese) were selected as COPCs for surface soil. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential adult receptors. For a residential child, the HI is equal to the minimum acceptable limit, primarily from iron in surface soils. However, iron concentrations are within the range of background concentrations. Therefore, this site does not present an unacceptable risk to human health.

Areawide Groundwater Evaluation – Former Public Works Area

Groundwater samples were collected from certain sites located within the former Public Works Area. These five sites included SWMU 14, SWMU 15, AOC C, AOC F and AOC K, where wells had been installed to investigate groundwater. The wells from the five NFA sites included in the site-specific evaluations in this NFA report are evaluated to determine

areawide groundwater quality within the former Public Works Area, and also to determine the potential exposure related risks from potable use of the area groundwater. The shallow water table in this area is not of adequate production capacity to serve as a potable source, as observed during well monitoring at different sites during the two phases of PA/SI. Thus, this evaluation is primarily for comparison purposes, and was added at the request of the reviewing agencies.

The groundwater in the shallow water table is greater than 40 ft below surface (ft bls). The shallow aquifer has poor yield; thus; during sampling the groundwater had high turbidity and often ran dry when sampled (in spite of the 24 hours allowed for stabilization purposes). The samples were high in suspended material, which includes soil particles. The high turbidity contributed to the high metals measured in the samples. Because of the high turbidity noted during field sampling, each sample was also analyzed for dissolved metals, which were much lower in concentration, and indicated that the measured total metals were mostly from suspended particles. Only the total metals concentrations were used for the risk assessment.

The exposure concentrations were mostly the maximum detected concentrations. The cancer risks from groundwater in the shallow water table are within acceptable limits for industrial workers and future residential receptors. Metals concentrations detected in shallow groundwater resulted in hazard indices (His) above acceptable limits for residential adult and child receptors. The primary contributor, thallium, is from the upgradient wells (upgradient of AOCK, Former Water Supply Well Area) to the former Public Works Area, and thus is not specific to any of the sites. The secondary contributor is iron, which is similar in concentration to the background levels. In addition, detected metals were elevated in background and site wells due to turbidity in the samples which could not be avoided due to the nature of low yield aquifer occurring in this area. Observed metals are from suspended soil particles. Dissolved levels of all the metals are within the acceptable limits. None of the chemicals from site wells are above the Maximum Contaminant Levels (MCLs).

Conclusions

Based on conservative analysis of the potential for human health risks at each of the nine sites, there are no risks above acceptable limits. Although some HIs derived were above a target value of 1.0 from the presence of some of the inorganic chemicals identified in the soil and groundwater, none of these chemicals are above those detected in background soils and groundwater. The wells across the former NASD had similar metals concentrations, and wells were reported to have high turbidity during PA/SI sampling reporting. In fact, these are the same chemicals identified as COPCs that were also detected at similar concentrations in background settings. No ecological or human health impacts are identified from historical activities at these former NASD sites. No further investigation or remedial action for the soils or groundwater is necessary. Therefore, these nine sites are recommended for NFA and subsequent closure.

TABLE ES-1

Potentially Complete Exposure Pathways, Media, Routes and Receptors for Various Sites at the Former NASD

NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	**Media**	**Exposure Route and Point of Exposure**
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils
Industrial Worker	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater
Construction Worker	Subsurface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils
Residents	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater

TABLE ES-2
COPCs Selected for Nine NFA Sites
NFA Report for Nine Sites, Former NASD, Vieques Island

Site ID	Description	COPCs	Unacceptable Human Health Risk?	COPCs Above Background?
SWMU 05	Former IRFNA/MAF-4 Disposal Site	Benzo[a]pyrene	No	NA
SWMU 10	Former Waste Paint and Solvents Disposal Ground	Aluminum, arsenic, chromium, iron, manganese, and thallium	No	No
SWMU 14	Former Wash Rack	Aluminum, arsenic, chromium, iron, manganese, thallium, vanadium, and dieldrin	No	No
SWMU 15	Former Waste Transportation Vehicle Parking Area	Aluminum, arsenic, chromium, iron, manganese, thallium, vanadium, and benzo(a)pyrene	Yes	No
AOC B	Former Wastewater Treatment Plant	Aluminum, arsenic, iron, manganese, thallium, and vanadium	No	No
AOC C	Drainage Ditch at Former Transportation Shop	Aluminum, arsenic, iron, manganese, thallium, and vanadium	Yes	No
AOC F	Former UIC Septic Tank	Aluminum, antimony, arsenic, chromium, iron, manganese, and vanadium	Yes	No
AOC K	Former Water Well	Aluminum, barium, chromium, iron, manganese, and vanadium	Yes	No
AOC L	Abandoned Septic Tank	Aluminum, arsenic, iron, manganese	No	No
Areawide Groundwater	Groundwater as Single Unit in Former Main Operations Area	Aluminum, antimony, barium, chromium, iron, manganese, thallium, vanadium	Yes	No

COPC – chemical of potential concern
NA – not applicable/not available

TABLE ES-3
Risk Summary
NFA Report for Nine Sites, Former NASD, *Vieques Island, Puerto Rico*

Receptor	Site Risk	SWMU 05	SWMU 10	SWMU 14	SWMU 15	AOC B	AOC C	AOC F	AOC K	AOC L	Combined Groundwater
Maintenance Worker	ELCR	8.7E-08	5.2E-07	2.2E-07	3.1E-07	6.0E-08	1.4E-07	NA	NA	1.3E-07	NA
	HI	0	0.021	0.027	0.025	0.020	0.020	NA	NA	0.017	NA
Industrial Worker	ELCR	4.2E-07	2.5E-06	1.6E-06	1.5E-06	2.9E-07	6.7E-07	NC	NC	6.3E-07	5.6E-07
	HI	0	0.10	0.13	0.77	0.088	0.43	1.3	1.5	0.08	1.8
Recreational Adult	ELCR	2.2E-07	1.1E-06	4.8E-07	6.9E-07	1.3E-07	3.0E-07	NA	NA	2.8E-07	NA
	HI	0	0.044	0.057	0.052	0.041	0.041	NA	NA	0.035	NA
Recreational Child	ELCR	2.9E-07	2.1E-06	9.0E-07	1.2E-06	2.4E-07	5.6E-07	NA	NA	5.3E-07	NA
	HI	0	0.36	0.47	0.42	0.35	0.35	NA	NA	0.30	NA
Construction Worker	ELCR	NA	NC	NC	NA	NC	NC	NC	NA	4.8E-08	NA
	HI	NA	0.14	0.24	NA	0.25	0.23	0.26	NA	0.17	NA
Residential Adult	ELCR	4.6E-07	3.1E-06	2.8E-06	1.8E-06	3.6E-07	8.4E-07	NC	NC	7.9E-07	1.5E-06
	HI	0	0.14	0.20	2.1	0.13	1.1	3.7	4.3	0.11	5.0
Residential Child	ELCR	9.6E-07	7.1E-06	3.9E-06	4.0E-06	8.2E-07	1.9E-06	NC	NC	1.8E-06	8.8E-07
	HI	0	1.2	1.6	6.0	1.2	3.6	8.7	10.1	1.0	11.9

ELCR = Excess Lifetime Cancer Risk

HI = Hazard Index

NA = Not Applicable NC = No carcinogenic COPCs identified

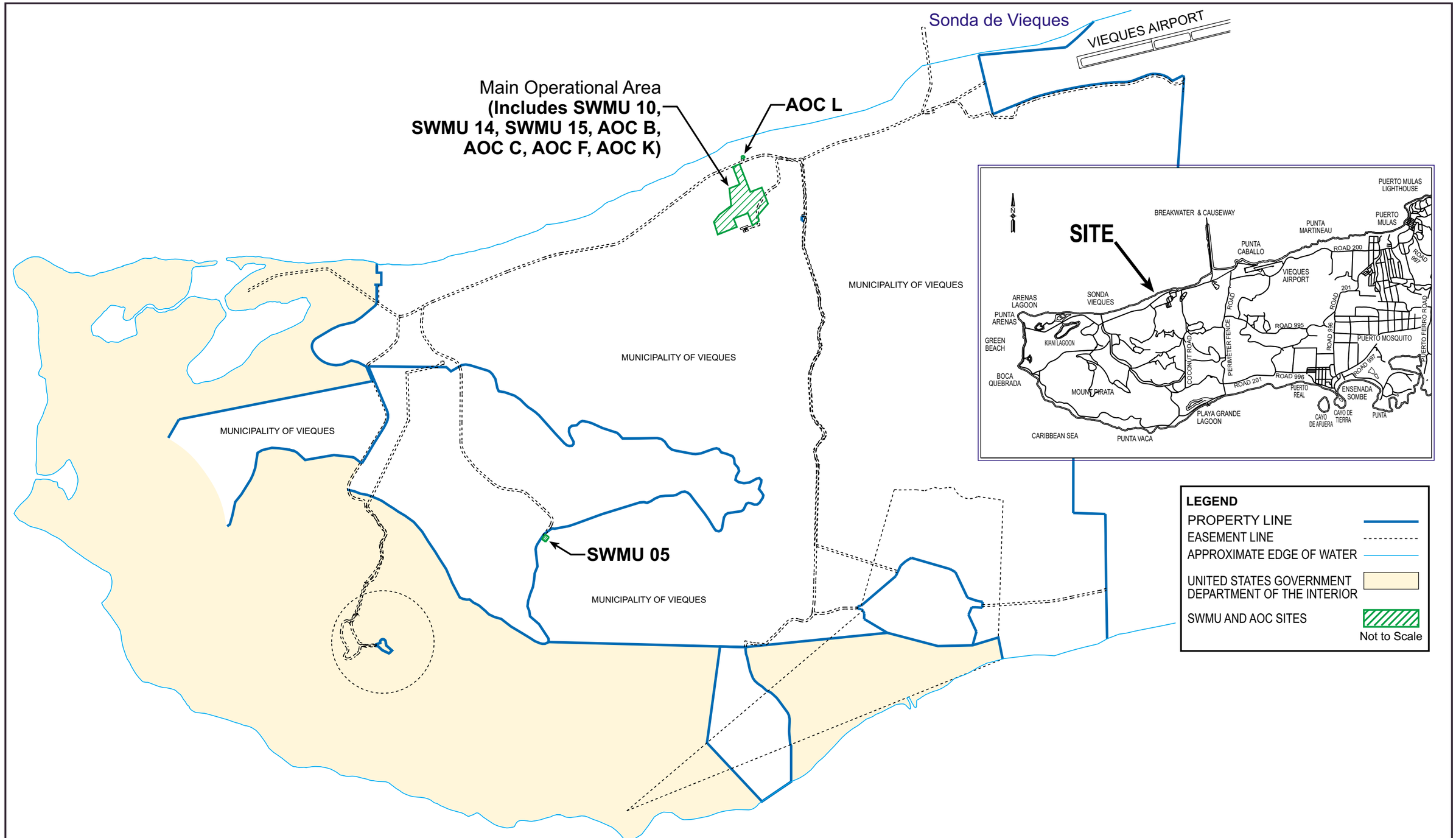
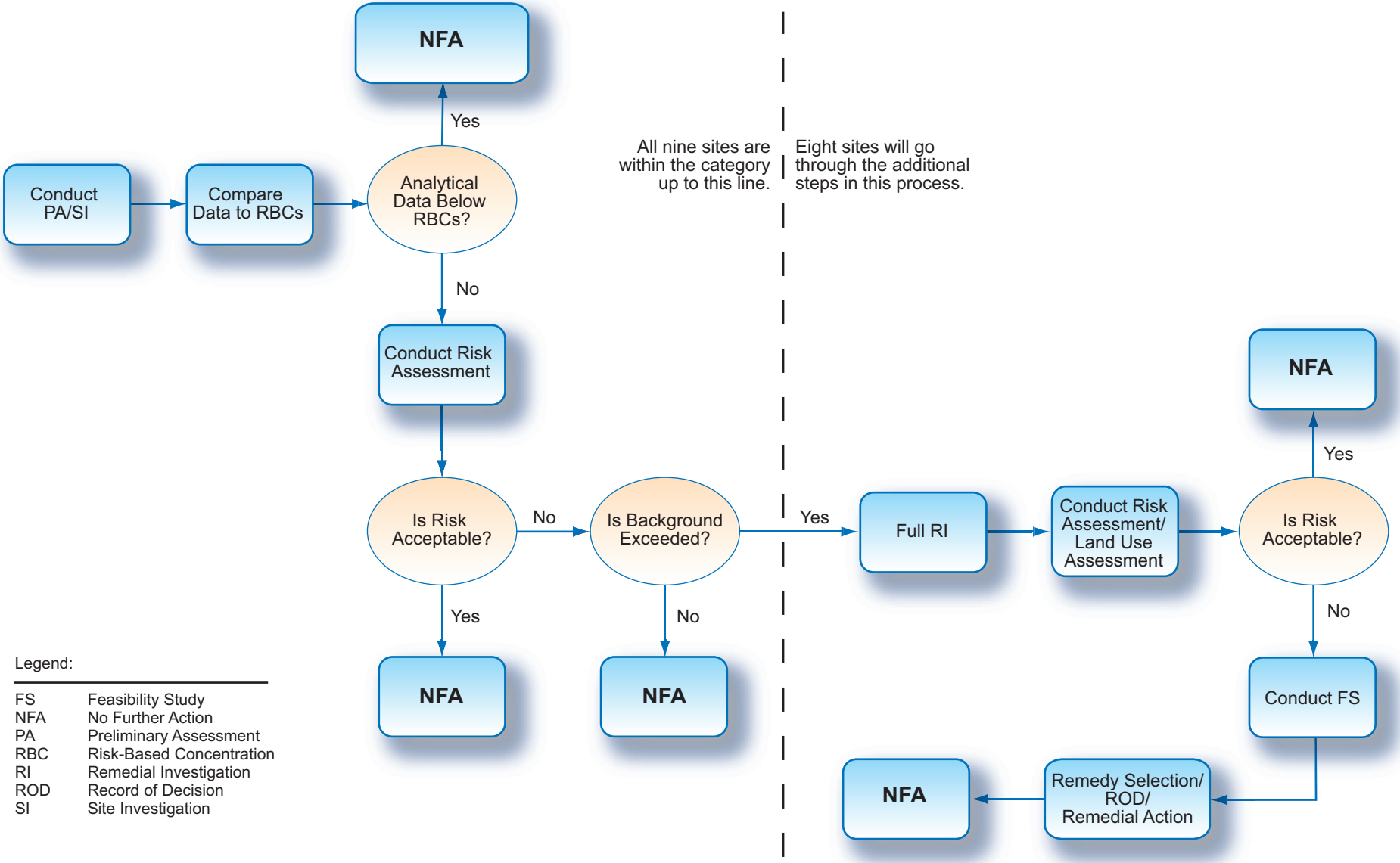


Figure ES-1
Location of 9 NFA Sites
(SWMU-5, SWMU-10, SWMU-14, SWMU-15, AOC-B, AOC-C, AOC-F, AOC-K, AOC-L)
NFA Report for Nine Sites
NASD, Vieques Island Puerto Rico

CH2MHILL

E052003002GNV



Legend:

FS	Feasibility Study
NFA	No Further Action
PA	Preliminary Assessment
RBC	Risk-Based Concentration
RI	Remedial Investigation
ROD	Record of Decision
SI	Site Investigation

Figure ES-2
Site Risk Management Process for All Sites Identified
NFA Report for Nine Sites
Former NASD, Vieques Island Puerto Rico

CH2MHILL

E052003002GNV

SECTION 1

Introduction

1.1 Site Background

The former Naval Ammunition Support Detachment (NASD) property, located on Vieques Island, Puerto Rico, was transferred to the Municipality of Vieques and the U.S. Department of Interior (DOI) on April 30, 2001. As part of the transfer, seven Solid Waste Management Units (SWMUs) and ten Areas of Concern (AOCs) were investigated through the U.S. Environmental Protection Agency's (EPA's) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. Expanded Preliminary Assessment/Site Investigations (PA/SIs) were conducted at the former NASD sites to assess the soils, groundwater, sediment, and surface water for possible hazardous waste releases. Prior to the transfer of the 17 sites, the Navy imposed land use restrictions at each of the sites until they could be further evaluated. If the PA/SI sampling results indicated a need, the site was recommended for further investigation under the Remedial Investigation/ Feasibility Study (RI/FS) process or for interim remedial action. If the risk-based evaluations of the data collected during the two phases of the PA/SI indicated that a site's conditions did not present human health or ecological concerns, then the site was recommended for No Further Action (NFA). Of the 17 sites investigated, eight sites were recommended for an RI/FS, and nine sites were recommended for NFA. Further details of the previously conducted studies can be found in the *Final Expanded Preliminary Assessment/Site Investigation Report, Phase I* (CH2M HILL, October 2000) and the *Final Expanded Preliminary Assessment/Site Investigation Report, Phase II, Seven Sites* (CH2M HILL, November 2002). This report includes the nine sites that are recommended for NFA status.

The entire former NASD consists of approximately 8,000 acres along the western third of Vieques Island. All of the former NASD property, with the exception of approximately 100 acres, was transferred to the DOI, the Municipality of Vieques, and the Puerto Rico Conservation Trust. Currently, the acreage is owned by the DOI (3,100 acres), the Municipality of Vieques (4,000 acres), the Navy (100 acres), and the Puerto Rico Conservation Trust (800 acres). Figure 1-1 shows the location of Vieques Island and the former NASD. Figure 1-2 shows the former NASD, the location of the current property owners, and the location of the nine PA/SI sites. Figures 1-3 and 1-4 are aerial photographs of the SWMUs/AOCs identified for NFA status in this report.

The former NASD was used by the U.S. Navy Atlantic Fleet for storage of munitions between 1942 and 2000. The activities at the former NASD were directed under the consolidated command of Commander Fleet Air Caribbean, Naval Forces Caribbean, and Antilles Defense Command, whose headquarters are at Naval Station Roosevelt Roads (NSRR). The mission of the former NASD was to receive, store, and issue all ordnance authorized by NSRR for support of Atlantic Fleet activities.

1.2 Site History

Figure 1-5 presents a timeline summary of the historical uses of the western portion of Vieques Island, where the former NASD is located. The sugarcane industry was the major economic base of Vieques Island during the latter part of the 19th century and early 20th century. Several sugarcane factories, including Arcadia, La Playa Grande, Resolución, and Santa Elena, were located at or near the former NASD. The sugarcane operations ceased in the 1940s.

The Navy began using the former NASD in 1941 as a base for Allied fleets during World War II. Construction of the Mosquito Pier, magazines, and support facilities for an ammunition storage depot were generally completed by 1943. The former Naval Ammunition Facility (NAF), which is approximately 1,000 feet to the east of what is now AOC H, operated until 1948, at which time the ammunition was removed and the NAF was closed. Drawings obtained during the records search indicated that the main compound at that time was near the current helicopter pad and approximately 1,000 feet to the east of AOC H. Record searches, aerial photograph analyses, and interviews conducted during the Environmental Baseline Survey (EBS) did not indicate any signs of environmental concerns at this location.

The former NASD was reactivated in 1962 in response to the Cuban missile crisis. Interviews and aerial photograph analyses indicate that a construction staging area was in operation from 1962 to 1971 near the current location of Building 401. In 1971, the Main Operations Area was completed, and all support operations were relocated to that area (Program Management Company [PMC], October 2000).

Results from a records search and personnel interviews indicate that training for Navy personnel occurred from 1941 to 1948 and from 1962 to the 1980s. This training was conducted on the southwest portion of the former NASD, and consisted of beach landings as well as ambush and assault team practice. This was investigated as part of a separate report (see the *Final Preliminary Ordnance and Explosives Site Assessment Report for the Green Beach Area U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico* [CH2M HILL, July 2001]). Records indicate that live munitions firing was not conducted as part of this training.

The following nine sites are recommended for NFA and are the focus of this report:

SWMU/AOC	Historical Operation
SWMU 5	Former IRFNA/MAF-4 Disposal Site
SWMU 10	Former Waste Paint and Solvents Disposal Ground
SWMU 14	Former Wash Rack
SWMU 15	Former Waste Transportation Vehicle Parking Area
AOC B	Former Wastewater Treatment Plant (WWTP)
AOC C	Former Transportation Shop Drainage Ditch
AOC F	Former Underground Injection Control (UIC) Septic Tank

SWMU/AOC	Historical Operation
AOC K	Former Water Well
AOC L	Abandoned Septic Tank

As shown on Figure 1-2, with the exception of SWMU 5, the sites that are proposed for NFA are located in proximity to each other and are at or near the former NASD Main Operations Area, which is also referred to as the Public Works Area.

1.3 Purpose of the NFA Report

The purpose of this NFA report is to present the supporting documentation that led to the recommendation of NFA status for the nine sites located within the former NASD. This document was developed for the Atlantic Division of the Navy (LANTDIV), and is reviewed by EPA Region 2 and the Puerto Rico Environmental Quality Board (PREQB). A document containing the required sections for the Record of Decision (ROD) will be submitted separately with the appropriate signature sheet.

As part of the documentation for NFA at each site, a brief site history is presented in each section, and an evaluation of the previous investigations is described. The analytical results of the samples collected to date were included in the Expanded PA/SI Reports to demonstrate that the nature and extent of chemical concentrations at each NFA site were sufficiently characterized. In addition, this NFA report presents the individual risk assessment conducted for each site, which was not included in the Expanded PA/SI Reports (CH2M HILL, October 2000 and November 2002).

An ecological survey and qualitative impacts assessment were previously conducted and documented in the Expanded PA/SI Reports. For these reports, the results from soil and groundwater data collected from the sites were compared to the most current EPA screening criteria to determine whether any of the detected chemicals were considered chemicals of potential concern (COPCs). Human Health Risk Assessments (HHRAs) were conducted at each of the nine sites for the COPCs that were identified as a result of screening comparisons. The risk assessments followed the procedures and assumptions provided in EPA's *Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (Part A)* (EPA, 1989) to assess potential human health risks and hazards. The detailed risk assessments for each site are provided as appendices to this report, and a summary of the risk assessment is included in the text for each site. All risk assessment tables were formatted according to the latest RAGS Part D guidance, and are included in Appendix D of this report.

1.4 Report Organization

This NFA report consists of the following sections:

Section 1 – Introduction. This section provides general background information, the purpose of the NFA report, information concerning the physical and environmental settings of the former NASD site, and the risk-based criteria screening procedure.

Sections 2 through 10 – Site-Specific Decision Summaries. These sections summarize the nature and extent of contamination, and provide a risk assessment and rationale to support the NFA decision for each SWMU or AOC.

Section 11 – Areawide Groundwater Evaluation for Former Main Operations Area . This section includes the groundwater risk assessment for the areawide data collected within the former Main Operations Area.

Section 12 – Summary and Recommendations by Site. This section summarizes the overall results of the NFA investigation and provides a recommendation based on these data for each SWMU or AOC.

Section 13 – References. This section provides a summary of the works cited.

Appendix A contains Appendix A-1: CH2M-HILL's responses to comments on the *Draft No Further Action Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico* (CH2M HILL, November 2002); and Appendix A-2: CH2M HILL's responses to comments on the *Final Expanded Preliminary Assessment/Site Investigation Report, Phase I* (CH2M HILL, October 2000) and the *Final Expanded Preliminary Assessment/Site Investigation Report, Phase II, Seven Sites* (CH2M HILL, November 2002).

Appendix B contains the data screening tables for samples collected at each of the nine sites proposed for NFA in this report.

Appendix C contains the statistical evaluations summary for the environmental media at all nine sites proposed for NFA in this report.

Appendix D contains the summary tables for the data used in the risk assessment for the nine sites. The tables are formatted in accordance with the latest RAGS Part D guidance.

Appendix E contains a detailed risk assessment conducted for each site included in this NFA report.

Appendix F contains the analytical resampling data for the well at AOC K.

Appendix G contains the toxicity profiles for chemicals with provisional toxicity factors.

Appendix H contains the 95 percent-Upper Confidence Limit (UCL_{95}) calculations relevant to the nine sites, and comparisons with the ProUCL tool.

Appendix I contains the latest EPA Region 9 Preliminary Remediation Goal (PRG) values (October 2002) used for screening comparisons, a copy of the EPA *2002 Edition of the Drinking Water Standards and Health Advisories* (Summer 2002), and background values information.

All tables and figures are presented at the end of their respective sections.

1.5 Former NASD Location and Description

1.5.1 Location

With a surface area of approximately 51 square miles, Vieques Island is the largest of the offshore islands of Puerto Rico. It is approximately seven miles east-southeast of the eastern end of the main island of Puerto Rico. The former NASD is traversed in different directions by paved asphalt and dirt roads. The main entrance to the former NASD is at the extreme northeast end of the site near the Vieques Municipal Airport. The approximate coordinates of the center of the former NASD site are 18 degrees 7 minutes north (N) latitude and 65 degrees 33 minutes west (W) longitude.

1.5.2 Structures, Roads, and Other Site Features

The central and northeastern portions of the former NASD contained munitions storage magazines and installation support facilities. Paved roads are present along the north end and eastern boundaries, in the main support compound, and near the inactive munitions magazines. Although the road to the Mount Pirata communications facility is paved, the majority of the site is traversed by dirt roads or roads overgrown with vegetation.

1.5.3 Vicinity Characteristics

The former NASD is bounded by water on three sides: on the north by Vieques Sound, on the west by the Vieques Passage, and on the south by the Caribbean Sea. The area east of the former NASD is controlled by the Puerto Rico Department of Natural Resources, the Puerto Rico Port Authority, and private landowners. The Vieques Municipal Airport property lies adjacent to the northeast portion of the former NASD; the portion abutting the site constitutes the runway approach clear zone. South of the airport property is undeveloped land controlled by the Puerto Rico Department of Natural Resources; this land is used primarily for cattle grazing. Further south lies the area known as the “South La Hueca” parcel. This area is inhabited by individual landowners with private homes, small pastures, and farms.

1.5.4 Climate

The climate of Vieques Island is tropical-marine. Temperatures are nearly constant, with an annual average of approximately 79 degrees Fahrenheit (°F). August is the warmest month (82°F), and February is the coolest month (76°F). Vieques Island lies directly in the path of the prevailing easterly trade winds that regulate the climate of Puerto Rico. The trade winds result in a rainfall pattern characterized by a dry season from December through July and a rainy season from August to November. Heavy precipitation may be induced by tropical storms from June to November. The western part of the island, where the former NASD site is located, averages approximately 50 inches of rainfall per year, 50 percent of which occurs during the rainy season (United States Geological Survey [USGS], 1989).

1.5.5 Topography and Surface Water

The majority of the former NASD is undeveloped and heavily vegetated with trees, low-lying brush, and tall grasses. The topography of the former NASD is characterized by a

series of low hills and small valleys. The most elevated areas occur along a west-to-east axis near the center of the site. The highest point is Mount Pirata, which is approximately 987 feet above sea level. In general, the slope of the site tapers gradually down from the center to the coastal areas, with the exception of steep slopes in the vicinity of Mount Pirata. The surface water flow direction follows the slopes, generally from an elevated center radially outwards to the ocean. Of the nine sites included in this NFA Report, eight are located within the Main Operations Area, where surface water flows north to the ocean. Figure 1-6 is a topographical map of the site.

Surface water present on the former NASD consists of several lagoons and intermittent streams. The Arenas, El Pobre, and Kiani Lagoons are at the northwestern end of the site, and the Playa Grande Lagoon is at the southeastern end of the site. These lagoons are generally very shallow and are characterized by a large concentration of mangroves along the shorelines. Most of the streams on the former NASD are transient, flowing only for a short period of time after precipitation (i.e., rain) events. These natural storm drainage channels are located throughout the former NASD, generally running in a northerly or southerly direction downward from the central, elevated portions of the property. None of the nine sites evaluated in this NFA Report are surface water bodies, nor are they located adjacent to surface water bodies. Site AOC C is a stormwater runoff ditch, which transmits water only during rain events.

1.5.6 Regional and Site-Specific Geology

Regional Geology

Based on the information available from the USGS (1989) and investigations conducted at sites selected for an RI/FS (e.g., AOC E and AOC H), the regional geology is characterized by volcanic rocks generally overlain by alluvial deposits and patches of limestone. Volcanic andesites and a quartz-diorite plutonic complex are exposed over a large percentage of the island. A gradual change in texture from coarse- to fine-grained quartz-diorite has been observed from west to east. Limestone occurs in sectors of the north, south, and eastern parts of the island. The most extensive areas of limestone are found on the southern coast peninsulas. The limestone is generally soft and yellowish and well indurated where exposed to the atmosphere. The sedimentary deposits generally consist of a mixture of sand, silt, and clay. The floodplains consist of beach and dune deposits formed by calcite, quartz, volcanic rock fragments, and minor magnetite (USGS, 1989).

Site-Specific Geology

The soil samples collected during the installations of soil borings and monitoring wells associated with the *AOC E Site Characterization (SC) Report* (CH2M HILL, 1999) and *Expanded PA/SI Report* (CH2M HILL, October 2000) were used to describe the site geology of the former NASD Main Operations Area. The site-specific geology near SWMU 5 is discussed later in this report. The former Main Operations Area lies near the downgradient slope of the rolling topography (approximately 45 feet above mean sea level [ft msl]), which is underlain by weathered volcanic rock. Beneath the area are silt and clay from highly weathered volcanic rock. The colors of encountered lithologies were primarily brown, dark greenish gray, yellowish red, and brownish yellow. These sediments generally possess high plasticity when moist, are very hard when dry, and are not easily crumbled under hand

pressure. Because of the tight binding of these hard clays, the soil has low permeability, and surface runoff is generally the primary migration pathway for any surface releases. A transect location map for the monitoring wells utilized for the site-specific geology at AOC E, which is representative of the former Main Operations Area geology, is presented in Figure 1-7. Geologic cross sections A-A' and B-B' are presented in Figures 1-8 and 1-9, respectively.

1.5.7 Regional and Site-Specific Hydrogeology

Regional Hydrogeology

The USGS has mapped one groundwater aquifer on the northwestern part of Vieques Island, referred to as the Resolución Valley aquifer. The Resolución Valley aquifer covers approximately the northern half of the flanks of Mount Pirata. The valley slopes from Mount Pirata toward the Vieques Passage, with an area of approximately 8 square miles. Although no perennial streams are present in the valley, this area receives more rainfall than any other area of Vieques Island. The geology of the Resolución Valley aquifer consists of sedimentary deposits that overlie saprolite derived from plutonic rocks. Geophysical surveys show that alluvial deposits average approximately 30 ft in thickness (USGS, 1989).

Site-Specific Hydrogeology

The former Main Operations Area is underlain by a semi-confined groundwater flow system. The subsurface geology is composed of plastic clays. Groundwater was encountered at 50 ft below land surface (ft bls) during monitoring well installation procedures; however, the water levels eventually stabilized at approximately 41 to 42 ft bls.

Groundwater flow near the former Main Operations Area is controlled by elevation differences between adjacent hills and the gently sloping topography. Groundwater flows generally north toward the Atlantic Ocean, as shown in Figure 1-6. Based on the in situ hydraulic conductivity results from the *AOC E Site Characterization Report*, the subsurface material exhibits a relatively low groundwater velocity of 13.18 ft per year (ft/yr).

1.5.8 Conceptual Site Model

A conceptual site model (CSM) was developed for each site using the information regarding known and suspected waste sources, pathways, and receptors. The conceptual understanding of the site was prepared as described in the RI/FS guidance (EPA, 1988). Because the CSM was used to characterize the potential risks to human health and the environment, it included known and suspected sources of contamination, types of contaminants, affected media, known and potential routes of migration, and known or potential human and environmental receptors. This effort also involved identifying locations for sampling during the work planning stage, and identifying exposure pathways and receptors for risk assessment. A CSM for the entire former NASD is presented on Figure 1-10. This figure illustrates the topographic conditions that influence surface drainage, subsurface conditions that influence the contaminant migration to groundwater, and groundwater flow direction.

The site-specific CSM presents the potential and suspected sources investigated, potentially affected media, and potential human receptors for exposure to the environmental media.

This CSM is presented for each site in the respective sections of this report. Ecological receptors were previously identified for the sites, and the Expanded PA/SI Reports (CH2M HILL, October 2000 and November 2002) presented the potential receptors and impacts for each of the sites.

1.5.9 Current and Future Land Use

Although the former NASD occupies approximately 8,000 acres, most of the area is undeveloped and was used for cattle grazing. The past use for the former NASD was presented above. Currently, all nine sites described in this report are inactive and overgrown. The majority of the former NASD area, including the nine sites proposed for NFA, was transferred to the Municipality of Vieques, and is proposed for the land use category Development Plan Area, according to the *Finding of Suitability for Early Transfer for U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico* (CH2M HILL, November 2000). Land use for the Development Plan Area is not defined in the zoning regulations. The Puerto Rico Planning Board will prepare a Master Plan to outline specific development strategies for this area. Preliminary proposed land use from the Puerto Rico Planning Board shows zoning as commercial, historic, tourism, and harbor area for the former NASD main compound area, which includes eight of the nine sites (SWMU 10, SWMU 14, SWMU 15, AOC B, AOC C, AOC F, AOC K, and AOC L). SWMU 5 is located in a proposed Resource Conservation Area.

1.5.10 Background Study of the Former NASD

A background study was conducted to characterize the environmental media for the western portion of Vieques Island (see the *Final Soil, Groundwater, Surface Water, and Sediment Background Investigation Report, Former NASD, Vieques Island* [CH2M HILL, October 2002]). The primary purpose of this study was to develop a set of background values for inorganic chemicals that occur commonly in environmental media, to be used in comparison with sites investigated within the former NASD.

Surface soil samples were collected from 0 to 6 inches bls from 26 surface soil locations. Subsurface soil samples were collected from 11 of the soil sampling locations at depths ranging from 2 to 6 ft bls, depending on the depth to rock in the sampling area. Additionally, five rock samples were collected from the southwestern end of Vieques Island. Groundwater was sampled from five newly installed background wells.

Two surface water bodies, identified as Laguna Kiani and Laguna Playa Grande, were included for surface water and sediment sampling, where four samples each of sediment and surface water were collected from each surface water body. With the exception of two surface water and sediment samples from Laguna Kiani, all samples were determined by the background report review team (see below) to not be usable as representative of background conditions for future background versus site comparisons. This was due to the presence of high suspended particulates associated with metals in some of the surface water samples. It was decided that site-specific surface water and sediment samples would be collected for each surface water body site in the future sampling efforts.

Following EPA guidance, a single data background value is developed for each chemical for soil for future "point" comparisons between site and background, as part of the initial site

screening analysis. The estimated "point estimate" background value is the 95-percent upper confidence limit (UCL_{95}). Alternatively, site inorganic concentration ranges for all samples at a particular site can be compared to the inorganic concentration ranges in background samples. When necessary, future comparisons between site data and background data may involve additional statistical methods for comparisons to determine whether the site concentrations are significantly different from background. Such comparisons will be limited to chemicals and media where it is identified as appropriate or necessary, because of the additional level of effort involved for such comparisons.

The *Draft Soil, Groundwater, Surface Water, and Sediment Background Investigation Report, Former NASD, Vieques Island* was submitted by CH2M HILL for review by regulatory agencies and other interested parties on June 15, 2001. Several sets of comments were received, including comments from EPA, PREQB, the Puerto Rico Commissioner's Office, and the technical review representative for the public (i.e., Technical Assistance for Public Participation [TAPP]). The *Final Soil, Groundwater, Surface Water, and Sediment Background Investigation Report, Former NASD, Vieques Island* was submitted by CH2M HILL on October 16, 2002.

After review committee comments regarding the background study report were resolved, a set of background values was developed for soils by combining surface and subsurface soil. This resulted from the fact that there were no differences between the surface and deeper soils. Though some wells were retained as background wells, the review committee suggested using area or site-specific upgradient wells as background wells to appropriately represent background groundwater conditions. Thus, a well within the Main Operations Area will be used for comparisons with groundwater at sites within this area. The well located within SWMU 14 (SWMU14-MW02), which is located upgradient of most of the sites, will be used for comparison with site wells downgradient of this area. Since there are no surface water bodies within any of the nine sites included in this NFA report, no surface water or sediment background levels were included here.

Appendix I of this NFA report contains the background values tables presented in Section 4.0 of the *Final Soil, Groundwater, Surface Water, and Sediment Background Investigation Report, U.S. Naval Ammunition Support Detachment, Vieques Island* (CH2M HILL, October 2002), as well as the most current PRG tables used in comparison against screening criteria.

1.5.11 Data Quality Evaluation

The analytical data for the nine sites were collected in two previous investigations. The Expanded PA/SI consisted of two phases, Phase I and Phase II. Both reports were finalized in October 2000 and November 2002, respectively. SWMUs 5, 10, 14, and 15, and AOCs C and F were investigated as part of the Phase I PA/SI; AOCs B, K and L were investigated as part of Phase II PA/SI.

The Data Quality Evaluation (DQE) performed for the two sampling phases were presented in Appendix K of the Phase I PA/SI report, and Appendix I of the Phase II PA/SI report. The data was validated by an independent contractor to Navy, Heartland Environmental Services, Inc., in accordance with EPA Region 2 Functional Guidelines for Data Review Standard Operating Procedures. Following this guidance, the DQE included evaluation for the laboratory performance, and matrix interference. Both phases of the PA/SI included

analysis of laboratory performance to be within the required detection limits of the analytical methods. The matrix interference evaluation analyzed several results such as surrogate recoveries, matrix spike recoveries, and duplicate sample results. The DQE focused on the usability of the data to support project data interpretation and the decision-making process.

Phase I PA/SI DQE

During the DQE of the Phase I PA/SI data, no data were rejected for failed holding times, or control limit criteria in the method accuracy evaluations. However, during calibration several data were rejected due to calibration deficiencies during organic chemical analysis. This was due to interference from acetone and 2-butanone, and resulted in "J" or "UJ" flags for several of the organic chemicals.

Twenty trip blanks, 26 equipment blanks, five field blanks, and 55 method blanks were analyzed during the Phase I PA/SI. According to the EPA functional guidelines, concentrations of common lab contaminants detected in samples at less than 10 times the concentration associated with blanks can be attributed to the field sampling and laboratory contamination rather than environmental contamination from site activities. For other inorganic and organic chemicals, five times the concentration detected in the associated blanks is used to qualify results as potential field/laboratory contamination.

In the Phase I PA/SI, blanks were reported to have several low-level volatile organic compounds (VOCs). Bis-ethylhexyl phthalate (BEHP), two low-level polycyclic aromatic hydrocarbons (PAHs), pp-DDT, and the polychlorinated biphenyl (PCB)-1016 were detected in different blank samples. Some of the chemicals were not detected in site samples, therefore no qualifiers were modified for field samples for these chemicals.

Phase II PA/SI DQE

During the Phase II PA/SI DQE no data were rejected due to missed holding times. The calibration deficiencies were again noted because of the presence of acetone and 2-butanone. A total of 18 trip blanks, 13 equipment blanks, three field blanks, and five method blanks were analyzed for these analytical data.

In the Phase II PA/SI DQE, blanks were reported to have BEHP, di-n-butyl phthalate, and diethyl phthalate, which was attributed to the plastic gloves used during sample analysis. Several low-level VOCs were also reported, and one blank sample also had several organo-chlorine pesticides, including dieldrin at parts per billion (ppb) concentration levels.

The Phase I and Phase II PA/SI DQE concludes that the samples results for metals near the method detection limits (MDLs), that were reported in blanks (specifically metals) may represent Type I (false positive) or Type II (false negative) errors. Thus, some values at the lower levels of detection may be false positives caused by instrument noise or low-level background shifts rather than a true analyte signal. Additionally, concentrations near the MDL should be considered as not necessarily accurate or precise. Further details can be found in Appendices K and I of the Phase I and Phase II PA/SI reports, respectively.

1.5.12 Ecological Characterization

A qualitative ecological habitat characterization for the former NASD was conducted as part of the Expanded PA/SI. The detailed results of the investigation were included in Appendix I of the Phase I Expanded PA/SI report (CH2M HILL, October 2000) and in Appendix F of the Phase II Expanded PA/SI (CH2M HILL, November 2002). A summary of the individual findings for each site was incorporated into the text of the report.

The ecological assessment conducted during the Expanded PA/SI concluded that past activities at the site have some degree of impact on the ecosystems, due to disturbed habitats from clearing and construction activities. However, these impacts appear to be limited to changes in species composition based on physical disturbances. The construction of roads and ground maintenance are the only disturbances that have caused noticeable differences. The wildlife at these sites seem to be healthy and are making use of their habitats to the fullest extent. The surveys did not identify any federally protected species at any of the sites. Thus, there are no significant ecological risks at any of the nine former NASD sites included in this report. As a result, no further ecological assessments were conducted for this NFA report.

1.5.13 Unexploded Ordnance Assessment

An Environmental Baseline Survey (EBS) was conducted as part of the transfer process for the former NASD. The EBS included interviews with NASD personnel, a detailed aerial photographic search, site inspections and investigations, and examinations of historical records to determine if releases of hazardous substances to the environment had occurred at the former NASD. The EBS also included unexploded ordnance (UXO) as a potential hazard. The records review and interviews indicated that no munitions rework, assembling, or manufacturing occurred at NASD and that no firing ranges have existed on the site. Since 1979, non-serviceable munitions were shipped off the site or disposed of at the Navy facility located on the eastern end of Vieques Island. Prior to 1979, disposal of some non-serviceable munitions occurred at the open burn/open detonation area at the western end of the NASD (SWMU 4). This site is currently under investigation for UXO. In addition, ordnance related items have been documented at disposal sites SWMU 6, SWMU 7, and AOC J which are being investigated further through an Remedial Investigation. These sites will be investigated for UXO in the future and are undergoing full remedial investigations. However, the nine sites recommended for NFA have no history of UXO use or disposal.

Additionally, as part of the *Preliminary Ordnance and Explosives Site Assessment Report for the Green Beach Area* (CH2M HILL, June 2001), a detailed archive search report was completed for the Western Training Area (WTA) which included the western and southwestern portions of the former NASD. Interviews were conducted and an extensive search of archival records was conducted in an attempt to determine the historical uses, activities, and site boundaries of the WTA at the former NASD. Records and maps from the 1940s to the 1980s were reviewed. Documents and interviews both confirmed that no live weapons firing was permitted during training exercises in the WTA, due to its proximity to storage magazines in the Naval Ammunition Depot (1973 Draft EIS) and the use of the Green Beach area by boaters (1992 range regulations). No evidence was obtained to support a conclusion that the former WTA is contaminated by explosive ordnance or UXO as a result of past training activities.

1.6 Risk-Based Screening Process

1.6.1 Data Analysis Introduction

The screening evaluation of the data for each site is based on validated analytical results obtained from previous investigations conducted from April through December 2000. For the initial data collected and the Phase I PA/SI Report (CH2M HILL, October 2000), the analytical results were screened against the EPA Region 3 Risk-Based Criteria (RBC). For the Phase II PA/SI Report (CH2M HILL, November 2002), the analytical results were screened against the EPA Region 9 PRGs. The evaluation conducted for this NFA report was based on the initial data (October 2000) that was rescreened against EPA Region 9 PRGs to provide a consistent approach throughout the screening evaluations.

1.6.2 Groundwater Turbidity vs. Metals Concentrations

The groundwater at these shallow depths is generally very turbid with very low yield, and the deeper aquifer is separated from the shallow zone by weathered granodiorite rock. Because of the turbidity, several well samples indicated high particulate-bound metals concentrations. During sample preservation, acidic conditions dissolved particulate-bound metals to be released into the groundwater samples during analysis. Several wells within the nine sites proposed for NFA had high turbidity-associated metals concentrations. However, analysis of the dissolved metals in the same samples did not have elevated metals concentrations. Both total metals and dissolved metals concentrations are provided in Appendix B of this report. Only total metals concentrations were used in the risk assessment, and dissolved metals are used for comparison purposes only.

1.6.3 Summary of Sample Collection and Analysis

Surface and subsurface soils were evaluated for direct exposure and indirect exposure through leaching to groundwater. The collection depths for each sample are provided in Appendix B of this report, along with the sample-specific chemical detections and concentrations. The groundwater samples were collected from various depths at approximately 41 to 42 ft bls, as presented above in the hydrogeology discusion. Copies of the well boring logs for individual wells were included in Appendices C and B of the Phase I and Phase II PA/SI reports, respectively.

SWMU 5 is located at a relatively higher elevation when compared to the other eight SWMUs. The shallow groundwater at most of the sites was encountered at a depth of 50 ft bls during monitoring well installation procedures; however, the water levels eventually stabilized at approximately 41 to 42 ft bls. There was no groundwater encountered at SWMU 5 during soil boring installation that was extended up to the rock underneath the site. The granite rock underneath the site is greater than 200 ft in thickness, as determined by previous studies for this general area. Therefore, a well could not be installed at SWMU 5. The soils in this area are tight clays and surface runoff is a likely preferential migration pathway due to low permeability of the native soils, as previously described above in this section.

A soil gas survey using an Organic Vapor Meter (OVM) was conducted on soil borings during the two phases of the PA/SI to determine if subsurface leaching of more mobile

contaminants such as VOCs was present at most of the subsurface soil samples. The results of this analysis were included along with the soil boring logs in Appendix B of the Phase I PA/SI report. The site monitoring wells were installed at locations nearest the highest measured reading area. Overall OVM results have relatively low positive detections, with the highest levels reported at AOC E and the part of SWMU 14 that is located near AOC E. This area is not included in this set of sites considered for NFA. A separate investigation is being conducted for AOC E to assess the petroleum contamination detected at this site. The OVM results were presented in Appendix B of the Phase I PA/SI report for SWMU 5, SWMU 10, SWMU 14, SWMU 15, AOC C, and AOC F.

1.6.4 COPC Selection

Concentrations of detected chemicals at each site were compared to the most current EPA Region 9 screening criteria for each matrix. These consisted of the residential and industrial risk-based criteria (i.e., PRGs), leachability criteria for soil (i.e., soil screening levels [SSLs] based on a dilution attenuation factor [DAF]=20), tap water PRGs, and drinking water MCLs for groundwater. The PRGs for the non-carcinogenic chemicals were divided by 10 to represent an HI level of 0.1. Groundwater COPCs were selected for risk assessment by comparing the chemicals against tap water PRGs (not MCLs).

Constituents with concentrations below the PRGs were eliminated. Those constituents with concentrations above the PRGs were retained as COPCs. All identified COPCs were evaluated through a risk assessment at each of the nine sites according to the EPA RAGS document (EPA, 1989) and the following EPA guidance:

- EPA, 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (Part A)*. EPA/540/1-89/002.
- EPA, 1990. *Guidance for Data Usability in Risk Assessment*. EPA/540/G-90/008.
- EPA, 1991. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"*. OSWER Directive 9285.6-03.
- EPA, 1997. *Exposure Factors Handbook*. EPA/600/P-95/002Fa.
- EPA, 2001. *Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual*. Part E Supplemental Guidance for Dermal Risk Assessment) Interim.

The results of the screening evaluation were used to define the nature and extent of contamination at each site for soil and groundwater. Although several of the inorganic chemicals occur above PRGs but were below background concentrations, no chemicals were eliminated based on their occurrence in the background, as recommended by the reviewing agencies. Such chemicals are further discussed in Appendix E as part of an uncertainty analysis. The final site NFA recommendations were based on this screening analysis, results of the risk assessment, and comparisons with the background levels as appropriate for the inorganic chemicals.

1.6.4 Risk Assessment

The risk assessment conducted for each site assessed the potential adverse effects to human health for current and future land use conditions. A schematic diagram of the risk assessment process is presented in Figure 1-11, and includes the identification of COPCs, exposure assessment, toxicity assessment, and risk characterization. The results of this risk assessment are used as the basis for the ROD for NFA recommendations at the nine sites. The risk assessments were conducted in the RAGS Part D format to ensure consistent documentation for review, as requested by the EPA and PREQB reviewers during their review of the draft NFA report. Copies of the site-specific risk assessment tables, provided in RAGS Part D format, are presented in Appendix D of this revised report.

A site-specific CSM was developed to present an overview of site conditions and to identify potential migration pathways, receptors, and exposure routes. This serves as the basis for the exposure pathway evaluations in the HHRA.

1.6.5 COPC Identification Summary

The sampled media include surface soils, subsurface soils, and groundwater. Some of the soils collected from drainage ditch sites (e.g., the quebrada) are identified as sediment. However, because these are not wet most of the year, they were considered as soils. The following sources were used to obtain the health-based screening criteria:

- Surface soil results were screened against human health direct exposure risk-based criteria for soils selected from the EPA Region 9 PRG table (November 2002). Noncarcinogenic RBC values were reduced by a factor of 10 (HI=0.1) to account for the potential presence of multiple chemicals.
- Subsurface soil samples up to 10 ft bls are potentially exposed during construction activities. Therefore, soils up to this depth were compared against industrial PRG values, and the COPCs selected were evaluated for a construction worker exposure.
- Surface and subsurface soils were screened against soil-to-groundwater protection risk-based criteria and the generic SSLs based on a DAF=20 from Appendix A of EPA's *Soil Screening Guidance: Technical Background Document* (1996).
- Groundwater samples were screened against human health direct contact exposure risk-based criteria for groundwater. These values consisted of the latest EPA Region 9 PRGs and MCLs from the EPA National Primary Drinking Water Standards.

Appendices B and C include the COPCs selected for soils and groundwater at the nine sites included in this report.

Surface Soil COPC Selection Process

For surface soils, the maximum detected concentration from site surface soil data set was compared to the residential soil PRG and SSL. If a chemical exceeded the PRG or SSL, it was selected as a COPC for quantitative risk evaluation. Those chemicals exceeding the SSL were considered COPCs for leachability to groundwater. This is a conservative approach in that the SSL is not based on a direct contact exposure concern to human receptors.

Subsurface Soil COPC Selection Process

For subsurface soils, the maximum detected concentration of a chemical was compared to the industrial PRG and SSL. If a chemical exceeded the industrial PRG, it was selected as a COPC for exposure to future construction workers. If a chemical exceeded the SSL, it was selected as a COPC for leachability to groundwater.

Groundwater COPC Selection Process

For groundwater, the maximum detected concentration of a chemical was compared to the tap water PRG for the risk assessment. If a chemical exceeded the screening criterion, it was selected as a groundwater COPC and included in the quantitative risk evaluation.

A detected chemical without a screening criterion was qualitatively evaluated to determine whether it should be considered a COPC. Frequency of detection, concentration, site-related use or release, and the structural activity relationship available in the EPA guidance was considered in that chemical's inclusion or exclusion from further consideration.

Commonly encountered laboratory contaminants (e.g., methylene chloride, BEHP) that are detected in similar concentrations in the quality assurance and quality control (QA/QC) samples, and that are not associated with site activities, were not included as COPCs; this follows EPA guidance for evaluating common laboratory contaminants (EPA, 1989). As described above in the DQE discussion, phthalates, some low-level VOCs, and low-level organo-chlorine pesticides were detected in the blank samples. The site-specific sections in this report include discussions regarding these chemicals if site samples also have these chemicals.

1.6.6 Exposure Assessment

An exposure assessment was performed to evaluate the potential exposure of the site media to the human receptors that were identified based on current or anticipated future land use at each site. The exposure assessment included potential exposure pathways for human receptors, potential routes of exposure, exposure factors assumed, and exposure concentrations estimated for exposure.

Potentially Exposed Populations

The former NASD is currently an inactive facility. After the property transfer, the land use and potentially exposed populations are likely to change. Therefore, unrestricted land use was assumed for each site, which is the most conservatively protective assumption available for risk assessment. Currently there are no human receptors based on the existing land use at the nine sites proposed for NFA. Based on anticipated future land use considerations, the following potentially exposed populations were identified:

- Maintenance workers
- Construction workers
- Industrial workers
- Recreational receptors(both adult and child)
- Residential receptors (both adult and child)

Other potentially exposed populations could exist; however, their likely exposure will be lower than those listed above. If these listed receptors are protected, all other potentially exposed populations will also be protected. Exposure assumptions were selected to be conservatively representative to estimate the possible upper-bound exposures by using the reasonable maximum exposure (RME) levels from the EPA guidance. In addition, when multiple exposure factors are available, a more conservative factor was selected to ensure conservatism in the exposure assessment. The exposure factors were selected from various sources such as the following EPA guidance:

- *Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors."* OSWER Directive 9285.6-03. March 25, 1991.
- *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft*. OSWER 9355.4. March 24, 2001.
- *Exposure Factors Handbook*, *Volume I*. May 1989.
- *Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual*. Part E Supplemental Guidance for Dermal Risk Assessment, Interim Draft. September 2001.
- *Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual*. Part A, Interim Final. December 1989.

The following subsections provide descriptions of the individual potentially exposed populations that were evaluated in this risk assessment.

Maintenance Workers

Currently, there are no human receptors within any of the nine sites. A limited number of personnel are currently employed to supervise the former NASD area, and none of these employees have duties within the sites. There are no maintenance activities occurring within the nine site areas evaluated in this report. Therefore, this exposure pathway under current conditions is incomplete. In the future, when the property is transferred, activities may include mowing and facilities maintenance. Based on the likely occupational duties, it was assumed that maintenance workers would have the potential for direct or indirect contact with surface soils at each site. The maintenance workers are not likely to use site groundwater, as it is deeper than 20 to 30 ft bls at shallower depths. The site groundwater is not being used (i.e., pumped) at the present time, and shallow groundwater is not usable for potable purposes (low yield, and high turbidity), as previously described in hydrogeology section. Therefore, this pathway was not evaluated for the maintenance worker scenario. The exposure assumptions for this scenario include a maintenance activity occurring at each site once a week (52 days/year), with the workers spending the entire workday within each site (each of the sites are much smaller, typically requiring less than an hour for grass moving). The soil ingestion rate (IR) is 100 milligrams per day (mg/day), for an exposure duration (ED) of 25 years. The tables provided in Appendix D include the relevant details of these exposure assumptions.

Construction Workers

A future construction worker scenario was evaluated for subsurface soil exposure at various sites where COPCs were identified in the subsurface soil. The COPCs were selected by comparing detected concentrations in subsurface soil samples that were collected up to 10 ft bls against industrial PRGs (see Appendix I for EPA Region 9 PRGs). Typically, construction work is assumed to last for six months, seven days per week, resulting in an EF of 183 days, and ED of six months. The soil IR for a construction worker is 330 mg/day, which is higher than any other worker scenario. All other exposure factors are similar to those of an industrial worker scenario, as provided in the risk tables in Appendix D.

The exposure point concentrations (EPCs) for a construction worker were calculated by combining surface and subsurface soils, as construction activities tend to mix both of these soil layers. Subsurface soil COPCs were identified at only some of the nine sites included in this report, and a construction worker exposure scenario was evaluated for these sites. Exposures to site groundwater are not expected for this scenario, as typical construction depths (6 to 10 ft bls) will not encounter groundwater at the site, since it is encountered at approximately 20 to 30 ft bls (depending on the location).

Industrial Workers

This scenario was evaluated assuming a site would be converted into a future industrial facility where a worker spends his/her entire work day at the site in direct contact with soils. Depending on site-specific conditions, future development of some of these sites could potentially allow for light industrial/commercial use, which would bring industrial workers into contact with site media. Industrial workers were also assumed to be indoor workers, and to have potential exposure to site groundwater as a potable water source. The industrial worker assumptions include a soil IR of 50 mg/day and a groundwater IR of 1 liter (L)/day. The EF is 250 days/year, and the ED is 25 years. The dermal exposure route assumptions were selected for all receptors from the EPA dermal guidance, as cited above.

Recreational Receptors

After transfer of the property, some of these sites may be used for recreational purposes, which may include hiking, picnicking, and other outdoor activities. Recreational receptors are assumed to have direct contact with site soils. Recreational users are not expected to have exposure to site groundwater; therefore, a groundwater exposure pathway is incomplete. Exposure to this site was thus assumed to occur via surface soil while using the site for recreational purposes. Though each site is too small for complete recreational activities during an outing, such a scenario was assumed as a conservatively protective pathway evaluation. Both recreational adult and child receptors were evaluated. A child receptor is assumed to have a soil IR of 200 mg/day. An adult receptor is assumed to visit each of the sites both days of the weekend, every weekend of the year. The EF for an adult is 104 days/year with an ED of 24 years. The ED for a child is 6 years. Further details regarding the exposure assumptions calculated for each receptor are provided in Appendix D.

Residential Receptors

To evaluate the most conservative future land use scenario for each site, residential land use was considered to occur where site-specific conditions permit. Future residents were assumed to have direct contact with surface soils and to use site groundwater as their potable water source. Several sites are drainage areas that are not conducive for use as residential lots. However, this scenario was evaluated to provide the most conservatively protective risk estimation. If the risks for this scenario are within acceptable limits, the site can be used for unrestricted (i.e., residential) land use. The default exposure assumptions for an adult and child were used, as listed in the above guidance. A child is assumed to have an EF of 350 days/year and an ED of 6 years. For an adult the EF is 350 days/year, and the ED is 24 years. Thus, the total ED for a residential receptor is 30 years.

1.6.7 Exposure Route Factors

The exposure route factors used for intake and risk estimates at each site, for each receptor identified, are listed in RAGS Part D tables that are included in Appendix D, as well as the site-specific risk estimation tables. All of the risk estimations are presented in RAGS Part D format in this revised report, as the EPA guidance recommends using this format in order to minimize the text documentation in the report.

Surface Soil Ingestion

Ingestion exposures to surface soil were evaluated for the appropriate receptors and media identified in the site-specific CSM. The ingestion intake of soil for a worker was assumed to be 50 mg/day, a default exposure factor derived from EPA (1997b). The incidental ingestion of soil for an outdoor maintenance worker is 100 mg/day, for a recreational adult or child the IRs are 100 mg/day and 200 mg/day, respectively. For residential receptors, the incidental ingestion of soil by an adult is 100 mg/day, and 200 mg/day for a child. A construction worker is assumed to have an IR of 330 mg/day.

Groundwater Ingestion

Ingestion of groundwater by a worker was assumed to be 1 L/day. Ingestion for a residential adult and child was assumed to be 2 L/day and 1 L/day, respectively.

Surface Soil Dermal Contact

The skin surface area available for contact was estimated using best professional judgment, and was based on current practices derived from EPA guidance. The surface areas used were selected from the latest dermal guidance (RAGS Part E, as listed above). The soil adherence factors were estimated using body-part and activity-specific data, which were also provided by RAGS Part E. In addition, the dermal exposure estimation was performed according to the equations provided in RAGS Part E.

Groundwater Dermal Contact

Residential receptors were assumed to have dermal contact with groundwater. Dermal contact was assumed to occur through showering/bathing and includes an ED of 0.25-hr for an adult and 0.45-hr for child, for daily exposure to the entire estimated skin surface area.

An industrial worker is assumed to have a dermal exposure through washing hands while at work.

Surface Soil Inhalation

Inhalation of dust from surface soils was assumed to occur for workers, recreational users, and residential receptors. For workers, the default inhalation rate is 20 cubic meters (m^3)/8-hour work day. For smaller sites, time spent within the site is expected to be less than 8 hours, and the inhalation rate will be modified by a site-specific factor to account for the reduced onsite exposure, if appropriate. The inhalation rate for recreational receptors will be 20 m^3/day for adults and youths. Inhalation rates for residential adults will be 20 m^3/day and 15 m^3/day for children.

The default particulate emission factor (PEF) of 1.36E+9 m^3/kg from the latest Supplement to the EPA Soil Screening Guidance (2001) listed above was selected. No VOCs were identified as COPCs, therefore exposure through inhalation for VOCs from soils is not a relevant pathway at any of the nine sites.

Groundwater Inhalation

This pathway was determined not to be applicable to any of the nine sites, as none contained VOC contamination in the groundwater.

Chemical-Specific Factors

Dermal absorption factors (ABS_{dermal}) and permeability constants (Kp) were obtained from RAGS Part E, as listed above.

1.6.8 Exposure Quantitation

Intake Estimates

The intake estimates for each exposure route identified are listed along with the intake factors used for intake estimations in the RAGS Part D tables, provided in Appendix D. For each receptor identified in the exposure assessment as having a complete exposure pathway, chemical- and media-specific intakes, known as chronic daily intakes (CDI), were estimated using the appropriate exposure factors and assumptions. The exposure assumptions used for the scenarios identified above are listed in detail in Appendix D.

Chronic exposure (represented by CDI) is expressed in terms of milligrams of chemicals contacting the body/kilogram of body weight/day (mg/kg/day). For the exposure routes to be evaluated, the following generic equation applies:

$$Exposure(mg/kg/day) = \frac{CxIRxEDxEF}{BWxAT}$$

Where:

C = concentration of chemical in medium or exposure point concentration (EPC)
IR = intake or ingestion rate
EF = exposure frequency
ED = exposure duration

BW = body weight
AT = averaging time (period over which exposure is averaged)

Appendix D includes tables of exposure factors for the potential receptors, exposure routes, and exposure pathways.

Exposure Point Concentration

The EPC is the reasonable upper-bound estimate of the mean concentration that is contacted over the exposure period. The EPC is recommended by EPA to be the UCL_{95}, which is 95 percent of the arithmetic average (EPA, 1989).

The UCL_{95} was calculated using site data. In estimating the UCL_{95}, one-half the detection limit was assumed for non-detects. The process of UCL_{95} estimation following EPA-recommended procedures is presented in Appendix H. If sample sizes were small, the UCL_{95} defaulted to the maximum detected concentration as the EPC. The estimated EPC values are presented in site-specific sections as tables, along with dose (intake) estimates.

1.6.9 Toxicity Assessment

The HHRA includes a toxicity assessment section that compiles the toxicity criteria for use in cancer risk and hazard index estimates. The toxicity criteria were obtained from the following sources:

- The Integrated Risk Information System (IRIS), a database available through the EPA National Center for Environmental Assessment (NCEA) in Cincinnati, Ohio. IRIS, prepared and maintained by the EPA, is an electronic database (http://www.epa.gov/iris/) containing health risk and EPA regulatory guidance information regarding specific chemicals. This database was the primary source of toxicity values used.
- For chemicals with no toxicity criteria listed on IRIS, EPA Region 2 contacted NCEA for interim toxicity criteria. The toxicity profiles provided by EPA are included in Appendix G of this report.
- For vanadium, as IRIS or NCEA did not have a toxicity criterion, the Health Effects Assessment Summary Tables (HEAST), provided by the EPA Office of Solid Waste and Emergency Response (OSWER) (EPA, 1997c), which compiles toxicity values published in various health effects documents issued by EPA were used.
- For chromium, a hexavalent chromium-based toxicity factor was used as a conservative risk evaluation measure.

The toxicity profiles for the appropriate chemicals are presented in Appendix G of this report.

Dermal Toxicity Factors

Adjustments of oral toxicity values were considered to estimate the effects of dose absorbed through skin. Recommended ABS_{GI} values from RAGS Volume I, *Human Health Evaluation Manual* (Part E, Supplemental Guidance for Dermal Risk Assessment) interim Review Draft

(EPA/540/R/99/005), were used. These values are provided in the RAGS Part D-formatted tables in Appendix D, for the identified COPCs.

Carcinogenic Polycyclic Aromatic Hydrocarbons

At some of the sites, only benzo[a]pyrene was identified as a COPC. Therefore, the toxicity equivalent factors (TEFs) were not used for any of the nine sites.

1.6.10 Risk Characterization

The exposure and toxicity information was integrated to estimate the potential risks and HI. The estimated excess lifetime cancer risk (ELCR) and HI represent the site being investigated for site-specific risk management decisions. The cumulative risks and HIs are then compared against the acceptable risk ranges. For the purposes of regulatory decision-making, the EPA recommends an acceptable risk range of 1E-4 to 1E-6 (1 to 100 in a million). Typically, results falling within or below this range are considered a reasonable basis for NFA. An HI value above 1.0 is further evaluated if any individual target organ HIs exceeded a value of 1.0. Typically, unless the cumulative HI to a target organ exceeds an HI of 1.0, it is typically not considered an exceedance. The conservative nature of the analysis and the uncertainty inherent in the risk assessment was considered when interpreting the results.

The risk estimations included several exposure pathway assumptions, exposure factors, EPC estimations, site conditions, and receptor behavior. Because these are assumed values, there is an inherent uncertainty associated with these hypothetical scenarios, as well as practical limitations to obtaining true value versus an assumed value. Also, the inclusion of chemicals that occur in background conditions attributes risks to a site, even though these chemicals are not likely to be specific to the site. The toxicity factors supplied by the EPA uses several extrapolation methods that are ridden with inherent uncertainty and tend to include conservatively protective assumptions during such extrapolations. Such uncertainty in toxicity factors is not addressed in this assessment, as EPA sources provide adequate documentation of such uncertainty. The uncertainty analysis section at the end of each site-specific risk assessment section presented in Appendix E qualitatively discusses the uncertainty associated with estimated risks.

Additionally, any cancer risks or non-cancer HIs from chemicals occurring in the background are also identified to determine if the estimated risks and hazards are not related to the site, but rather are a result of background conditions. When risks and HI are similar to the background, site risk management actions are not recommended.

Former NASD - Former Naval Ammunition Storage Detachment

N

Scale in Miles

0 15

Figure 1-1
Site Location Map
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

E052003002GNV

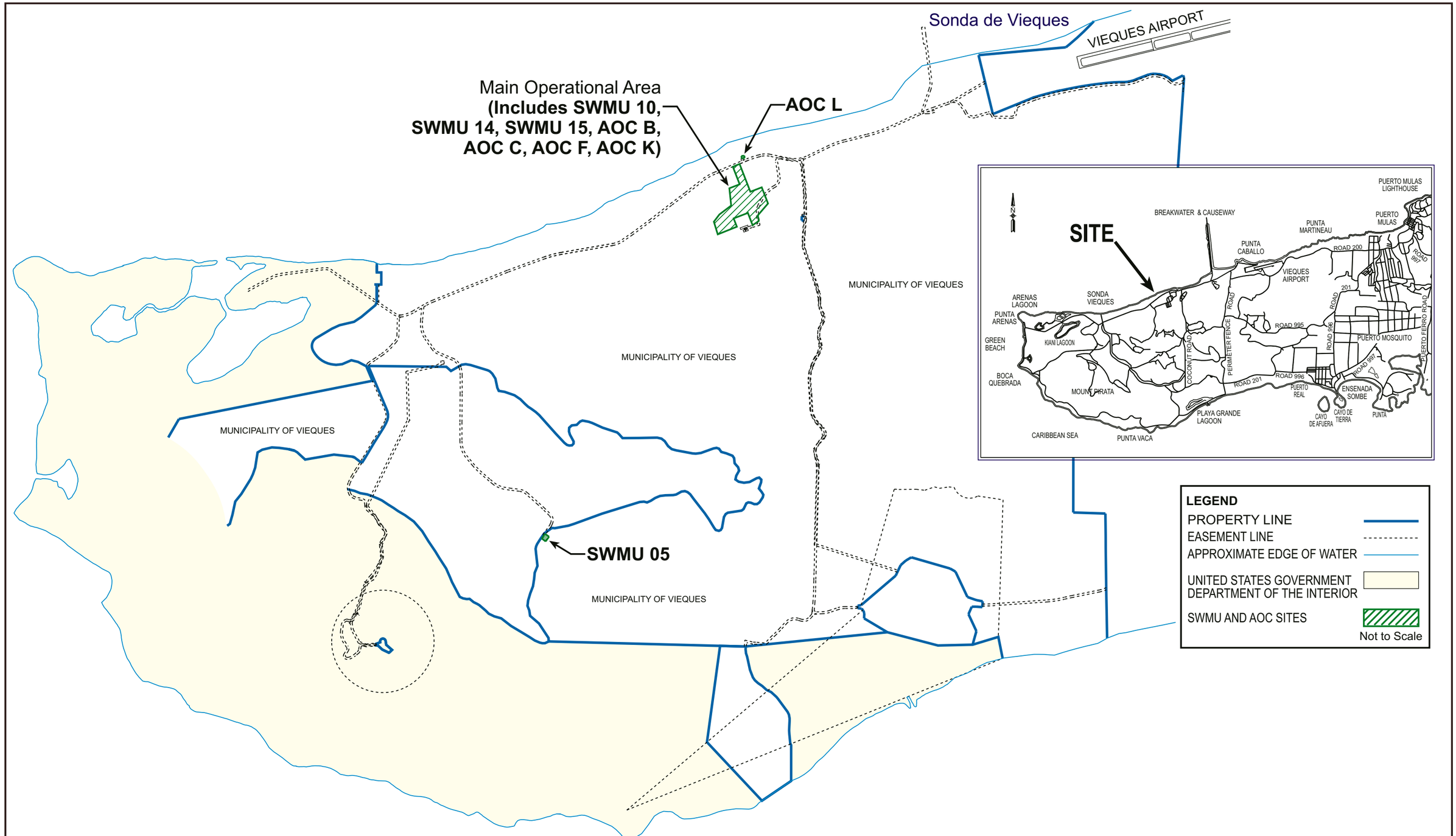


Figure 1-2
Location of NFA Sites
(SWMU-5, SWMU-10, SWMU-14, SWMU-15, AOC-B, AOC-C, AOC-F, AOC-K, AOC-L)
NFA Report for Nine Sites
Former NASD, Vieques Island Puerto Rico

CH2MHILL

E052003002GNV

NOTE: Original figure created in color

Access Restriction Boundary

Aerial Photograph Date 1994

N

0 200 400 Feet

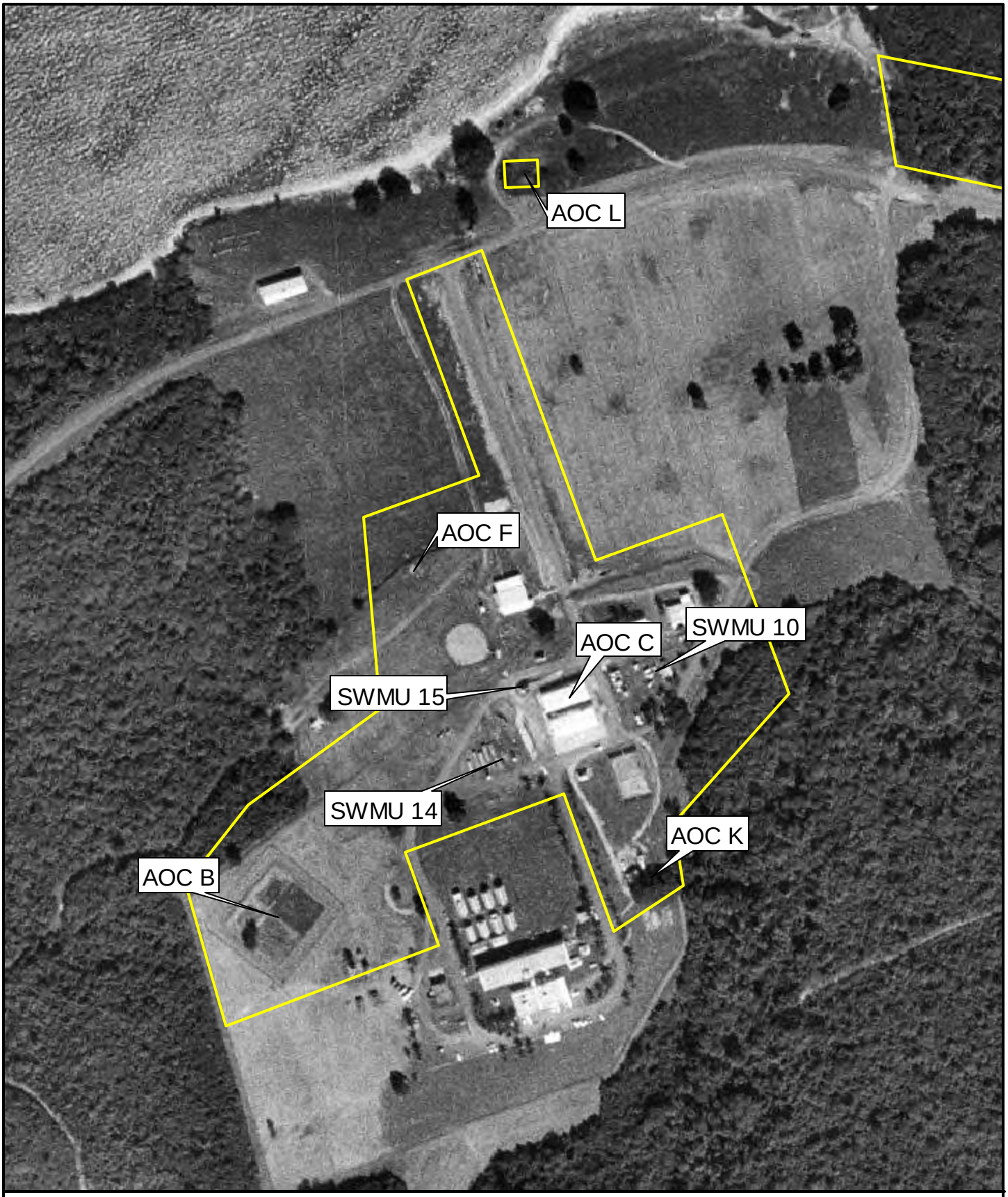
1 inch = 200 feet

Figure 1-3
Aerial Photograph of SWMU 5
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:\18gis\vieques\aprs\aerials.apr, Date: 19 May 2003 10:53, User: NMOUDRY, Figure 1-2 Aerial Photograph

NOTE: Original figure created in color



Access Restriction Boundary

Aerial Photograph Date 1994

N

0 200 400 Feet

1 inch = 300 feet

Figure 1-4
Aerial Photograph of SWMUs 10, 14, and 15 and AOCs B, C, F, K and L
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:\18gis\vieques\aprs\aerials.apr, Date: 19 May 2003 10:47, User: NMOUDRY, Figure x-x Aerial Photograph of SWMUs 10, 14, and 15 and AOCs B, C, F, K and L

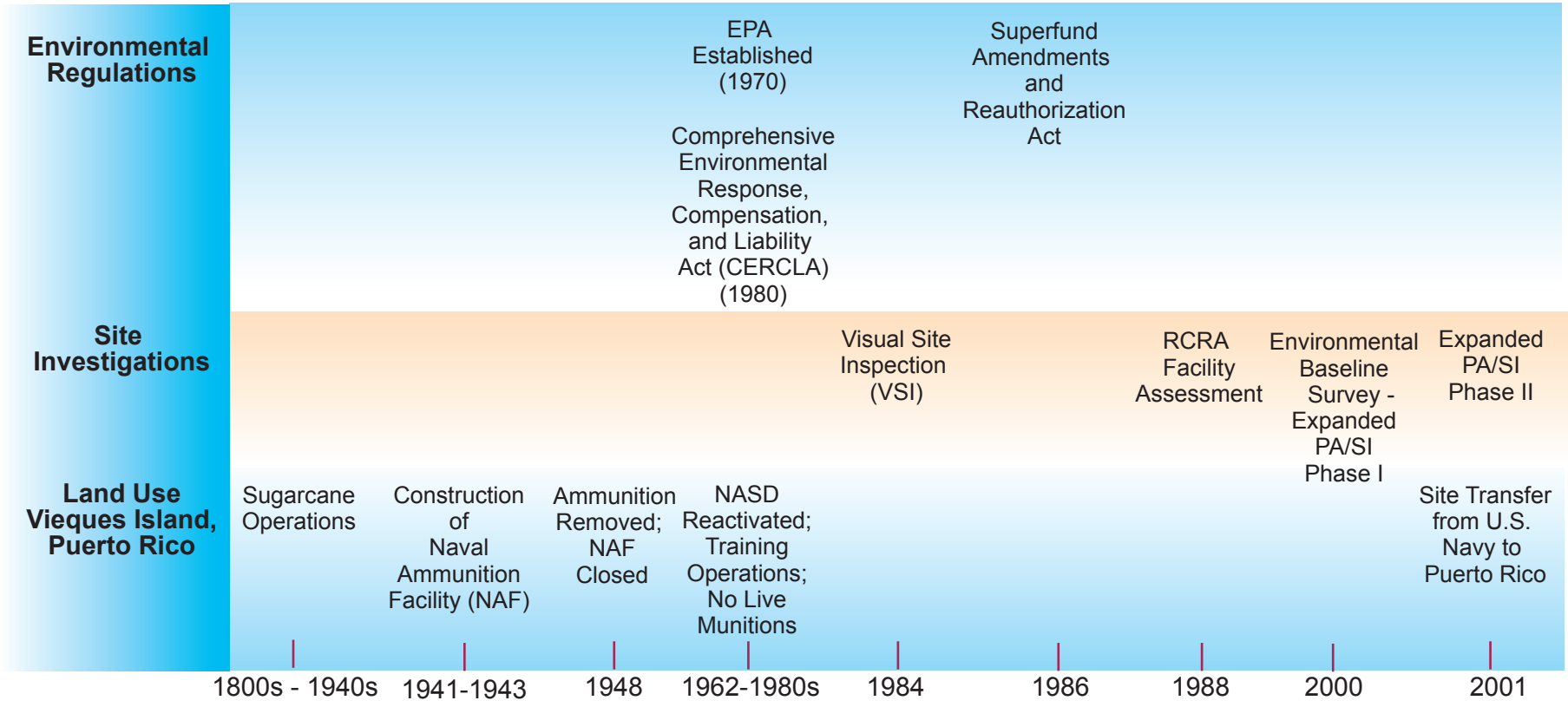


Figure 1-5
NASD Timeline
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

E052003002GNV

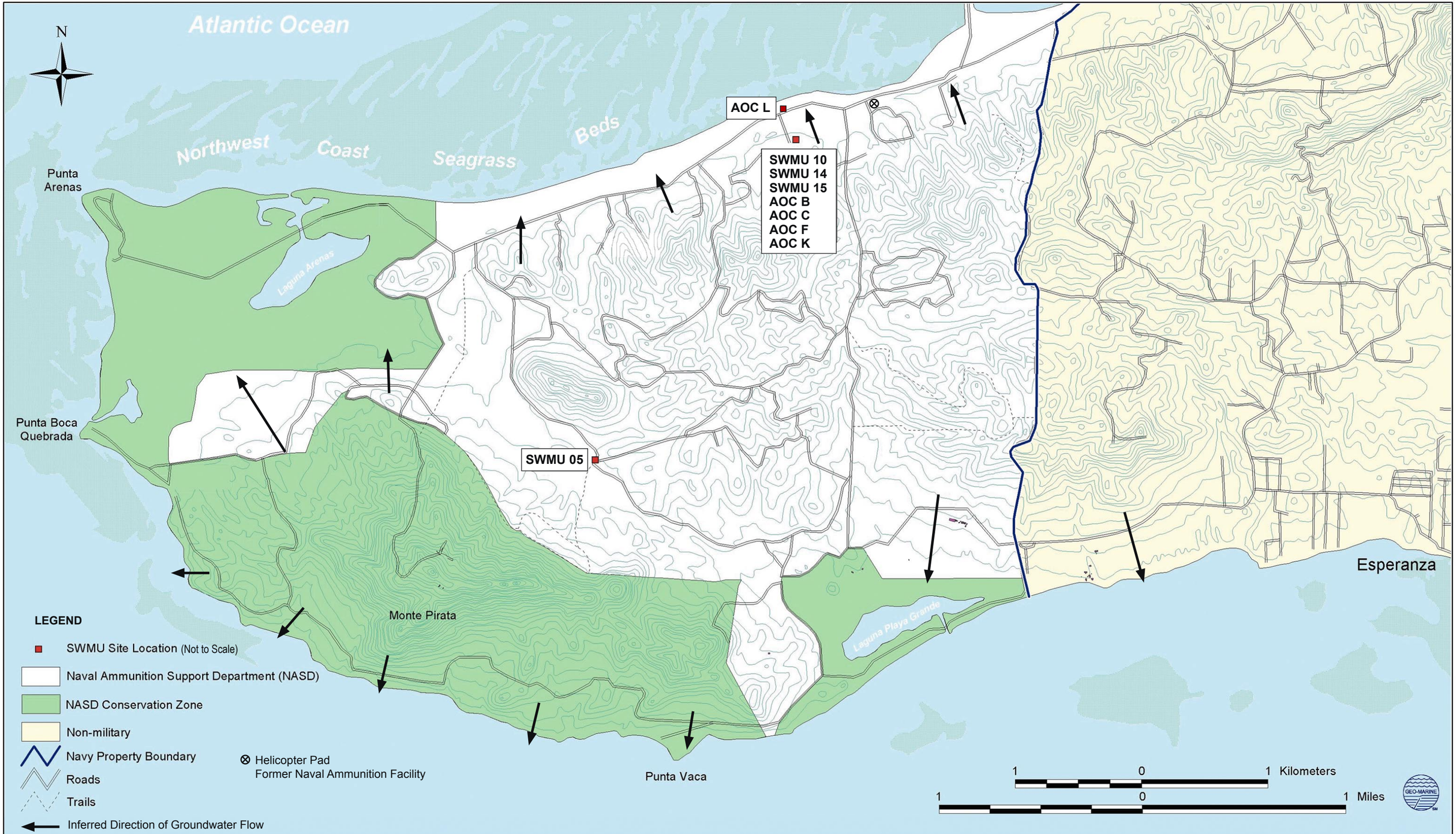
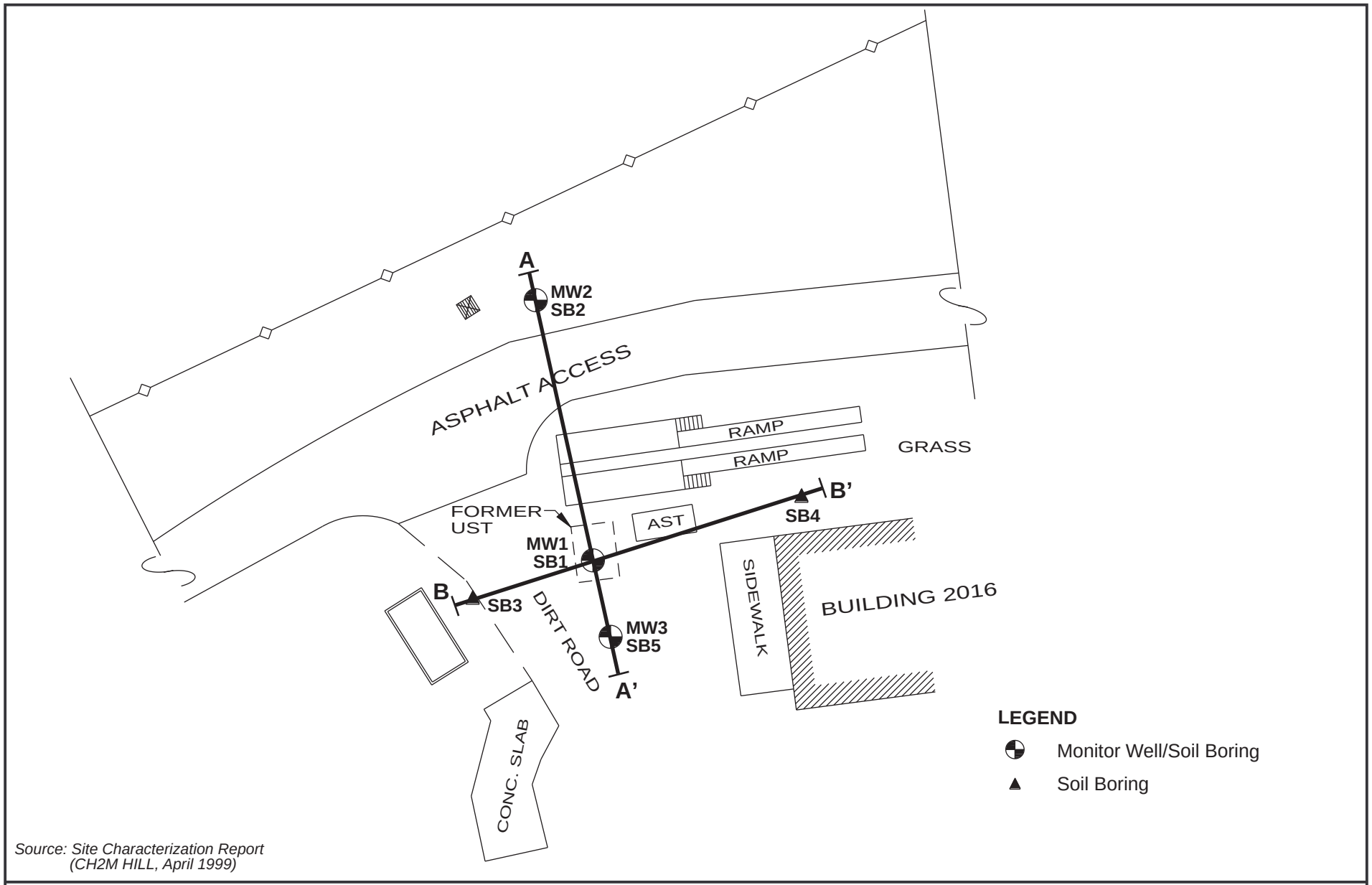


Figure 1-6
Site Topography
NFA Report for Nine Sites
Former NASD, Vieques Island Puerto

CH2MHILL

E052003002GNV



Source: Site Characterization Report (CH2M HILL, April 1999)

0 30 60

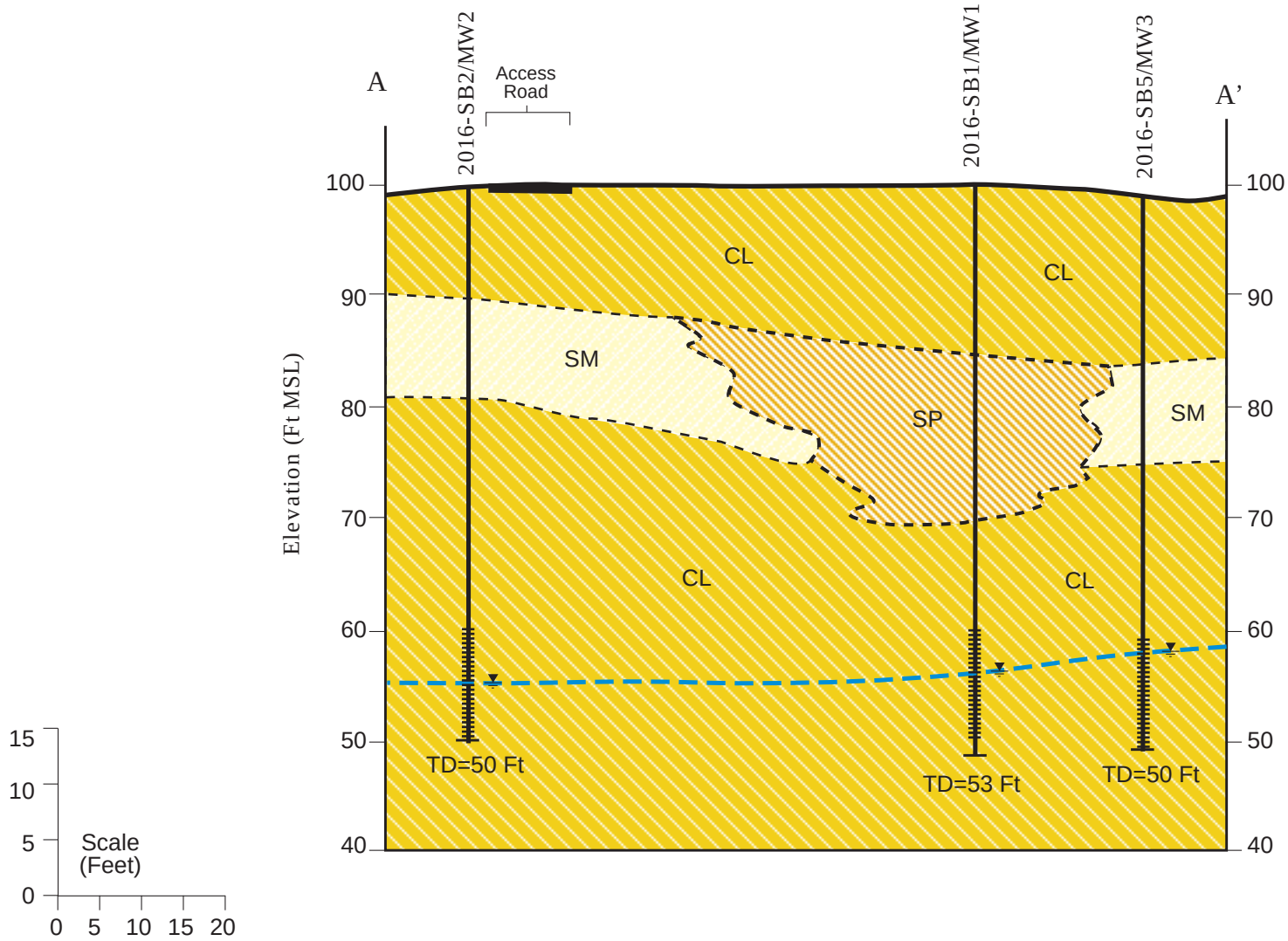
Scale: 1" = 30'

N

Figure 1-7
Location of Geologic Cross Sections
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

E052003002GNV



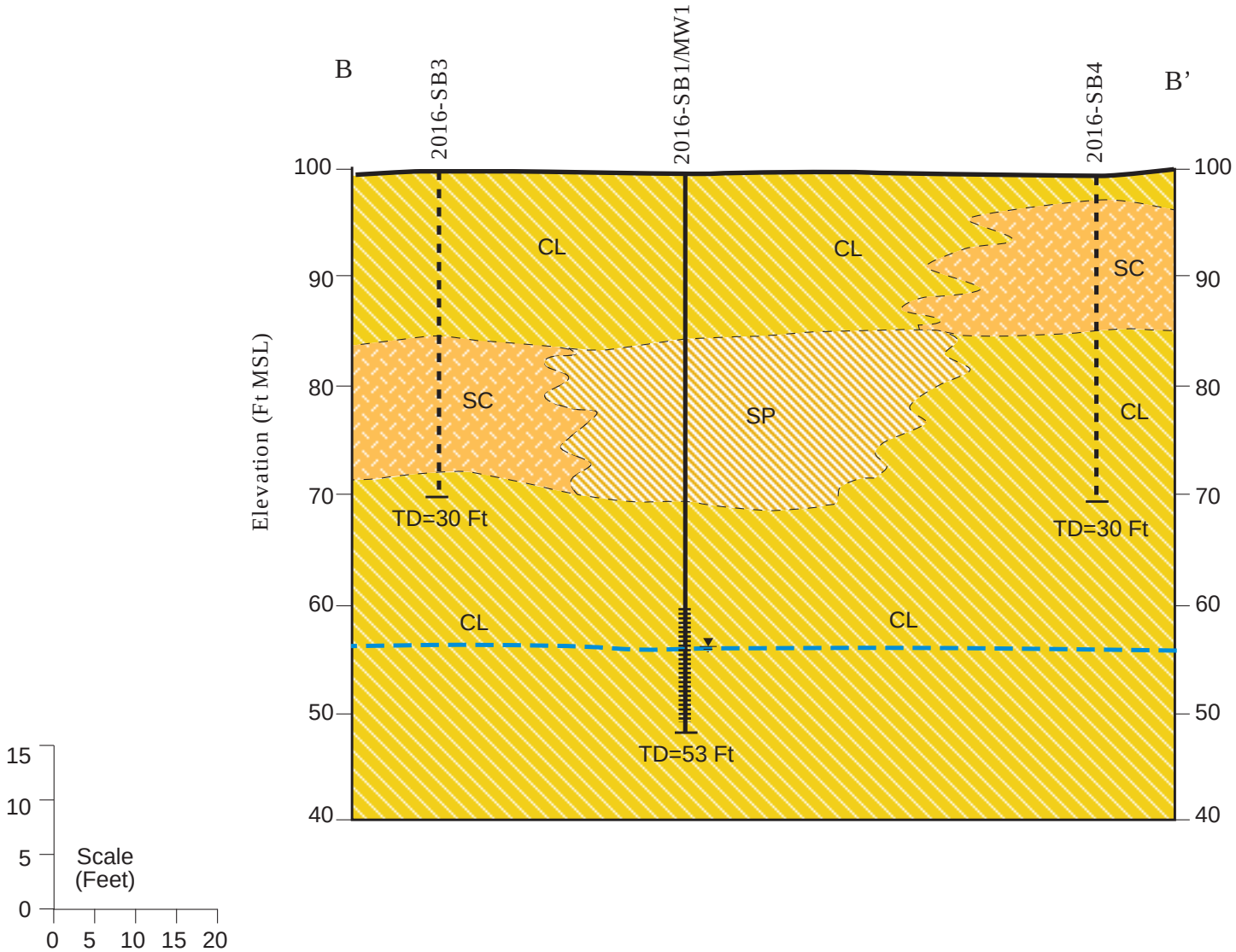
LEGEND

SM	Silty Sand		Monitor Well Screen Interval
CL	Sandy Clay		Soil Boring Total Depth
SP	Poorly Sorted Sand		Groundwater Level Elevation
TD	Total Depth	FT MSL	Feet Above Mean Sea Level

Figure 1-8
Geologic Cross-Section A-A'
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

E052003002GNV



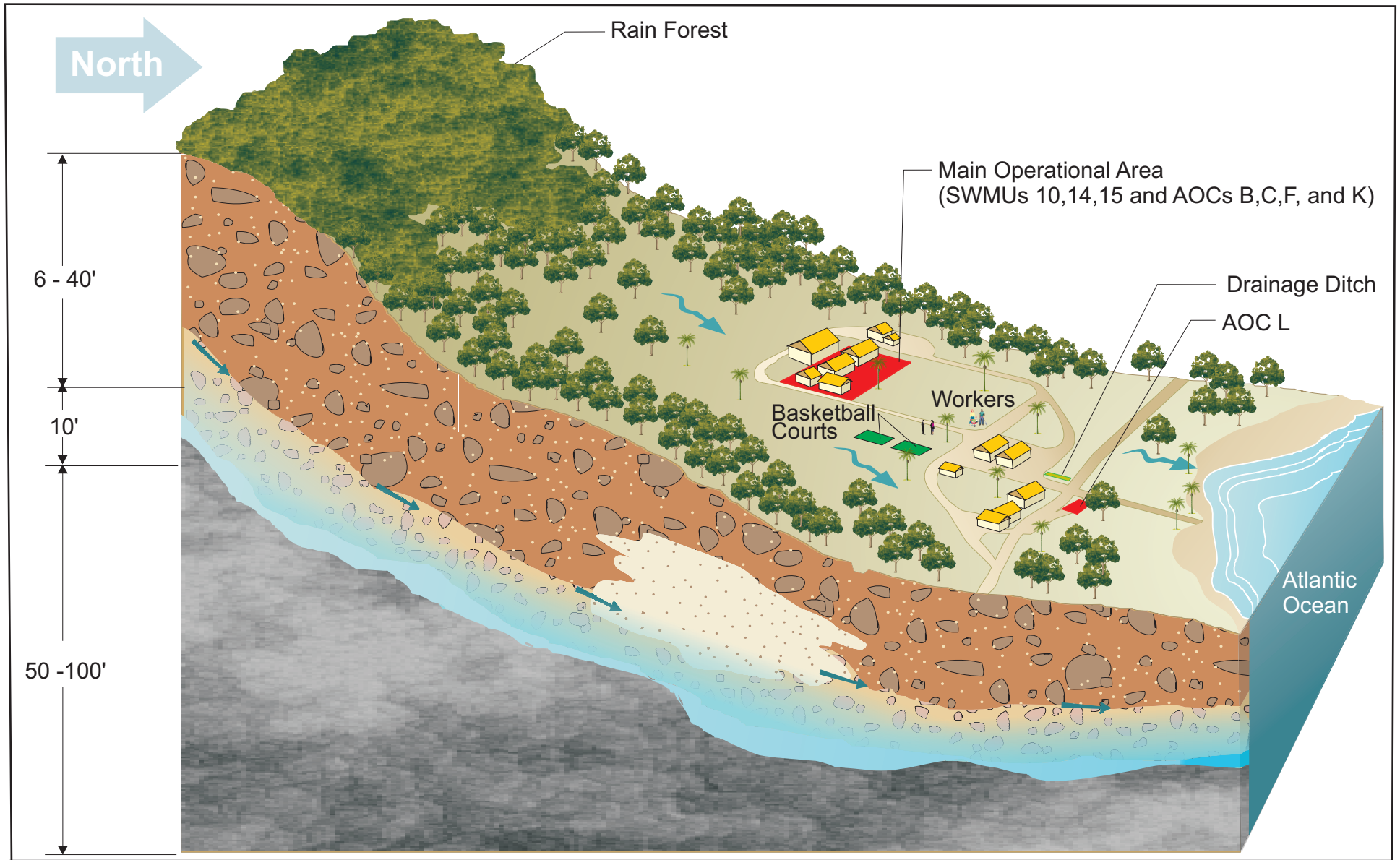
LEGEND

SC	Clayey Sand		Monitor Well Screen Interval
CL	Sandy Clay		Soil Boring Total Depth
SP	Poorly Sorted Sand		Groundwater Level Elevation
TD	Total Depth	FT MSL	Feet Above Mean Sea Level

Figure 1-9
Geologic Cross-Section B-B'
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

E052003002GNV



LEGEND

- Granite
- SC Clayey Sand/Sapprolite
- CL Sandy Clay
- SP Poorly Sorted Sand
- Groundwater
- Surface Water Flow
- Groundwater Flow

Figure 1-10
Generic Conceptual Site Model for Groundwater and Surface Water Flow and Potential Exposure Pathways
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

E052003002GNV

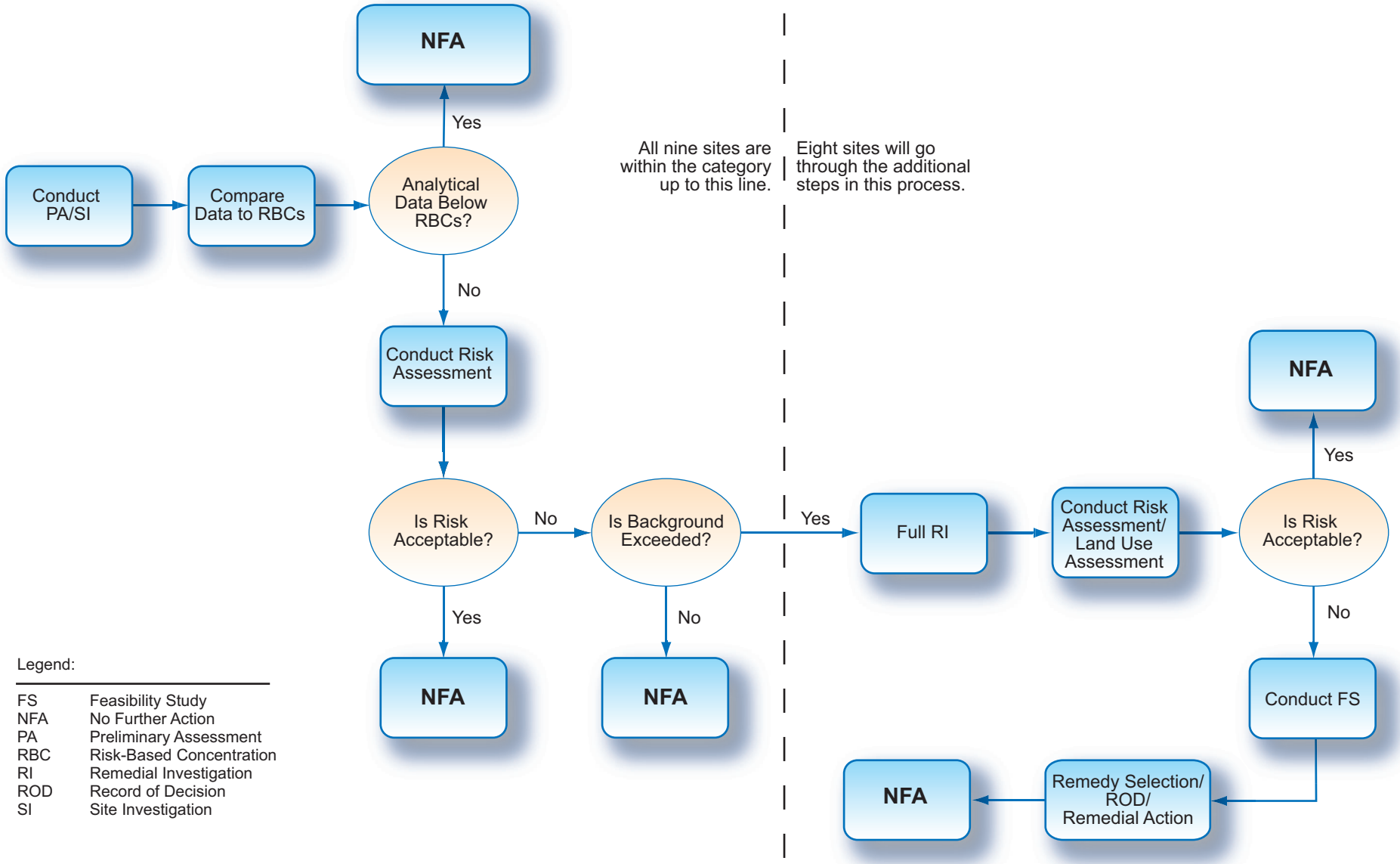


Figure 1-11
Site Risk Management Process for All Sites Identified
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

E052003002GNV

SECTION 2

Site-Specific Decision Summary for SWMU 5 – Former IRFNA/MAF-4 Disposal Site

2.1 Description

The IRFNA/MAF-4 Disposal Site (SWMU 5) is in a remote area of the former NASD in the vicinity of Magazine Building 422, as shown on Figure 1-3. Photographs of the area near SWMU 5 and the drainage ditch where a past release is reported to have occurred are shown in Figures 2-1 and 2-2.

In 1975, approximately 7,000 pounds (lbs) of fuel were reportedly emptied from leaking AQM-37A target drones into a low spot in a road near Building 422 at SWMU 5. The fuel contained 5,275 lbs of inhibited red fuming nitric acid (IRFNA) and 1,775 lbs of mixed amine fuels (MAF-4), which were emptied into a natural storm intermittent drainage channel that eventually discharges into the Vieques Sound. Mixed amine fuels contain isomers of amino xylene (49 percent) diethylamine and triethylamine (50 percent), and moisture and mechanical impurity (less than 0.25 percent) (Qinghai Limimg Chemical Co., Ltd., 2000). IRFNA is 86-percent nitric acid, 6 to 15-percent nitrogen dioxide, and less than 5-percent water (Baker Environmental, Inc., 1992). Inorganic chemicals were not reported as significant constituents of these fuels.

The location where the disposal took place was originally thought to be in the probable surface recharge area for one of the few naturally occurring springs on Vieques Island. This spring flows year-round, and is approximately 1 mile southeast of the disposal site. It was used by the local cattle cooperative until 1992. During the EBS the well area was identified as an AOC and further investigations identified that the dry ditch (quebrada) at SWMU 5 drains to the north, and the area near cattle cooperative spring drains to the south and southeast. Therefore, the spring is in a different drainage basin (PMC, 2000).

Section 1.0 of this report summarizes the general issues related to all of the sites, including SWMU 5. The summary included the site background information, physical characteristics, site hydrogeological features, future land use, unexploded ordnance/ordnance explosive waste (UXO/OE) survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

2.1.1 Topography and Surface Water Conditions

SWMU 5 is on the west-central portion of Vieques Island, approximately 60 ft northwest of Magazine Building 422, which is one of several magazine buildings in this area. The topography at this site is relatively flat, with an elevation of approximately 120 ft above msl. Stormwater drains to an intermittent stream that flows north to the Vieques Sound. No lakes or springs are present in the vicinity of this site.

2.1.2 Geological Conditions

The site geology is characterized by volcanic rocks overlain by alluvial deposits and patches of limestone. The soils are mostly tight clays with a mixture of silt and sand. Granodiorite (granite rock) and quartz diorite are the predominate geologic features present across the former NASD area of Vieques Island, including the area near SWMU 5. Soil borings collected at this site indicated that bedrock was encountered at 6, 8, and 19 ft bls. Gravel, brown silt, and some clay were present between land surface and the rock formation contact.

2.1.3 Groundwater Conditions

Groundwater was not encountered during soil boring installations up to the rock at SWMU 5. Therefore, monitoring wells were not installed at this site. As previously discussed, the spring that was used by the local cattle cooperative until 1992 is approximately 2 km southeast of the disposal site, and is in a different drainage basin that flows to the south and southeast, whereas the area around SWMU 5 drains to the north and northwest. There is no hydrological connection between the release to the dry ditch at SWMU 5 (quebrada) and the watering well. Thus, contamination from a one-time release of IRFNA/MAF-4 could not reach the watering well.

2.2 Site Characterization

2.2.1 Nature and Extent of Contamination

Surface soil was sampled from 0 to 6 inches (0.5 ft bls) depths and subsurface soil samples were collected from 6 to 19 ft bls at SWMU 5. Groundwater was not encountered at the site above the rock, therefore, no wells were installed. The depth to groundwater here is estimated to be 120 ft, based on USGS reports that groundwater occurs near sea level at the former NASD. The ditch length was sampled at four locations. Analytical data evaluations and DQE findings presented in the PA/SI report were summarized in Section 1.0 of this report. Sample-specific concentration comparisons with the most current PRGs (last updated in 2002) are included in the report, along with sampling depths for each soil sample.

Figure 2-3 shows the location of SWMU 5 within the former NASD and the cattle cooperative area well, relative to the site. The following discussion presents the results of the investigation conducted at SWMU 5 and the analytical results that were previously presented in the Expanded PA/SI report prepared by CH2M HILL (October 2000). A summary of the previously presented information from the PA/SI is included herein. The Expanded PA/SI field investigations for SWMU 5 were conducted in April and May of 2000 and included the collection of surface soil and subsurface soil samples from four borings.

Additionally, field screening using an Organic Vapor Meter (OVM) was conducted at various depths at all four soil boring locations during the Phase I Expanded PA/SI (see Appendix B of the Expanded PA/SI Report for details). One boring (SWMU5-SB01) had OVM readings of 21 ft bls. Another three soil borings had OVM measurements of 6 or 8 ft bls. Only trace level readings were measured at SWMU5-SB01, and none were measured at the other three soil borings. These results indicated that VOCs are not apparent in the subsurface soil at this site. These samples were further analyzed for VOCs in the laboratory and results were included in the screening analysis.

The soil sampling locations are shown in Figure 2-4. The samples were analyzed for VOCs, SVOCs, and explosives. Because metals are not significant constituents of the fuels that were reported to have been released, they were not included in the analytical suite of parameters during the Expanded PA/SI. The data were reevaluated with respect to the screening procedures outlined in the *Final Expanded PA/SI Report - Phase II*, prepared by CH2M HILL in November 2002. The specific details and results for SWMU 5 are documented in the Phase II Expanded PA/SI report. These data provide the rationale for the recommendation of NFA for SWMU 5.

Concentrations of detected chemicals were screened against risk-based criteria at each site. These criteria include EPA Region 9 screening criteria for surface soil direct exposure to human receptors, residential and industrial risk-based concentrations (i.e., PRGs), and indirect leachability criteria for soil (SSL based on DAF=20). A summary of the chemicals that exceed screening criteria is presented in Table 2-1, and is depicted in Figure 2-5. The complete set of data for SWMU 5 is presented in Appendix B, and a data statistical summary is presented in Appendix C. Appendix D-1 includes the RAGS Part D formatted tables for the COPC selection.

Surface Soil Results

Table 2-1 presents the results of the screening analysis for surface soil data, and Appendices B and C present the analytical data and statistical summaries, respectively. The analytical results from the SWMU 5 soil borings as presented in the Expanded PA/SI report indicated two detections of benzo[a]pyrene at levels slightly greater than detection limits and the screening criteria, the residential PRG, but less than industrial PRG. Benzo[a]pyrene was detected in soil boring SWMU05-SB01 at a concentration of 0.088 mg/kg and in soil boring SWMU05-SB04 at a concentration of 0.075 mg/kg. Both concentrations are above the residential PRG of 0.062 mg/kg.

Benzo[a]pyrene is a constituent of PAHs, and is present in low levels within petroleum fuels and other common materials, such as the asphalt used to pave roads, the tar on roof shingles, and the exhaust emissions from cars (ATSDR, 1995). The detected benzo[a]pyrene may not be related to a fuel spill, as amino fuels are not reported to be sources of PAHs (see www.atrtonautix.com/props/nitamine.htm). Thus, this constituent may not be related to the one-time release of drone fuel at the site. In addition, the site is located near asphalt pavement, of which PAHs are constituents. Considering the low levels of PAHs present in fuels and the relatively large proportion of PAHs in asphalt material, it is likely that the source of the PAHs is the asphalt material.

However, to provide a conservative approach, these detections were evaluated as part of the risk assessment. VOCs, SVOCs, pesticides, PCBs, and explosives were either not detected, or were detected at concentrations below their applicable screening criteria. Table 2-1 summarizes the surface soil detections above the PRGs.

Subsurface Soil Results

A total of 13 subsurface soil samples were collected from four soil borings. Appendices B and C present the data and statistical summaries for the soil borings. Several of the fuel constituents were detected at trace levels in the subsurface soils. No constituents were detected above screening criteria in subsurface soils.

Groundwater Results

The Expanded PA/SI did not include groundwater sampling, because no constituents were detected in the subsurface samples at levels greater than the screening criteria.

2.2.2 Contaminant Fate and Transport

The objective of the environmental fate and transport evaluation is to examine the potential for the contaminants to impact other currently uncontaminated media in the future through migration. The migration potential is identified by evaluating the physical, chemical, and biological changes that occur to chemicals currently identified in the site media. The potential contamination expected from drone fuel release to soils at SWMU 5 and its theoretical fate and transport is discussed in detail in Section 2.2.4. MAF-4 and IRFNA are both used as propellants/rocket fuels, which were reported to have been released to the dry ditch. Of the constituents identified as potentially present in the MAF-4/IRFNA released, only a selected subset was identified as part of the Target Chemical List (TCL), which is the EPA list for CERCLA sites. These target chemicals include xylene, nitroso-dimethylamine, and nitroso-trimethylamine, which may have been fuel constituents of MAF-4 and/or IRFNA, were analyzed for in the soil samples but never detected. Thus, none of the drone fuel-specific chemicals were detected in the site soils. The only chemicals detected that may or may not be related to the past fuel releases are PAHs.

Trace levels of PAHs (in two of four samples) and toluene (in one of four samples) detected in soil samples were less than the reporting limits, with a "J" qualifier in surface soil. Benzene, toluene, ethylbenzene, xylene (BTEX), and PAHs were also detected in the subsurface soil samples at low-level concentrations as compared to their detection/reporting limits. In addition, they were all less than the screening criteria for leachability, which indicates that observed concentrations do not present a continued release concern to the site subsurface. Also, the site is underlain by thick, impervious granite rock, which minimizes the migration potential to groundwater.

Only one SVOC (benzo[a]pyrene) was identified in surface soil above screening criteria, and is thus considered a COPC for surface soil at SWMU 5. This constituent is a potential by-product that may be derived from the asphalt pavement located adjacent to the sampling site. Benzo[a]pyrene also occurs in fossil fuels refining/cracking process, burnt engine oils, and can be associated with rubber tire wear (ATSDR, 1990).

As a result of its very low vapor pressure, low solubility, and tendency to bind to organic matter, benzo[a]pyrene deposited in soil is likely to remain adsorbed by soil particles. Desorption from soil into water or air is very unlikely. In addition, photodegradation from exposure to sunlight and biodegradation by bacteria, fungi, and plants is the major fate process for benzo[a]pyrene in soils, which likely reduces its concentrations in surface soil with time (ATSDR, 1990).

2.2.3 Summary of Data Evaluation

Benzo[a]pyrene exceeded the screening criteria in two surface soil samples. No other chemicals exceeded the screening criteria. Because of its chemical properties, benzo[a]pyrene has a tendency to remain absorbed to soil particles or to biodegrade naturally. The site was recommended for NFA at the end of the Expanded PA/SI. However, a risk assessment was conducted to assess potential risks from the surface soil, which had

only benzo[a]pyrene as a COPC. A summary of the results of the risk assessment is provided in Section 2.4.

2.2.4 Conceptual Site Model

Figure 2-6 presents the exposure CSM for SWMU 5. IRFNA is a strong oxidizing acid, and MAF-4 consists of highly volatile, nitrogen-containing fuel compounds. Both chemicals undergo rapid degradation or transformation, and are therefore not persistent in the soil to which they are released. The acids may alter the pH of soils that immediately come into contact with them for a short time after the release of large amounts of these chemicals. However, rainfall washes the soils, which allows the pH to stabilize and to return to its characteristic level. The fuel oils that are part of the MAF-4 were not detected in any of the surface or subsurface soil samples above screening criteria. No organic contamination is expected from the IRFNA reported to have been released at this site.

The organic constituents of the fuels typically include hydrocarbons, such as total petroleum hydrocarbons (TPH), with a smaller proportion (<0.5 to 5 percent) of more volatile BTEX-type of chemicals, and PAHs. However, the drone fuel reported as having been released at SWMU 5 contained mostly xylenes and di- and tri-methyl amines mixed with acids, which is not likely to contain any measurable amount of PAHs. The past surface release of fuels containing hydrocarbons tend to retain heavier hydrocarbons in the surface, and lighter hydrocarbons may migrate through volatilization into air as well as to some extent through leaching into subsurface soils. A one-time release of fuel has a very limited potential to contribute to the subsurface soil contamination. Because these highly oxidative fuels are designed for quick burning and are relatively unstable (more so than gasoline), they are expected to have shorter half-lives in soils. In addition, there are no fuel-oil-related chemicals in the subsurface soil samples collected at the site. Finally, because 25 years have passed between the time of release and sampling, any migration that may have occurred may have attenuated/degraded with time, and thus are not present in measurable levels at this time.

In summary, there are no significant migration pathways for this 27-year-old, one-time fuel release. The organic portion of the fuel oils is not likely to be a significant migration pathway because of the short half-lives of these highly oxidized amine fuels, and the subsurface migration is not a significant pathway because of the presence of impervious rock in relatively shallower subsurface depths (e.g., 6 to 19 ft bls) as well as the absence of water above the rock material. The groundwater at the site is below the rock, thus a release to reach groundwater is unlikely. Based on the absence of measurable levels of fuel oils in site media, no media were identified as significant for exposure at this site. The surface soil at the site had detectable levels of PAHs. These may have been from either the release at the site or related to the background soils at the site. Because there is a possibility that these PAHs are related to the past release at the site, potential exposure pathways were conservatively evaluated.

2.3 Ecological Assessment at the Former NASD

An ecological assessment was conducted for various sites within the western portion of Vieques Island, including the former NASD area. A copy of the survey results was included as an appendix in both of the Phase I and Phase II PA/SI reports, and the results are

summarized in Section 1.0 of this report. A site-specific summary of the ecological assessment conducted is included herein.

At SWMU 5 two plant communities were present: 1) the maintained grasslands of the small ditch where the past release of IRFNA/MAF-4 was reported, and 2) the non-maintained large ravine. The non-maintained ravine consists of a patchy canopy of various trees, shrubs, and herbaceous ground cover. During the wildlife survey numerous wildlife species were observed utilizing the habitat of this site, including indications of the presence of horses that likely frequented the area. Birds of coastal forest species were also observed along with numerous species of lizards. There was no evidence that the SWMU 5 had any impact on wildlife species or their habitats. There were no federally protected species or preferred habitats observed at this site. A terrestrial forested plant community dominated the site and is not the preferred habitat of any of the species. Further details of this survey can be found in the Phase I PA/SI Report, Appendix I in Volume II (CH2M HILL, October 2000).

2.4 Human Health Risk Assessment

A risk assessment was performed for benzo[a]pyrene, which was identified as a COPC in surface soil at SWMU 5. There were no COPCs identified in subsurface soil. Toxicity factors available on IRIS were used in this risk assessment, and are provided in Appendix D-1. As no noncarcinogenic chemicals were identified as COPCs at this site, no reference doses were provided and the risk characterization did not include a HQ/HI calculation.

The individual sample data used in the risk assessment for surface and subsurface soils are included in Appendices B-3 and B-4, respectively. Appendix C includes a statistical summary for the total number of samples analyzed, the number of detections, and the minimum and maximum concentrations. All data and risk tables were formatted according to the RAGS Part D formatting guidelines. During the risk assessment the latest available EPA guidance was used; a list of the applicable references is included in Section 1.0 and as a footnote to the tables in Appendix D-1. The comprehensive risk assessment is provided in Appendix E. A total of four surface soil and 13 subsurface soils were collected at SWMU 5 as part of the PA/SI sampling effort (CH2M HILL, October 2000), and results were screened against the appropriate, residential risk-based criteria (see Table 2-1). The comparison criteria used for screening the data are included in Appendix B-2.

Exposure pathways were considered complete for maintenance workers, industrial workers, recreational receptors, and residential receptors (see Table 2-2). Subsurface soil was evaluated for exposure to construction workers at all sites proposed for NFA in this report. However, because there were no COPCs identified in the subsurface soil at SWMU 5, the exposure pathway is incomplete for a future construction worker in this area. Table 2-3 presents the risks estimated for benzo[a]pyrene in surface soil for the receptors identified in the exposure assessment at SWMU 5.

Because of the topography and physical characteristics of this site, it is unlikely that this site would be suitable for industrial or residential land use. Occasional maintenance, such as weed control, could occur in the future. However, the assumption that a worker or recreational user would spend an entire day at this site is conservative, and the potential exposure such receptors would receive is likely to be overestimated. A residential receptor exposure scenario was evaluated only for comparison purposes, as the site is much smaller

(50-ft long and less than 6-ft wide) than a typical residential lot of 0.5-acre. Thus, risks are estimated based on higher exposures than those realistic for the site. This ensures high conservatism in the estimated risks (see Appendices D and E). The results of the risk estimations for each of the receptor populations are summarized below:

Maintenance Worker

For a future maintenance worker, the Excessive Lifetime Cancer Risk (ELCR) for exposure to surface soils is 8.7E-8, which is less than the acceptable risk range of 1E-4 to 1E-6. Thus, maintenance worker exposure to site surface soils does not present an excessive risk.

Industrial Worker

The estimated ELCR for a future industrial worker exposed to benzo[a]pyrene in surface soils is 4.2E-7. This is less than the acceptable risk range for carcinogenic effects. Therefore, there are no unacceptable levels of carcinogenic risk to future industrial workers from exposure to surface soils at this site.

Recreational Receptors

The estimated combined ELCR for a future recreational adult and child exposed to surface soils is 2.2E-7 and 2.9E-7, respectively, and the combined cancer risk is less than the acceptable risk range. Thus, there is no unacceptable risk associated with exposure to surface soils for a recreational adult or child.

Residential Receptors

For future residential receptors, the ELCR for an adult is 4.6E-7. The residential child ELCR is estimated to be 9.06E-7. The combined cancer risk from exposure to a resident living in the same area as a child and an adult is 1.4E-6, which is within EPA's acceptable risk range of 1E-4 to 1E-6. Thus, the residential receptor exposures are also well within acceptable range.

2.5 Conclusions and Recommendations

Only benzo[a]pyrene, a PAH, presented an exceedance of the screening criteria in two surface soil samples at SWMU 5. No other COPCs were identified in site media. These may or may not be related to past site releases. The residual PAHs in soils do not present risks to human health above acceptable levels. No further investigation is required for the soils for the protection of human health or the environment based on an analysis of available surface and subsurface soil sample results and the pertinent information for the site. None of the site media require further monitoring or action. In addition, the risks are well within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential receptors.

It is not clear if the detected benzo[a]pyrene is associated with the reported past spill or from nearby road runoff from the asphalt material located at the site. Thus, the benzo[a]pyrene may or may not be related to past site releases. The residual PAHs in soils do not present risks to human health above acceptable levels. No further investigation is required for the soils for the protection of human health or the environment based on analysis of available surface and subsurface soil sample results and pertinent information for the site. Therefore, the selected remedial alternative for the soils and groundwater at the site is NFA.

TABLE 2-1
SWMU 5 COPC Selection for Surface Soil
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Mean Concentration of Detects	Best Estimate of the Mean[a]	Residential PRG[b] (HI=0.1)	Industrial PRG[b] (HI=0.1)	SSL[c] (DAF=20)
Benzo[a]pyrene	4	2	0.088	0.075	0.082	0.13[c]	0.062	0.29	8.0

All values are presented in units of milligrams per kilogram (mg/kg) (parts per million [ppm]).
[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] EPA Region 9 Preliminary Remediation Goals (PRGs). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA *Soil Screening Guidance: Technical Background Document*. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm

DAF dilution attenuation factor
HI Hazard Index
PRG preliminary remediation goal
SSL soil screening level

TABLE 2-2
SWMU 5 Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site soils	Yes	Scenario is protective of any occasional site visitors.
Industrial Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site soils	Yes	Area could be developed in the future for industrial use.
Construction Worker	Subsurface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site soils	No	There are no COPCs identified in subsurface soil, making it an incomplete pathway.
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site soils	Yes	Area could be developed in the future for recreational use and would be protective of any occasional trespasser.
Residents	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site soils	Yes	Although the site topography is unsuitable for residential development, this is a worst-case scenario for comparison purposes.

TABLE 2-3
SWMU 5 Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Future Receptor	**Ingestion**	**Dermal**	**Inhalation**	**Total**	**Ingestion**	**Dermal**	**Inhalation**	**Total**
Maintenance Worker								
	Surface Soil				Surface Soil			
	4.7E-08	4.0E-08	NA	8.7E-08	NA	NA	NA	NA
	Total				Total			
	4.7E-08	4.0E-08	NA	8.7E-08	NA	NA	NA	NA
Industrial Worker								
	Surface Soil				Surface Soil			
	2.2E-07	1.9E-07	NA	4.1E-07	NA	NA	NA	NA
	Total				Total			
	2.2E-07	1.9E-07	NA	4.1E-07	NA	NA	NA	NA
Recreational Adult								
	Surface Soil				Surface Soil			
	9.0E-08	1.3E-07	NA	2.2E-07	NA	NA	NA	NA
	Total				Total			
	9.0E-08	1.3E-07	NA	2.2E-07	NA	NA	NA	NA
Recreational Child								
	Surface Soil				Surface Soil			
	2.1E-07	7.6E-08	NA	2.9E-07	NA	NA	NA	NA
	Total				Total			
	2.1E-07	7.6E-08	NA	2.9E-07	NA	NA	NA	NA
Residential Adult								
	Surface Soil				Surface Soil			
	3.0E-07	1.6E-07	NA	4.6E-07	NA	NA	NA	NA
	Total				Total			
	3.0E-07	1.6E-07	NA	4.6E-07	NA	NA	NA	NA
Residential Child								
	Surface Soil				Surface Soil			
	7.0E-07	2.6E-07	NA	9.6E-07	NA	NA	NA	NA
	Total				Total			
	7.0E-07	2.6E-07	NA	9.6E-07	NA	NA	NA	NA

HI Hazard Index
ELCR Excess Lifetime Cancer Risk
NA Not applicable
The combined carcinogenic risks for a residential child and adult (if a receptor lives in same area as a child and adult) is 1.4E-6.

FIGURE 2-1
Ditch at SWMU 5, Facing Northeast

FIGURE 2-2
Ditch at SWMU 5, Facing Southwest

File Path: t:\environmental\171028_nasd nfa\gis\nfa sites.apr

LEGEND

- Cattle Cooperative Well 3PW01
- SWMU 05

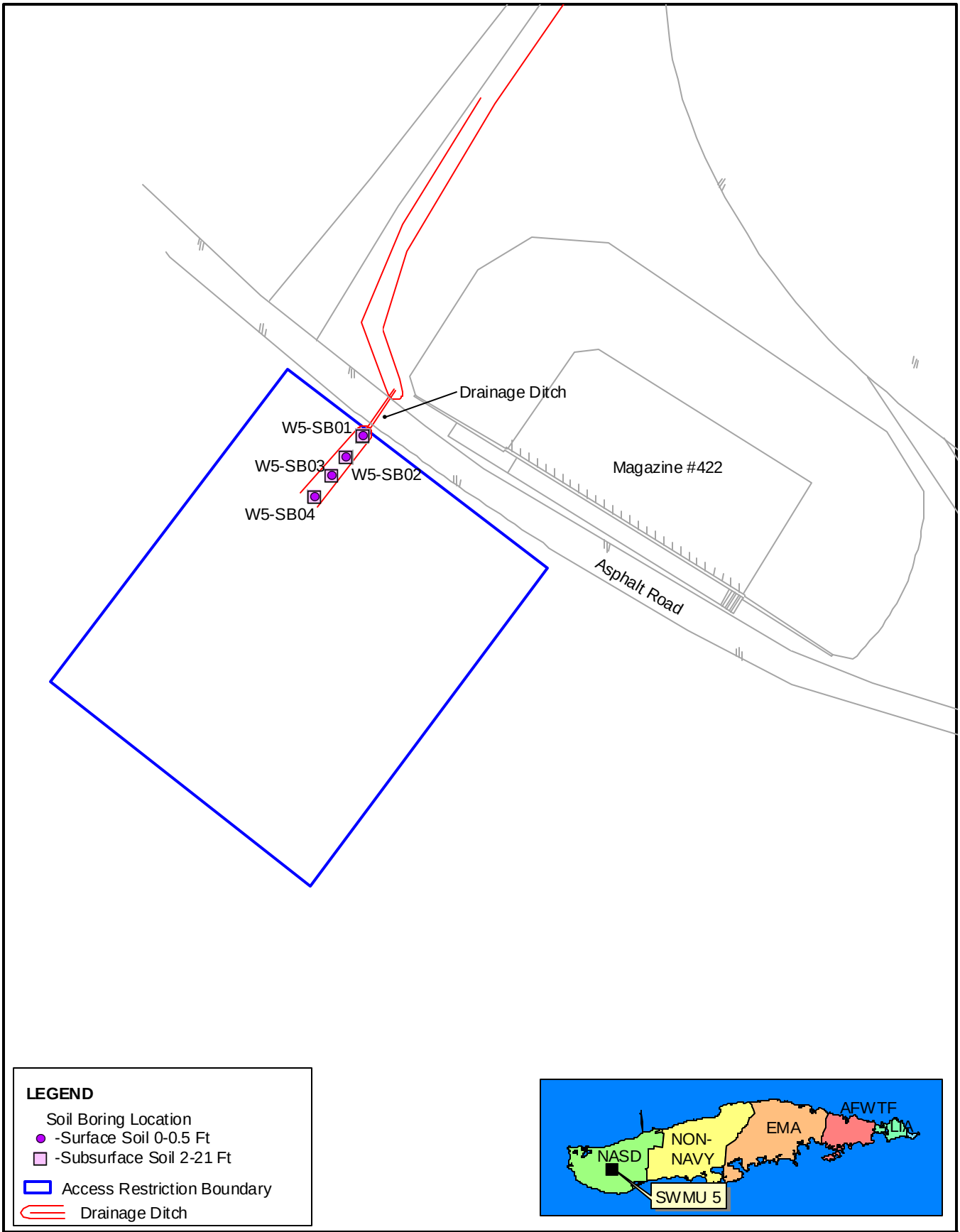
N

0 0.5 1 Mile

Figure 2-3
SWMU 05 and Cattle Cooperative Well 3PW01 Site Location
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr



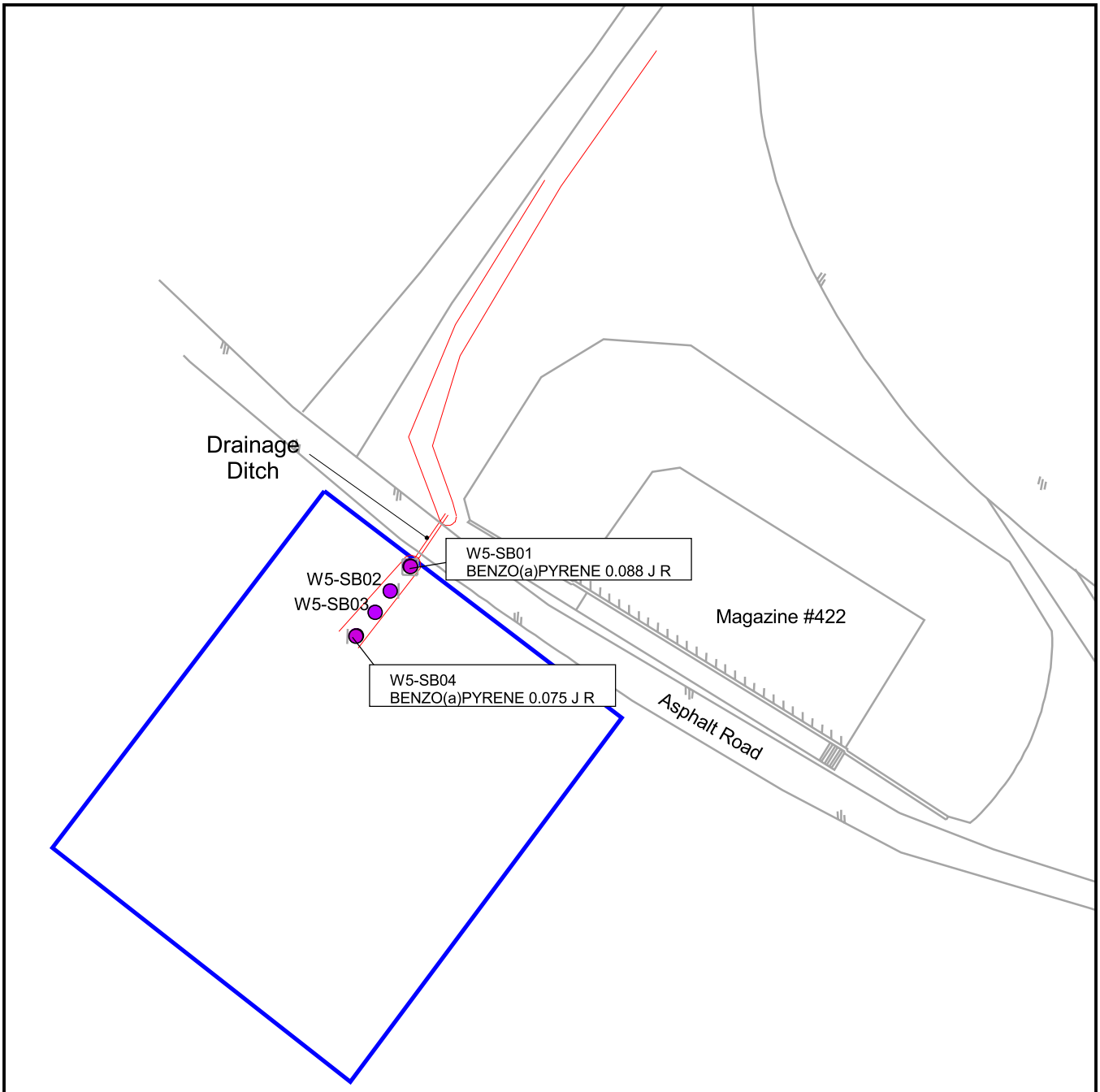
N

0 30 60 Feet

Figure 2-4
SWMU 5 Soil Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr



LEGEND

- Surface Soil Boring Location (0-0.5 Ft)
- Access Restriction Boundary
- Drainage Ditch

ANALYTICAL RESULT QUALIFIER

J = Estimated Value

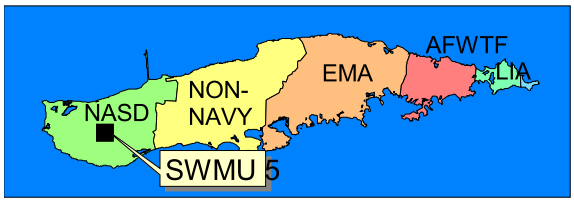
SOIL RESULTS QUALIFIER

R = Residential PRG Exceedence

NOTES

Soil Detections Reported as mg/kg

PRG = EPA Region 9 Preliminary Remediation Goal



0 30 60 Feet

Figure 2-5

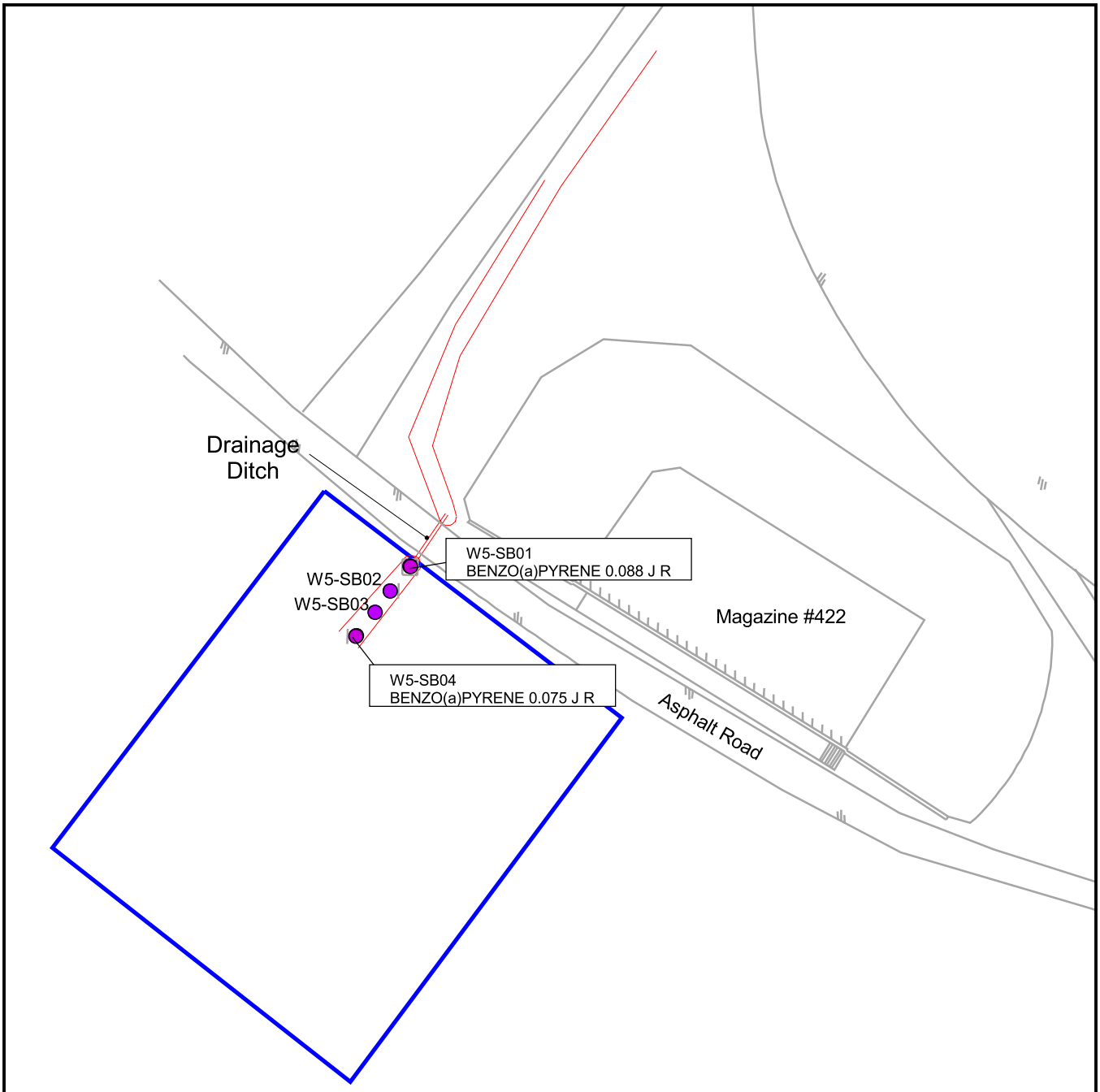
SWMU 5 Surface Soil Detections Above Screening Criteria

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr



LEGEND

- Surface Soil Boring Location (0-0.5 Ft)
- Access Restriction Boundary
- Drainage Ditch

ANALYTICAL RESULT QUALIFIER

J = Estimated Value

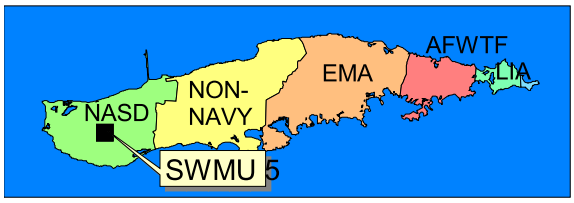
SOIL RESULTS QUALIFIER

R = Residential PRG Exceedence

NOTES

Soil Detections Reported as mg/kg

PRG = EPA Region 9 Preliminary Remediation Goal



0 30 60 Feet

Figure 2-5

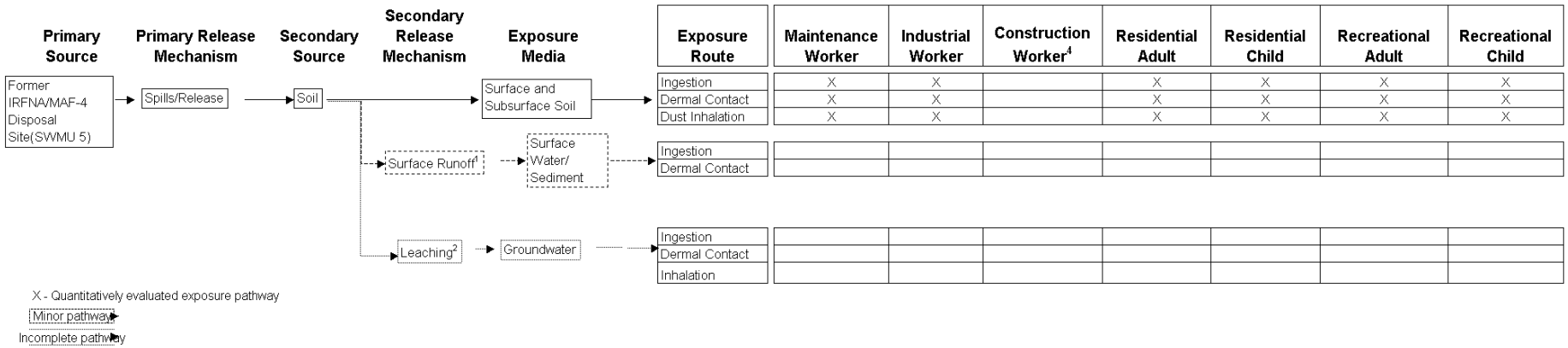
SWMU 5 Surface Soil Detections Above Screening Criteria

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 2-6
Conceptual Site Model for SWMU 5
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Notes:

[1] Considered a minor pathway based on the historical nature of suspected contaminant release

[2] Considered incomplete pathway due to the depth to groundwater and nature of suspected contaminant release

[3] The site is a short dry ditch, and these pathways are not possible, however were included for conservative assessment

[4] Construction worker exposure pathway is incomplete due to absence of COPCs in subsurface soil

SECTION 3

Site-Specific Decision Summary for SWMU 10 – Former Waste Paint and Solvents Disposal Ground

3.1 Description

SWMU 10 is the Former Waste Paint and Solvents Disposal Ground. The SWMU consists of an area surrounding the former Paint Locker, Building 4001, within the Public Works Area, which is located on the northern portion of the former NASD. The building itself is a relatively small metal shed, and can be seen in the photographs provided in Figures 3-1 and 3-2. SWMU 10 was used between the mid-1970s until approximately 1990. The storage shelves inside the metal shed had small storage space, and it was reported during the site investigation that small paint cans were stored there. It is suspected that small quantities (less than 1 gallon) of paints, solvents, and thinners were disposed of on the ground outside Building 4001. Although an area of 3 square feet (ft^2) of staining and stressed vegetation was reported during the RCRA site inspection in 1988 (A.T. Kearney, 1988), no impacted areas were observed during the Expanded PA/SI. The site is currently inactive, overgrown, and shows no signs of stressed vegetation.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including SWMU 10. The summary included the site background information, physical characteristics, site hydrogeological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

3.2 Site Characterization

3.2.1 Nature and Extent of Contamination

The Expanded PA/SI at SWMU 10 was conducted in April and May of 2000, and included the collection of ten surface soil samples and ten subsurface soil samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs. Figure 3-3 presents the sampling locations around the former paint storage building.

Because there is no known area of release at the building or in the area surrounding the building, the surface and subsurface soil samples were collected at evenly spaced locations (approximately 20 ft apart) around the perimeter of the building. The surface soil samples were collected from 0 to 6 inches bls, and the subsurface soil samples were collected at an average depth of 5 ft bls (sample intervals were 4 to 6 ft bls). In addition, OVM readings were collected from 0 to 3 ft bls and 4 to 6 ft bls during the soil sampling. The OVM results did not indicate a potential for presence of volatiles in the soils around SWMU 10.

Thallium was detected in one out of ten surface soil samples, and in six out of ten subsurface soil samples. The concentrations ranged between 0.71 mg/kg and 1.3 mg/kg, compared to an SSL of 0.7 mg/kg. As indicated in the DQE for these samples, the results for metals that were near the MDLs may represent a false positive.

Though thallium exceeded the SSL value, it is provided as an initial screening criterion by the EPA SSL guidance document. The potential impact to the groundwater is then considered in conjunction with the site-specific information such as the chemical distribution and sample depth information, types of soils, and groundwater depth and characteristics. No groundwater samples were collected from SWMU 10 because the analytical results of the subsurface soil samples did not reveal any site-related contaminants above the range of background levels in the soils. Furthermore, the potential for subsurface soil and groundwater contamination is minimal, as the site soils are clayey with very low permeability. Thus, the likelihood of migration to groundwater is minimal. Additionally, the water table at this site is approximately 40 ft bls. These conditions suggest that it is not necessary to sample the groundwater, as thallium could not migrate through 40 ft of clay-rich soils.

Surface Soil Results

All detected chemical concentrations in surface soil and the results from the screening evaluation for SWMU 10 are presented in Appendices B, C, and in the RAGS Part D formatted tables (Appendix D-2). The analytical results indicated detections of aluminum, arsenic, iron, chromium, manganese, and thallium in surface soil at concentrations above the residential PRG and/or leachability screening criteria. The total chromium detected was compared with a PRG for hexavalent chromium for a conservative analysis of the potential contamination presence at the site. None of the VOCs, SVOCs, pesticides, or PCBs detected were identified as COPCs. Table 3-1 summarizes the surface soil detections. The distribution of the surface soil detections above screening criteria are presented on Figure 3-4.

The metals detected in the surface soil at SWMU 10 were detected in all samples at relatively similar concentrations, and that distribution patterns of the detected metals do not indicate that they are associated with the paints and solvents that were disposed of at SWMU 10. However, the metals were identified as COPCs and are evaluated in the risk assessment. A comparison of SWMU 10 surface soil inorganic chemical concentrations against background levels is included at the end of this section.

Subsurface Soil Results

All detected chemical concentrations in subsurface soil and the results from the screening evaluation for SWMU 10 are presented in Appendices B, C, and in the RAGS Part D formatted tables in Appendix D-2. A total of ten subsurface soil samples were collected and analyzed for VOCs, SVOCs, PCBs/pesticides, and metals. Some of the low-level organic chemicals (e.g., 1,2-dichloroethane [1,2-DCA) and inorganic chemicals (e.g., thallium) that were detected in subsurface soil were also detected in various blank samples. This information is summarized in Section 1.0 of the Phases I and II Expanded PA/SI Reports (CH2M HILL, October 2000 and November 2002). Iron and thallium were identified as having exceeded screening criteria. Iron was detected above the industrial PRG value, and thallium was detected above its SSL value. Iron is included as a COPC for further evaluation

in the risk assessment. Table 3-2 summarizes the subsurface soil detections, which are also presented on Figure 3-4.

The thallium detections ranged between 0.5 and 1.3 mg/kg, which are above the SSL value of 0.7 mg/kg. No other chemicals were detected above screening criteria. However, because the soils at this site have low permeability and are more than 40-ft thick above the groundwater table, and the fact that thallium was detected at similar concentrations in soils at other sites, it is likely the result of natural soil minerals. A comparison of subsurface soil detections from SWMU 10 with background levels is included at the end of this section.

3.2.2 Contaminant Fate and Transport

Releases of waste paints or solvents on the ground would be expected to result in the presence of VOCs and metals (e.g., lead, chromium) in surface soil. If the solvents are large enough in volume, they could carry VOCs and any dissolved paints (metals) to the subsurface soil. However, VOCs were not detected in either surface soil or subsurface soil at SWMU 10, indicating that there is no evidence that any releases have occurred in the past. Low levels of 1,2-DCA and DDT were reported in site soils at levels much lower than screening criteria, and were also detected in blank samples, as presented in the DQE summary in Section 1.0 and in the Phase I and II PA/SI Reports.

1,2-DCA was detected at similar levels at other sites (e.g., SWMU 14, AOC B, SWMU 5), as well as in several blank samples. 1,2-DCA and DDT are likely not specific to the site, particularly because DDT, with very low solubility and a high affinity to bind to soil and organic carbon material, is not very mobile. Thus, DDT cannot reach deeper soils through migration to the subsurface. The detections are likely investigation artifacts, however at low levels that do not interfere with analytical requirements.

The metals detected above PRG values for direct exposure in surface soil were aluminum, arsenic, chromium, iron, manganese, and thallium. None of these concentrations was considered a leachability concern, as the area soils have very low permeability and the shallow groundwater is relatively deep, as previously described above. With the exception of thallium, subsurface soils at SWMU 10 do not contain chemicals with concentrations above their respective SSLs. Iron was detected in the subsurface soil at a concentration above the industrial PRG.

In accordance with the reasons stated previously, thallium is not considered a leachability concern at SWMU 10. In addition, it is near the detection limit range and likely a false positive, as described in the DQE section summarized in Section 1.0 of this report. All detected concentrations are within the range of concentrations detected in background samples. Groundwater contamination was not expected for these sites, as no migration potential was identified. Further, the surface runoff is not identified as a significant migration pathway, as SWMU 10 does not have any drainage features and consists of a relatively flat surface area.

3.2.3 Summary of Data Evaluation

Some of the low-level concentrations of organic chemicals that were detected were also present in laboratory blank samples, as indicated in the DQE of the samples analyzed (see Phases I and II PA/SI Reports). The metals were detected in surface soil samples at

concentrations above PRG levels, and are included for risk assessment, although their concentration levels are similar to background sample concentrations. No constituents exceeded screening criteria in subsurface soil, except for one low-level detection of thallium. No evidence of hazardous waste contamination as a result of a paint materials release associated with site-related activities from 1971 to 1990 exists at this site in the surface or subsurface soils. The surface and subsurface soil inorganic chemicals detected above PRGs are included in the risk assessment, which is summarized in Section 3.4.

3.2.4 Conceptual Site Model

Figure 3-5 presents the CSM for SWMU 10. SWMU 10 consists of the former Waste Paint and Solvents Disposal Site and its surrounding area. The potential source of contamination at the site is the accidental/intentional release of mixed paints and paint solvents to the ground (soil). The type of contamination expected from paint operations includes inorganic chemicals, such as lead, chromium, nickel, and other paint constituents, and solvents used as paint thinners, which are usually simple hydrocarbons and are mostly volatile.

Any inorganic constituents released from paints are likely to remain in the area surface soil, and surface runoff is the most prominent potential migration pathways for such releases, as soils have low-permeability limiting vertical downward migration. However, the site is located within a relatively flat surface area, no drainage features are associated with the site, and runoff is not in a channeled flow, and thus is not likely to extend far from the site. As previously stated, there is no surface drainage pathway connected to this site.

The site groundwater in this area of the former NASD is greater than 40 ft bls. Groundwater is not likely to be contaminated because of the physical limitations presented by the depth that the solvents must travel to reach the groundwater, and the small volume of reported releases. Furthermore, if the surface and subsurface soil samples did not show any contaminants, it is unlikely that the contaminants would reach the groundwater. Thus, the media of concern for SWMU 10 are surface and subsurface soils above the granite rock.

The potential receptors at the site include human receptors working in this area performing maintenance work, such as mowing the grass. In the future, potential receptors include tourists and recreational visitors. Under unrestricted land use conditions anyone could use the site, therefore a conservative assumption would be to assume a future residential use for the area.

As the site is in an open former Public Works Area, the habitat is limited to plant species common in the area, such as grasses and shrubs. Animal species include invertebrates present at the site, small mammals, and birds feeding in the area. Further discussion of the ecological and human receptors are provided below.

3.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMU s10, 14, 15, AOCs C and F

An ecological survey was conducted for the sites located within the Main Operations Area (or Public Works Area). The sites investigated included SWMUs 10, 14, 15, and AOCs C and

F. The plant communities are similar among all these sites. The plant communities mainly consist of herbaceous species typical of mowed/maintained areas. Maintenance of the grounds appeared to be main factor effecting the plant community composition and structure within this area at the time the ecological survey was conducted in 2000.

To determine the relative health of the ecological community within the Main Operations Area, a comparison was made by selecting a control plot outside of the sites, which is located southeast of SWMU 14, and comparing the habitat with the sites identified above. The ecological assessment concluded that there was no significant difference between any of the sites and the control site, however it was noted that SWMU 10 presented a greater abundance of some plant species than the control site.

AOC C had higher abundance of hydrophytic vegetation than the other sites because it is a drainage ditch. SWMU 15, which is an old parking lot was reported to have stressed vegetation, with domination by an exotic and invasive grass which is not significant. The stress and decumbent growth is thought to be due to heavy vehicles parked in this area at the time of the survey (see Figure 4-2). The soil compaction also limits the species diversity of the site, and small patches of oil stains in the soil were reported in the south central portion of the site.

The wildlife observed at these sites is typical for developed areas on Vieques Island. Horses and mongoose were the mammal species observed, and several species of birds were also observed. No federally protected species were observed in this area. The nearby NSRR located on the main Island of Puerto Rico is identified as habitat for Arctic perigrine falcon, which prefers to feed in open areas. Since the Main Operations Area is an open area, it could be a feeding habitat for this species, although none were observed at the site during the ecological survey.

3.4 Human Health Risk Assessment

The risks were estimated for SWMU 10 according to the latest EPA guidance, and the tables were formatted according to the RAGS Part D. This section summarizes the pertinent information contained in the risk assessment for SWMU 10.

Screening data for all of the exposure routes and potential human receptors are provided in Appendix D-2, and the complete risk assessment and accompanying tables are found in Appendix E of this report. The analytical results of the ten surface soil samples collected from 0 to 0.5 ft depths, and the ten subsurface soil samples collected from 4 to 6 ft bls at during the Expanded PA/SI were screened against the appropriate risk-based criteria. Aluminum, arsenic, chromium, iron, manganese, and thallium in surface soils exceeded the screening criteria and were considered COPCs (see Table 3-1) at SWMU 10. As iron was detected above industrial PRG value, it is included as COPC for subsurface soil exposure evaluations to future construction workers. Thallium was selected as a COPC based on the exceedance of its SSL, however as previously discussed above, it is not likely to present a leachbility concern (see Table 3-2).

Exposure pathways for future hypothetical maintenance workers, industrial workers, construction workers, recreational users, and residential receptors were considered complete at SWMU 10 (see Table 3-3). Most receptors were assumed to be exposed to surface soils, and construction workers were assumed to be exposed to subsurface soils.

Because of the small size of this site (i.e., smaller than a 0.5-acre exposure unit assumed for a residential dwelling), exposure estimates were likely to be overestimated for the evaluated receptors. Table 3-4 presents the risk characterization summary for the quantitatively evaluated receptors at SWMU 10.

The results of the risk estimations for each of the receptor populations are summarized below:

Maintenance Worker

For a maintenance worker, the ELCR for exposure to surface soils is 5.2E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.021 and is less than the target HI of 1.0 for noncarcinogenic exposure.

Industrial Worker

The estimated combined ELCR for an industrial worker exposed to surface soils and groundwater is 2.5E-6. Arsenic in soils ranged in concentrations from 0.7 mg/kg to 6.4 mg/kg and contributed to the overall ELCR. The ELCR is within the acceptable risk range for carcinogenic effects. The estimated HI of 0.1 for exposure to surface soils is less than the target HI of 1.0.

Construction Worker

In the potential exposure scenario for a construction worker, only iron was identified as a COPC in subsurface soil, and no carcinogenic COPCs were identified. The HI to a future construction worker is estimated to be 0.142, which is less than the target HI of 1.0.

Recreational Receptors

The estimated combined ELCR for a recreational adult and child exposed to surface soils is 1.10E-6 and 2.1E-6, respectively, and is less than the acceptable risk range. The HIs of 0.044 for a future recreational adult and 0.36 for a future recreational child are less than the target HI of 1.0.

Residential Receptors

The ELCRs for a residential adult and child are 3.1E-6 and 7.1E-6, respectively, which are within the EPA acceptable risk range of 1E-4 to 1E-6. The noncarcinogenic HI for a residential adult is estimated at 0.14, which is below the target value of 1.0. For a future residential child, the HI for exposure to surface soils is 1.2, which slightly exceeds the target HI of 1.0. However, as presented in Appendix D-2 for SWMU 10, no single target organ HI exceeded a value 1.0, thus the target HI of 1.0 is exceeded at target organ level.

3.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

No organic chemicals were detected above screening criteria for direct exposure or leachability to groundwater. The inorganic chemicals detected in site soils were generally within the range of background concentrations detected (see Table 3-5). Arsenic and thallium in site concentrations had ranges slightly greater than the background

concentration range, however health risks from arsenic for all the receptors is well within acceptable limits. Thallium levels are below the health-based screening levels and are slightly above leachbility screening levels. However, detected thallium concentrations are near detection limits and thus could be within instrument noise ranges (see DQE discussion above). Thallium is not considered a leachability concern at this site, for the reasons previously explained. Iron is the main contributor in the noncarcinogenic hazard estimations. Iron was detected at a concentration range of 8,190 mg/kg to 18,200 mg/kg, compared to a background concentration range of 2,500 mg/kg to 39,000 mg/kg. Thus, the site soil concentrations are similar to background inorganic concentrations, with the exception of arsenic. Overall risks and HI were well within acceptable limits.

3.6 Summary of Site Risks

The sampling analysis results of the ten surface soil and ten subsurface soil samples from evenly spaced locations around the former Building 4001 at SWMU 10 did not detect any paint-specific contaminants. No organic chemicals were detected above screening criteria for direct exposure or leachability to groundwater. The inorganic chemicals that were detected were also commonly found as part of natural mineralogy of soils. Any chemical detected above a screening value was evaluated for potential exposure-related health effects and leachability to groundwater.

The cancer risks and health hazard effects for SWMU 10 are within acceptable limits for all the receptors, including maintenance workers, industrial workers, construction workers, recreational adults and children, and residential adults and children. The estimated cancer risks were mostly from arsenic in surface soil, which were slightly elevated above background levels. The overall cancer risk to future residents (under an unrestricted land use scenario) is within the range of acceptable risks. The estimated HI was mainly from iron levels in soils. For a residential child, the HI slightly exceeded a value of 1.0, but no individual target organ HI exceeded a value of 1.0. However, site soil iron levels are well within background soil levels. Iron concentrations in surface soils are within the range of background soil iron concentrations for the former NASD and may be the result of magnetite soil formations reported for Vieques Island (see Table 3-5).

3.5 Conclusions and Recommendations

No further investigation or remedial action for the soils or groundwater at SWMU 10 is necessary for the protection of human health or the environment, based on an analysis of surface and subsurface soil sample results and pertinent information for the site. Therefore, the selected remedial alternative for the site media (soils and groundwater) at SWMU 10 is NFA.

TABLE 3-1
SWMU 10 COPC Selection for Surface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of Mean[a]	Residential PRG[b] (HI = 0.1)	Industrial PRG[c] (HI = 0.1)	SSL[c] (DAF=20)
1	Aluminum	10	10	3,740	10,000	5,575	5,575	7,614	10,000	NA
1	Arsenic	10	10	0.7	6.4	2.13	2.13	0.39	1.6	29
1	Chromium, Total	10	10	5.4	35.3	15.4	15.4	30.1	64	38
1	Iron	10	10	8,190	18,200	11,210	11,210	2,346	10,000	NA
1	Manganese	10	10	534	735	625	625	176	1,946	NA
1	Thallium	10	9	0.35	1.2	0.56	0.52	0.52	6.7	0.7

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). Http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 3-2
SWMU 10 COPC Selection for Subsurface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of the Mean[a]	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
1	Iron	10	10	17,700	10,300	12,720	12,720	10,000	NA
1	Thallium	10	10	1.3	0.50	0.77	0.77	6.7	0.70

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b]Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
NA -- Not available
SSL -- Soil screening level

TABLE 3-3
SWMU 10 Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Scenario is protective of workers involved with any occasional maintenance work such as lawn mowing.
Industrial Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Area could be developed in the future for industrial use.
Construction Worker	Subsurface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Scenario is protective of any occasional construction activities at the site.
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Area could be developed in the future for recreational use and would be protective of any occasional trespasser.
Residents	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Although the site is unlikely to be considered for residential development, this is a worst-case scenario for comparison purposes.

TABLE 3-4
SWMU 10 Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Maintenance Worker								
	Surface Soil				*Surface Soil*			
	4.3E-07	6.4E-10	8.6E-08	5.2E-07	0.0174	0.0018	0.0017	0.02096
	Total				*Total*			
	4.3E-07	**6.4E-10**	**8.6E-08**	**5.2E-07**	**0.0174**	**0.0018**	**0.0017**	**0.0210**
Industrial Worker								
	Surface Soil				*Surface Soil*			
	2.1E-06	3.1E-09	4.1E-07	2.5E-06	0.084	0.009	0.008	0.10
	Total				*Total*			
	2.1E-06	**3.1E-09**	**4.1E-07**	**2.5E-06**	**0.08**	**0.009**	**0.01**	**0.10**
Recreational Adult								
	Surface Soil				*Surface Soil*			
	8.3E-07	1.2E-09	2.8E-07	1.1E-06	0.035	0.004	0.006	0.04
	Total				*Total*			
	8.3E-07	**1.2E-09**	**2.8E-07**	**1.1E-06**	**0.03**	**0.004**	**0.01**	**0.04**
Recreational Youth								
	Surface Soil				*Surface Soil*			
	1.9E-06	1.4E-09	1.6E-07	2.1E-06	0.325	0.017	0.014	0.36
	Total				*Total*			
	1.9E-06	**1.4E-09**	**1.6E-07**	**2.1E-06**	**0.32**	**0.017**	**0.01**	**0.36**
Construction Worker								
	Surface Soil				*Surface Soil*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.141	0.000	0.000	0.14
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.14**	**0.000**	**0.00**	**0.14**
Residential Adult								
	Surface Soil				*Surface Soil*			
	2.8E-06	4.1E-09	3.3E-07	3.1E-06	0.117	0.012	0.007	0.14
	Total				*Total*			
	2.8E-06	**4.1E-09**	**3.3E-07**	**3.1E-06**	**0.12**	**0.012**	**0.01**	**0.14**
Residential Child								
	Surface Soil				*Surface Soil*			
	6.5E-06	4.8E-09	5.5E-07	7.1E-06	1.093	0.057	0.046	1.20
	Total				*Total*			
	6.5E-06	**4.8E-09**	**5.5E-07**	**7.1E-06**	**1.09**	**0.057**	**0.05**	**1.20**

TABLE 3-5
Background Range of Concentrations for Soil Compared to Site Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Parameter		Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Detected Site Concentration
		Minimum	Maximum			
Surface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	10,000	5,575
Arsenic	mg/kg	0.57	2.5	2.5	6.4	2.1
Chromium, total	mg/kg	2.20	74.0	74.0	35.3	15.4
Iron	mg/kg	2,500	39,000	37,531	18,200	11,210
Manganese	mg/kg	48	1,200	1,167	735	625
Thallium	mg/kg	0.45	0.67	0.67	1.2	0.52
Subsurface Soil						
Iron	mg/kg	2,500	39,000	37,531	17,700	12,720
Thallium	mg/kg	0.45	0.67	0.67	1.3	0.77

mg/kg = milligrams per kilogram or part per million (ppm)
UTL Upper tolerance limit

FIGURE 3-1
Waste Paint and Solvent Disposal Ground at SWMU 10 (2000), Facing North

FIGURE 3-2
SWMU 10 Waste Paint and Solvent Disposal Ground (2002), Facing North

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr

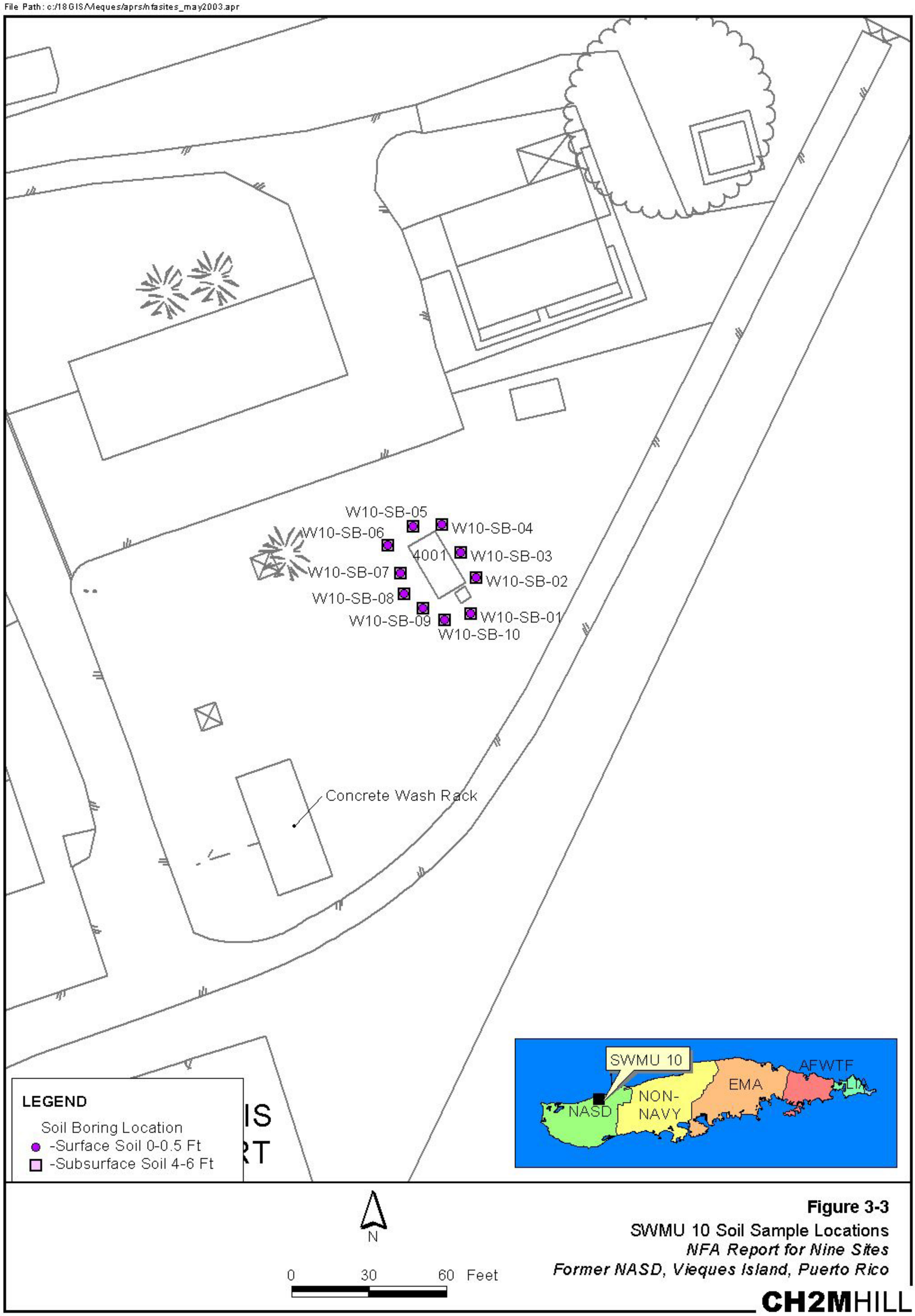


Figure 3-3
SWMU 10 Soil Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: t:\480013\vieques\apr08\fasites_nfa_2013.apr

W10-SB04
ARSENIC 1.3 J R (0-0.5)
CHROMIUM, 32.9 R (0-0.5)
IRON 13000 R (0-0.5)
MANGANESE 566 R (0-0.5)
THALLIUM 0.62 J R (0-0.5)
IRON 10300 R (4-6)
THALLIUM 0.93 J L (4-6)

W10-SB05
ARSENIC 1.4 J R (0-0.5)
IRON 10100 R (0-0.5)
MANGANESE 594 R (0-0.5)
IRON 15200 R (4-6)
THALLIUM 1.3 J L (4-6)

W10-SB03
ARSENIC 1.4 J R (0-0.5)
CHROMIUM, 35.3 R (0-0.5)
IRON 12900 R (0-0.5)
MANGANESE 576 R (0-0.5)
IRON 17700 R (4-6)
THALLIUM 0.95 J L (4-6)

W10-SB06
ARSENIC 6.4 R (0-0.5)
IRON 10300 R (0-0.5)
MANGANESE 735 R (0-0.5)
THALLIUM 0.54 J R (0-0.5)
IRON 14400 R (4-6)
THALLIUM 0.84 J L (4-6)

4001

W10-SB02
ALUMINUM 10000 R (0-0.5)
ARSENIC 1.1 J R (0-0.5)
CHROMIUM, 32.4 R (0-0.5)
IRON 18200 R (0-0.5)
MANGANESE 703 R (0-0.5)
THALLIUM 1.2 J R L (0-0.5)
IRON 13200 R (4-6)

W10-SB07
ARSENIC 2.8 R (0-0.5)
IRON 9250 R (0-0.5)
MANGANESE 652 R (0-0.5)
IRON 11000 R (4-6)

W10-SB01
ARSENIC 1.1 J R (0-0.5)
IRON 12500 R (0-0.5)
MANGANESE 534 R (0-0.5)
IRON 12200 R (4-6)

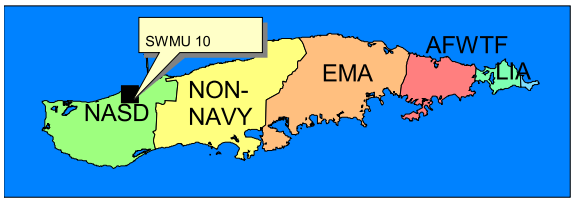
W10-SB08
ARSENIC 4.4 R (0-0.5)
IRON 8830 R (0-0.5)
MANGANESE 681 R (0-0.5)
IRON 10800 R (4-6)
THALLIUM 0.75 J L (4-6)

W10-SB10
ARSENIC 0.74 J R (0-0.5)
IRON 8830 R (0-0.5)
MANGANESE 643 R (0-0.5)
THALLIUM 0.52 J R (0-0.5)
IRON 10300 R (4-6)

Concrete Wash Rack

W10-SB09
ARSENIC 0.7 J R (0-0.5)
IRON 8190 R (0-0.5)
MANGANESE 563 R (0-0.5)
THALLIUM 0.62 J R (0-0.5)
IRON 12100 R (4-6)
THALLIUM 0.71 J L (4-6)

LEGEND
Soil BoringLocation
● -Surface Soil 0-0.5 Ft
□ -Subsurface Soil 4-6 Ft
ANALYTICAL RESULT QUALIFIER
J = Estimated Value
SOIL RESULTS QUALIFIER
L = Exceeds Leachability Criteria
R = Residential PRG Exceedence
NOTES
Soil Detections Reported as mg/kg
PRG = EPA Region 9 Preliminary Remediation Goal



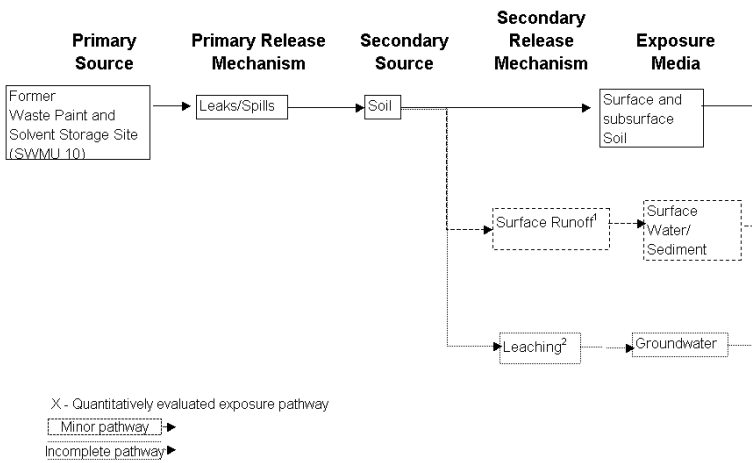
N

0 30 60 Feet

Figure 3-4
SWMU 10 Soil Detections Above Screening Criteria
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 3-5
Conceptual Site Model for SWMU 10
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Exposure Route	Maintenance Worker	Industrial Worker	Construction Worker[3]	Residential Adult	Residential Child	Recreational Adult	Recreational Child
Ingestion	X	X	X	X	X	X	X
Dermal Contact	X	X	X	X	X	X	X
Dust Inhalation	X	X	X	X	X	X	X
Ingestion							
Dermal Contact							
Ingestion							
Dermal Contact							
Inhalation							

Notes:
[1] Considered a minor pathway based on the nature of suspected contaminant release
[2] Considered incomplete pathway due to the depth to groundwater and nature of suspected contaminant release
[3] Construction worker exposure was evaluated for surface and subsurface soil

SECTION 4

Site-Specific Decision Summary for SWMU 14 – Former Wash Rack

4.1 Description

SWMU 14, the Former Wash Rack, is located in the Public Works Area, on the northern half of the former NASD and immediately west of the former Transportation Shop (Building 2016). Currently the structure is within a chain-link fenced area. The site consists of a concrete driveway with 4-inch curbs on each side, and ramps on each end measuring approximately 20-ft long by 10-ft wide. The runoff was collected into an oil/water separator (OWS) that was located at the end of the driveway. The OWS was removed and properly disposed of by a contractor, J.A. Jones Environmental Services Company, after the field sampling conducted during the Phase I PA/SI.

SWMU 14 is no longer in use, and the area is overgrown with grass and weeds. The surrounding area is primarily soil and grass, with concrete and asphalt driveways to the north and south. Immediately west of the former wash rack is a shallow, grassy ditch that ultimately travels north approximately 1,500 ft and discharges into the Atlantic Ocean. SWMU 14 is adjacent to several other sites in the Public Works Area; SWMU 15 directly west, and AOC E is immediately north. The total area of the site is approximately 100 ft (north-south) by 30 ft (east-west). Figures 4-1 and 4-2 show photos of the site taken in 2000 and 2002, respectively.

This site was in use from the late 1970s until the end of 2000, and was used primarily for cleaning Navy vehicles. Facility personnel stated that degreasing solvents were occasionally used in this area. During operations, the concrete bermed area drained into an OWS, which has been removed, prior to discharging runoff into an open ditch. A swale at the end of the unit facilitated the discharge of runoff water to the ditch, which eventually flowed downstream to the north, in the general direction of the Atlantic Ocean. The ditches that begin near the entrance to the Public Works Area entrance run parallel to the entrance road, proceed under the road and end in a diffuse drainage area beyond the road, with no direct continuous connection between the site and the ocean. There is no direct connection from the site to any continuously flowing water bodies. The drainage ditches are dry, except during rain events. These ditches were investigated as part of the AOC C investigation. Because the site is no longer in use, no operations-related releases are occurring at the present time or are likely to occur in the future. Currently, the site is a flat area with overgrown grass. Remnant concrete pads were left in place after removing most of the equipment used for vehicle maintenance in this complex.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including SWMU 14. The summary included the site background information, physical characteristics, site hydro-geological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types

of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

4.2 Site Characterization

4.2.1 Nature and Extent of Contamination

The Phase I Expanded PA/SI field investigation at SWMU 14 was conducted in April and May of 2000, and included the installation and sampling of two monitoring wells (one upgradient and one immediately downgradient), the collection of 14 surface and subsurface soil samples, and the collection of three samples of the accumulated sludge from the bottom of the OWS, which has been removed. All samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs. Figure 4-3 presents the site and sample locations for surface soil (0 to 0.5 ft bls) and subsurface soil (4 to 6 ft bls), and two groundwater monitoring wells, one upgradient (SWMU14-MW02) and one immediately downgradient (SWMU 14- MW01) of the site.

Three samples that were originally designated as sediment samples in Appendix B of the Phase I PA/SI Report (CH2M HILL, October 2000) were actually sludge samples taken from the OWS. These samples are not included in this report for further analysis, as the OWS and associated sludge was removed and disposed of properly by J.A. Jones Environmental Services Company. Therefore, the data collected from the bottom of the OWS is not discussed further in this section, as it does not represent current site conditions.

The chemicals that exceeded screening criteria in surface soil included aluminum, arsenic, total chromium, iron, manganese, thallium, and vanadium. Aluminum, iron, and thallium were detected above screening criteria in subsurface soil. The chemicals that exceeded screening criteria in groundwater at SWMU 14 included manganese and dieldrin.

Surface Soil Results

A total of 14 surface soil samples were collected from 0 to 0.5 ft bls around the former wash rack area. The sampling density is relatively high, considering that the site is only approximately 100-ft long and 30-ft wide. The sample detections are provided in Appendices B and C, and Appendix D-3 includes a statistical summary of all samples and range of detected concentrations for the data set. Surface soil samples detected several inorganic chemicals, trace levels of organic chemicals including petroleum VOCs, phthalates that are typical of plastic material, and organochlorine pesticides. All data were screened against criteria, as described in Section 1.0.

The analytical results indicated concentrations of aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium in surface soil are above the residential PRGs and/or leachability in some of the samples. None of the organic chemicals were detected above the conservative screening criteria, PRGs or SSLs, and therefore are not identified as COPCs for surface soil at SWMU 14. The metals levels were compared against background levels, as described later in this section, to determine if they are elevated above background soil concentration levels. Thallium was the only chemical detected in surface soil above a leachability criteria of 0.7 mg/kg, which is lower than the typical MDL for this chemical. Thallium was also detected in subsurface soils at similar concentrations, but was not

detected in site groundwater. Table 4-1 presents the analytical results for the surface soil detections, and Figure 4-4 presents the surface soil detections above screening criteria at SWMU 14.

Subsurface Soil Results

All detected chemical concentrations in subsurface soil and the results from the screening evaluation for SWMU 14 are presented in Appendices B, C, and in the RAGS Part D formatted tables Appendix D-3. Table 4-2 summarizes the subsurface soil detections that exceeded screening criteria, as well as those chemicals without criteria, for a conservative analysis. The exceedances are also presented in Figure 4-5.

The subsurface soil samples had trace levels of VOCs and pesticides at concentrations that are much lower than the screening criteria for leachability. These chemicals were not detected in the monitoring well SWMU14-MW01, which is located downgradient of the site. Several of the inorganic chemicals that are typically part of the soil mineralogy and a comparison of site soil concentrations against background levels are included at the end of this section. Of the detected chemicals, aluminum and iron were detected above industrial PRG values, and thallium was reported above the SSL value of 0.7 mg/kg in three out of 14 samples, with a reported concentration range of 0.41 mg/kg to 1.4 mg/kg. The thallium concentrations are similar across several of the sites within this area of the former NASD. Groundwater at the site is located more than 40 ft bls. Thallium was not detected in the monitoring wells at the site. Thus, it does not appear that thallium is leaching to groundwater at the site.

Groundwater Results

Monitoring well SWMU14-MW02 is located approximately 100 ft upgradient of the site, and SWMU14-MW01 is located in the immediate downgradient location, less than 10 ft from the nearest site soil sampling point. Appendix B presents the analytical data for detected chemicals in groundwater. Analytical results from unfiltered (total metals) samples indicate detections of aluminum, antimony, iron, manganese, and vanadium in groundwater samples at concentrations exceeding the PRGs and MCLs in the well located upgradient (SWMU 14-MW02), but not in the downgradient well. None of the filtered (dissolved) metals results show detections above groundwater criteria. While the concentrations of total metals were higher in SWMU14-MW02 than concentrations detected in downgradient monitoring well SWMU14-MW01, the dissolved metals were detected at relatively similar concentrations, indicating that the detections are likely indicative of non-dissolved (particulate-bound) concentrations. While the upgradient well has higher metals than the site well, both may be similar to general background conditions. A comparison table of background levels versus site well levels is included at the end of this section.

An organochlorine pesticide (dieldrin) was detected in well SWMU14-MW01 at a concentration (0.01 micrograms per liter [µg/L]) that is greater than the PRG (0.004 µg/L). However, the presence of dieldrin is likely an analytical artifact because it is not very soluble and thus does not migrate sufficient depths to reach groundwater. While sampling and analysis data met the data quality requirements according to the functional guidelines, dieldrin was also detected in blank samples at similar low concentrations levels in Phase II PA/SI sampling but not in Phase I sampling blanks. In addition, dieldrin was detected in

subsurface soil samples from other sites. Low levels of pesticides, DDT/DDE, and PCBs were also reported in Phase I PA/SI blanks. Section 1.0 provides a summary of this information. For these reasons, and because it was not detected in site subsurface soils, it is not likely related to the former wash rack activities at SWMU 14.

4.2.2 Contaminant Fate and Transport

In the surface soil at SWMU 14, low levels (i.e., near detection limits) of VOCs (benzene, toluene, xylenes [BTEX], all petroleum-hydrocarbon-related) and facility maintenance-related organochlorine pesticides were detected. None of the detected organic chemicals were greater than screening criteria. In surface soils, several inorganic chemicals were detected as exceeding the direct-exposure-based screening criteria, and only thallium in surface soil exceeded the SSL (leachability-to-groundwater) criterion. In subsurface soils, 1,2-DCA was detected in two samples (W14-01 and W14-08) at the same concentration (0.0003 J mg/kg), which is below the typical detection limit for soil of 0.005 mg/kg. The blanks from Phases I and II PA/SI had 1,2-DCA at similar concentrations, and thus is not likely a site-related chemical. The sludge samples previously taken from the OWS, as mentioned above, do not present a migration concern under current conditions at the site. Therefore these samples are not analyzed further in this report.

The groundwater analytical results indicated detections of metals and one detection of dieldrin at 0.01 J µg/L. Higher levels of metals were detected in an upgradient well. None of the organic chemicals detected in surface and subsurface soils were detected in groundwater. Though dieldrin was detected in one surface soil sample (W14-SB10), it was below the screening criteria. Further, the dieldrin detection was not in close proximity to the well, and subsurface soil from the same location did not have detections of dieldrin (see Appendix B). It was reported in blank samples from Phase II PA/SI. Thus, detected dieldrin in the groundwater sample is likely either a sampling or an analytical artifact.

Based on the nature of the surface soil chemicals detected at low levels (see Appendix B), BTEX-type VOCs are likely to degrade through volatilization, photodegradation, and biodegradation through bacterial activities in subsurface media, with a relatively small chance of migrating to subsurface soil through leaching from rain water percolation. Trace levels of 1,2-DCA and low level, infrequently detected BTEX in subsurface soils indicate that migration is occurring, although at very low levels. Because the groundwater at the site is at least 40 ft bls, and site soils are clay rich with low permeability, these low-level concentrations will likely attenuate within a short distance in the unsaturated soils before reaching the groundwater. The attenuation processes likely to occur include volatilization, biodegradation, and surface runoff. The absence of VOCs in groundwater samples from well SWMU14-MW01 indicates that VOCs have not migrated vertically to groundwater during the historical operations at the site. Because, detected soil VOCs were lower than screening criteria for subsurface migration, future contaminant migration is not an issue for SWMU 14 soils or groundwater.

The inorganic chemicals detected in soil are less than screening criteria for direct exposure and leachability to the subsurface (i.e., SSL). The only metal found in surface soil above the SSL was thallium. The detected thallium concentrations are similar to those at other sites in this area (see Appendix B). Also, thallium was not detected in groundwater located more than 40 ft bls. The clay-rich soils are likely to retard low-level metals from further migration,

if dissolved. Therefore, detected thallium near the MDLs is not likely to present a leaching concern for groundwater. Groundwater in the upgradient well has higher levels of aluminum, antimony, chromium, iron and manganese, all of which are also known to occur naturally in background groundwater. Overall, all detected inorganic chemicals in groundwater could be associated with suspected particulates, as filtered samples did not have as many detectable metals.

4.2.3 Summary of Data Evaluation

Low levels of VOCs detected in surface and subsurface soils at SWMU 14 were below screening criteria, are likely to decrease with time, and do not present a future migration concern. All detected chemicals exceeding screening criteria, though likely the result of the natural soil and groundwater composition on Vieques Island, were included for a human health risk evaluation, as summarized in Section 4.4. A comparison of site media concentrations compared to the background levels is included at the end of this section. The chemicals that were identified above screening criteria in surface soil, subsurface soil, and in the downgradient well at SWMU 14 are included in the risk assessment.

4.2.4 Conceptual Site Model

Figure 4-6 presents the CSM for SWMU 14, where potential source material consisting of small amounts of petroleum hydrocarbons/oils, degreasing solvents and any detergents used for vehicle cleaning during site operations could have been introduced to the environment. Metals and inorganic chemicals could also have resulted in contamination, though to a lesser extent. The former wash rack and associated OWS were removed in December 2000 and are no longer potential sources of contamination.

The historical vehicle wash operations may have contributed to the soil contamination at the site. Any significant release to surface soils may have degraded, moved with the flow of rain water, or leached to subsurface soil. Any such releases have the potential to ultimately reach subsurface groundwater. Additionally, surface releases that may have attached to soil particles in surface soil during storm/rain events could run off into the drainage ditch. Based on the highly volatile and soluble nature of potential contamination from vehicle washing operations, the conceptually possible migration pathways include volatilization to the air and leaching to subsurface for some of the operations-related chemicals, such as VOCs (SVOCs and metals tend to remain bound to surface soil particles and runoff with storm events). Because the groundwater is approximately 40 ft bls, site soils are tight low-permeability clays. Thus VOCs are likely to volatilize and degrade prior to reaching groundwater. If the volume of released solvents is small, it is not likely to reach groundwater in measurable levels, while metals and SVOCs could remain in site surface soils at measurable levels from former vehicle washing activities.

The site is within a fenced area of the maintenance yard. The site is inactive, with no maintenance currently being conducted, and the associated maintenance equipment has been removed. The only potential human activity is an occasional visit by contractor personnel. For a conservative estimate of potential exposure and risk, future potential exposure points and receptors were evaluated assuming unrestricted land use, which includes recreational, industrial, or residential use. Subsurface soils were evaluated for future construction worker exposures. Exposures to soil contaminants were assumed to

occur via incidental ingestion, inhalation of dust particles, and dermal contact. Exposure to groundwater is a potentially complete pathway for a future industrial worker and a resident. Exposure to groundwater contaminants could occur via ingestion, and dermal contact. The inhalation pathway for ground water is not important as none of the identified COPCs are VOCs. The likely ecological receptors in this developed area are plants and terrestrial animals. The ecological receptors in this area are described in the Phase I PA/SI report and are summarized in Section 4.3 below.

4.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F

An ecological survey was conducted for the sites located within the Main Operations Area (or Public Works Area). The sites investigated included SWMUs 10, 14, 15, and AOCs C and F. The plant communities are similar among all these sites. The plant communities mainly consist of herbaceous species typical of mowed/maintained areas. Maintenance of the grounds appeared to be main factor effecting the plant community composition and structure within this area at the time the ecological survey was conducted in 2000.

To determine the relative health of the ecological community within the Main Operations Area, a comparison was made by selecting a control plot outside of the sites, which is located southeast of SWMU 14, and comparing the habitat with the sites identified above. The ecological assessment concluded that there was no significant difference between any of the sites and the control site, however it was noted that SWMU 10 presented a greater abundance of some plant species than the control site.

AOC C had higher abundance of hydrophytic vegetation than the other sites because it is a drainage ditch. SWMU 15, which is an old parking lot was reported to have stressed vegetation, with domination by an exotic and invasive grass which is not significant. The stress and decumbent growth is thought to be due to heavy vehicles parked in this area at the time of the survey (see Figure 4-2). The soil compaction also limits the species diversity of the site, and small patches of oil stains in the soil were reported in the south central portion of the site.

The wildlife observed at these sites is typical for developed areas on Vieques Island. Horses and mongoose were the mammal species observed, and several species of birds were also observed. No federally protected species were observed in this area. The nearby NSRR located on the main Island of Puerto Rico is identified as habitat for Arctic perigrine falcon, which prefers to feed in open areas. Since the Main Operations Area is an open area, it could be a feeding habitat for this species, although none were observed at the site during the ecological survey.

4.4 Human Health Risk Assessment

This section summarizes the pertinent information contained in the risk assessment for SWMU 14. Screening data for all of the exposure routes and potential human receptors are

provided in Appendix D-3 in the RAGS Part D format. A more detailed discussion and accompanying tables of the risk assessment conducted are presented in Appendix E.

As previously discussed, a total of 14 surface soil and subsurface soil locations and two monitoring wells were sampled during the Phase I Expanded PA/SI for SWMU 14. Analytical results were screened against the appropriate criteria and chemicals detected above criteria were considered COPCs. Aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium were selected as surface soil COPCs (see Table 4-1). Aluminum, and iron were identified as COPCs for subsurface soil (see Table 4-2). Thallium exceeded the SSL in subsurface soils (see Table 4-2), but was not detected in groundwater. Thallium is not considered a leachability concern based on site-specific information, such as the low permeability of the clayey soils and the deep water table that is likely to retard the low levels of thallium concentrations from reaching groundwater. Thallium was below risk-based criteria, and therefore is not a COPC for risk estimations. One well located within the site was included for risk evaluation, and the upgradient well was used for comparison purposes for SMWU 14 and other sites located within the former NASD. The groundwater in the site well (SWMU14-MW01) contained the COPCs dieldrin and manganese (see Table 4-3).

Exposure pathways for future hypothetical maintenance workers, industrial workers, construction workers, recreational users, and residential receptors were considered complete at SWMU 14 (see Table 4-4 and Appendix D-3). All receptors were assumed to be exposed to surface soils. Because groundwater is deeper than typical construction depths, groundwater exposure to pathway for construction workers is incomplete. Construction workers were evaluated for combined surface and subsurface soil exposures for COPCs identified because of exceedence of industrial RBCs. Only industrial workers and residents were considered to be exposed to groundwater. This site (SWMU 14) is within the fenced compound area, which also includes SWMU 15, SWMU 10, and AOC E. Because these sites are within 1 to 2 acres in area, exposure is likely to be divided between the sites for any maintenance workers who works in this area. The receptors and exposure assumptions for this site are considered conservative because this site is not particularly suitable for most assumed uses and, because of its small size, it is unlikely that a receptor would spend a significant portion of a work-day or recreational time at this one site. However, exposure assumptions are based on each receptor spending the entire time within SWMU 14, thus making the estimates more conservative.

Table 4-5 and the RAGS Part D formatted tables in Appendix D-3 present the risk characterization summary for the quantitatively evaluated receptors at SWMU 14. The estimated cancer risks and hazard indices for the receptors identified are summarized below:

Maintenance Worker

For a maintenance worker, the ELCR for exposure to surface soils is 2.2E-7, which is significantly less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.027, which is also less than the target HI of 1.0 for noncarcinogenic exposure.

Industrial Worker

The estimated combined ELCR for an industrial worker exposed to surface soils and groundwater is 1.6E-6, which is within the acceptable risk range for carcinogenic effects. The estimated HI of 0.13 for exposure to surface soils and groundwater is below the target HI of 1.0. Therefore, future use of the site for industrial land use is not likely to pose any exposure-related health concerns to workers.

Construction Worker

The subsurface soil evaluation at SWMU 14 identified aluminum and iron as COPCs. Subsurface soil was evaluated for potential exposure to construction workers at this site. No carcinogenic COPCs were identified. The EPCs included both surface and subsurface soil samples. The HI to a future construction worker is estimated to be 0.24, which is less than the target HI of 1.0.

Recreational Receptors

The estimated ELCRs for a future recreational adult and child exposed to surface soils is 4.8E-7 and 9E-7, respectively, and are less than the acceptable risk range. The HIs for a recreational adult and child of 0.057 and 0.47, respectively, are less than the target HI of 1.0. Thus, there is no unacceptable risk associated with exposure to surface soils for a recreational adult or child.

Residential Receptors

For a future residential adult and child, the ELCRs are 2.8E-6 and 3.9E-6, respectively. These are within the EPA acceptable risk range of 1E-4 to 1E-6. The calculated risk is primarily due to arsenic in surface soils detected at 0.4 to 3 mg/kg, and dieldrin at 0.01 µg/L in groundwater. The HI for an adult, 0.24, is well within the target value of 1.0 for noncarcinogenic risks. The HI for a child, 1.6, is slightly above a value of 1.0. The highest target organ specific HI is 0.86 from iron in groundwater, which did not exceed a value of 1.0. Thus, the overall risks are well within acceptable limits for unrestricted land use.

4.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The arsenic and iron in site soil are compared against the range of background concentrations as presented in Table 4-6. Table 4-7 presents a comparison of the upgradient well (SWMU 14-MW01)with the site well (SWMU 14-MW02). As can be observed from these tables, SWMU 14 soil inorganic chemicals are well within background levels, with a slight exceedence for arsenic and thallium. These differences are attributable to soil's natural variability and analytical data reproducibility. Thus, site soil inorganic chemical concentrations are similar to the background soil inorganic chemical levels.

Manganese was the only inorganic COPC identified in the site groundwater. The levels of manganese are well below the background range of concentrations as well as below the site-specific upgradient well levels. Observed groundwater metals are higher in the upgradient well at SWMU 14, as listed in Table 4-7. As described in PA/SI reports, groundwater in the shallow water table has low yield and presents a challenge in obtaining low turbidity

samples. Most of the groundwater samples had high suspended particulates, which may be responsible for the measured metals. Since potable water is likely to be from much deeper aquifer, and the shallow groundwater is separate from it by soil and thick rock this may not be an issue in the deeper potable aquifer. The dissolved metals levels are much lower, and concentrations are similar across various sites and background wells.

4.6 Summary of Site Risks

The cancer risks at this site are within acceptable limits for the potentially exposed receptors evaluated in the risk assessment. The HI is greater than 1.0 for residential child but no individual target organ HI is greater than a value of 1.0. Iron levels in the soil are below 1.0, and the concentration of iron is lower than background levels in soil. Manganese levels in groundwater at the site are also lower than background levels. Further, the natural rock formations on the island are known to have magnetite, which is rich in iron ore (see Section 1.0) and may play a role in the contribution of iron to soils and groundwater.

Iron concentrations in surface soils are within the range of background concentrations found across the former NASD. Table 4-7 provides a detailed examination of dissolved and unfiltered metal concentrations in both wells and supports the hypothesis that metals in groundwater are related to the natural soil mineralogy. The dieldrin reported in groundwater is likely to be due to sampling or analytical artifacts, as discussed in the DQE summary portion of Section 1.0. Also, dieldrin has low solubility, it was not detected in any of the subsurface soil samples as previously discussed. Therefore, there are no site-specific exposure concerns present in SWMU 14 soils and groundwater from iron, and other metals are not related to this site. Carcinogenic or noncarcinogenic risks are well within acceptable limits for all of the receptors and pathways evaluated for SWMU 14.

4.5 Conclusions and Recommendations

No further investigation or remedial action for the soils or groundwater is necessary for the protection of human health or the environment based on an analysis of available soil and groundwater sample results and pertinent information for SWMU 14. Based on the risk assessment, SWMU 14 is suitable for unrestricted land use. Therefore, the selected remedial alternative for the soils and groundwater at the site is NFA.

TABLE 4-1
SWMU 14 COPC Selection for Surface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of Mean[a]	Residential PRG[b] (HI = 0.1)	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
1	Aluminum	14	14	16,300	4,900	8,471	8,471	7,614	10,000	NA
1	Arsenic	14	13	3	0.4	1.1	1.0	0.39	1.6	29
1	Chromium	14	14	31.5	5.3	15.3	15.3	30.1	64.0	38
1	Iron	14	14	28,300	7,490	16,251	16,251	2,346	10,000	NA
1	Manganese	14	14	907	263	524	524	176	1,946	NA
1	Thallium	14	11	1.7	0.4	0.70	0.59	0.52	6.75	0.7
1	Vanadium	14	14	74.3	19.7	43.7	43.7	55	715	6,000

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document.
(EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)

DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 4-2
SWMU 14 COPC Selection for Subsurface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of the Mean[a]	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
1	Aluminum	14	14	13,400	5,740	9,020	9,020	10,000	NA
1	Iron	14	14	21,600	10,600	16,886	16,886	10,000	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c]EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996).
http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)

DAF -- Dilution attenuation factor
NA -- Not available
SSL -- Soil screening level

TABLE 4-3
SWMU 14 COPC Selection for Groundwater
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration (µg/L)	Minimum Detected Concentration (µg/L)	Mean Concentration of Detects	Best Estimate of the Mean[a]	Tap Water PRG[b] (HI=0.1)	MCL[c]
Dieldrin	1	1	0.01	0.01	0.01	0.01	0.0042	NA
Manganese	1	1	97	97	97	97	87.6	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG, EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] Maximum Contaminant Levels. EPA Office of Water. http://www.epa.gov/safewater/mcl.html
Units in µg/L (ppb)

HI -- Hazard Index
MCL -- Maximum contaminant level
NA -- Not available
PRG -- Preliminary remediation goal

TABLE 4-4
SWMU 14 Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Scenario is protective of any occasional maintenance work such as lawn moving.
Industrial Worker	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater	Yes	Area could be developed in the future for industrial use. Both site soil and groundwater exposure is assumed. Inhalation exposure to groundwater is not significant as no volatile COPCs are identified.
Construction Worker	Subsurface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Scenario is protective of any occasional construction activities at the site.
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Area could be developed in the future for recreational use and would be protective of any occasional trespasser.
Residents	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater	Yes	Although the site is unlikely to be considered for residential development, this is a worst-case scenario for comparison purposes. Inhalation exposure to groundwater is not significant as no volatile COPCs are identified.

TABLE 4-5
SWMU 14 Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Maintenance Worker								
	Surface Soil				*Surface Soil*			
	1.8E-07	2.7E-10	3.6E-08	2.2E-07	0.0234	0.0018	0.0020	0.02725
	Total				*Total*			
	1.8E-07	**2.7E-10**	**3.6E-08**	**2.2E-07**	**0.0234**	**0.0018**	**0.0020**	**0.0273**
Industrial Worker								
	Surface Soil				*Surface Soil*			
	8.9E-07	1.3E-09	1.8E-07	1.1E-06	0.107	0.009	0.008	0.12
	Groundwater				*Groundwater*			
	5.6E-07	0.0E+00	4.6E-10	5.6E-07	0.009	0.000	0.000	0.009
	Total				*Total*			
	8.9E-07	**1.3E-09**	**1.8E-07**	**1.1E-06**	**0.11**	**0.009**	**0.01**	**0.12**
Recreational Adult								
	Surface Soil				*Surface Soil*			
	3.5E-07	5.2E-10	1.2E-07	4.8E-07	0.047	0.004	0.007	0.06
	Total				*Total*			
	3.5E-07	**5.2E-10**	**1.2E-07**	**4.8E-07**	**0.05**	**0.004**	**0.01**	**0.06**
Recreational Youth								
	Surface Soil				*Surface Soil*			
	8.3E-07	6.1E-10	6.9E-08	9.0E-07	0.437	0.017	0.016	0.47
	Total				*Total*			
	8.3E-07	**6.1E-10**	**6.9E-08**	**9.0E-07**	**0.44**	**0.017**	**0.02**	**0.47**
Construction Worker								
	Surface Soil				*Surface Soil*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.232	0.001	0.003	0.24
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.23**	**0.001**	**0.00**	**0.24**
Residential Adult								
	Surface Soil				*Surface Soil*			
	1.2E-06	1.8E-09	1.4E-07	1.3E-06	0.158	0.012	0.008	0.18
	Groundwater				*Groundwater*			
	1.5E-06	0.0E+00	4.6E-10	1.5E-06	0.024	0.000	0.001	0.026
	Total				*Total*			
	1.2E-06	**1.8E-09**	**1.4E-07**	**1.3E-06**	**0.16**	**0.012**	**0.01**	**0.18**
Residential Child								
	Surface Soil				*Surface Soil*			
	2.8E-06	2.0E-09	2.3E-07	3.0E-06	1.472	0.058	0.053	1.58
	Groundwater				*Groundwater*			
	8.8E-07	0.0E+00	4.6E-10	8.8E-07	0.057	0.000	0.003	0.060
	Total				*Total*			
	2.8E-06	**2.0E-09**	**2.3E-07**	**3.0E-06**	**1.47**	**0.058**	**0.05**	**1.58**

TABLE 4-6
Background Range of Concentrations for Site Media Compared to Site Concentrations
NFA Report for Nine Sites, *Former NASD, Vieques Island, Puerto Rico*

Parameter	Units	Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Detected Site Concentration
		Minimum	Maximum			
Surface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	16,300	8,471
Arsenic	mg/kg	0.57	2.5	2.3	3.0	1.1
Chromium	mg/kg	2.20	74.0	74.0	31.5	15.3
Iron	mg/kg	2,500	39,000	37,531	28,300	16,251
Manganese	mg/kg	48	1,200	1,167	907	524
Thallium	mg/kg	0.45	0.67	0.67	1.7	0.70
Vanadium	mg/kg	9.0	130	130	74	44
Subsurface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	13,400	9,020
Iron	mg/kg	2,500	39,000	37,531	21,600	16,886
Groundwater						
Aluminum	µg/L	130	3,500	3,500	26,100	13,126
Antimony	µg/L	5.1	5.2	5.2	2.3	1.5
Iron	µg/L	480	4,800	4,800	32,100	16,124
Manganese	µg/L	400	17,000	17,000	1,820	959
Vanadium	µg/L	3.5	75	75	108	64

mg/kg = milligrams per kilogram or part per million (ppm)
µg/L = micrograms per liter or parts per billion (ppb)
NA Not available
UTL Upper tolerance limit

TABLE 4-7
SWMU 14 Summary of Metals Concentrations in Groundwater Wells
NFA Report for Nine Sites, *Former NASD, Vieques Island, Puerto Rico*

Well	Chemical	Concentration (µg/L)	Qualifier
Site Well			
SWMU14-MW01	Aluminum	152	J
SWMU14-MW01	Aluminum, Dissolved	25.8	U
SWMU14-MW01	Antimony	1.4	U
SWMU14-MW01	Antimony, Dissolved	1.4	U
SWMU14-MW01	Iron	147	J
SWMU14-MW01	Iron, Dissolved	12.2	=
SWMU14-MW01	Manganese	97	=
SWMU14-MW01	Manganese, Dissolved	84	=
SWMU14-MW01	Vanadium	20.2	J
SWMU14-MW01	Vanadium, Dissolved	20.2	J
Upgradient Well[a]			
SWMU14-MW02	Aluminum	26,100	=
SWMU14-MW02	Aluminum, Dissolved	28	J
SWMU14-MW02	Antimony	2.3	J
SWMU14-MW02	Antimony, Dissolved	2.1	J
SWMU14-MW02	Iron	32,100	J
SWMU14-MW02	Iron, Dissolved	12.2	=
SWMU14-MW02	Manganese	1,820	=
SWMU14-MW02	Manganese, Dissolved	1,160	=
SWMU14-MW02	Vanadium	108	=
SWMU14-MW02	Vanadium, Dissolved	15.3	J

[a] Well SWMU14-MW02 is upgradient of SWMUs 14, 15 and AOC C, and represents site-specific background levels.

All values are presented in units of micrograms per liter (µg/L).

= Indicates that the chemical was detected at the concentration shown.

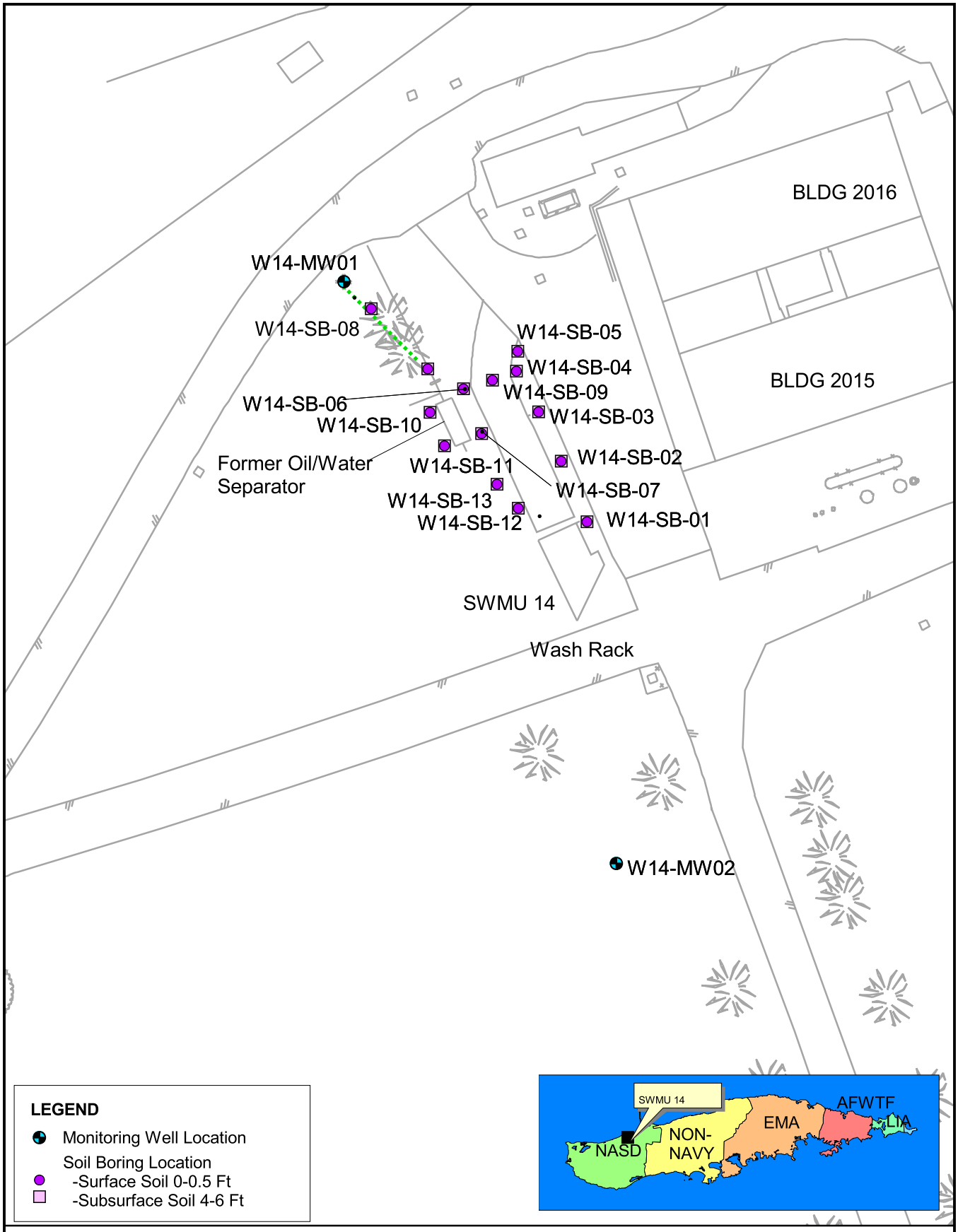
J Indicates an estimated value. One or more quality control (QC) parameters were outside control limits or the value was detected below the laboratory's quantification limit.

U Indicates that the concentration was not detected.

FIGURE 4-1
SWMU 14 Former Wash Rack (2000), Facing South

FIGURE 4-2
SWMU 14 Former Wash Rack (2002), Facing South

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr



N

0 50 100 Feet

Figure 4-3
SWMU 14 Soil and Groundwater Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr

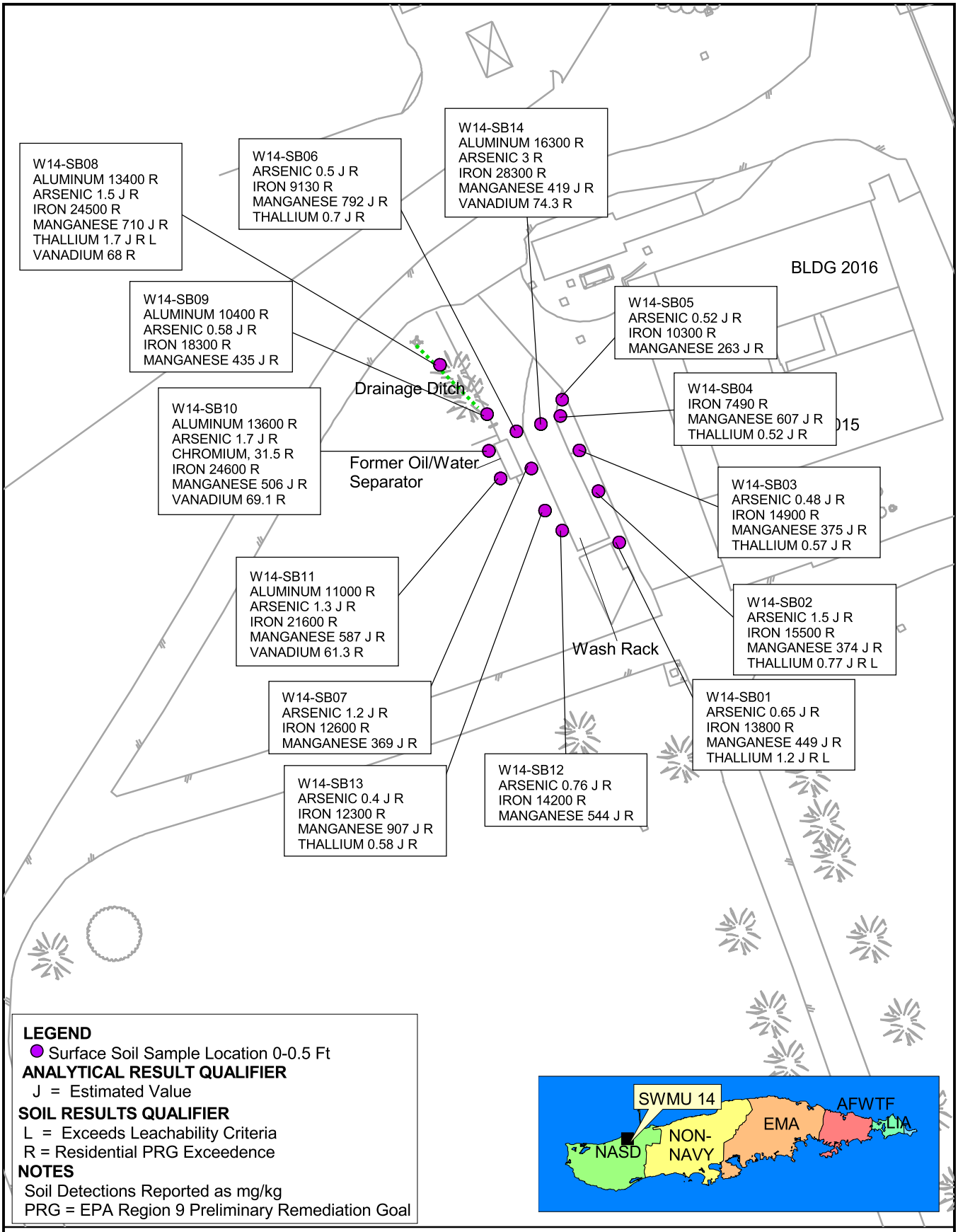


Figure 4-4
SWMU 14 Surface Soil Detections Above Screening Criteria
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr

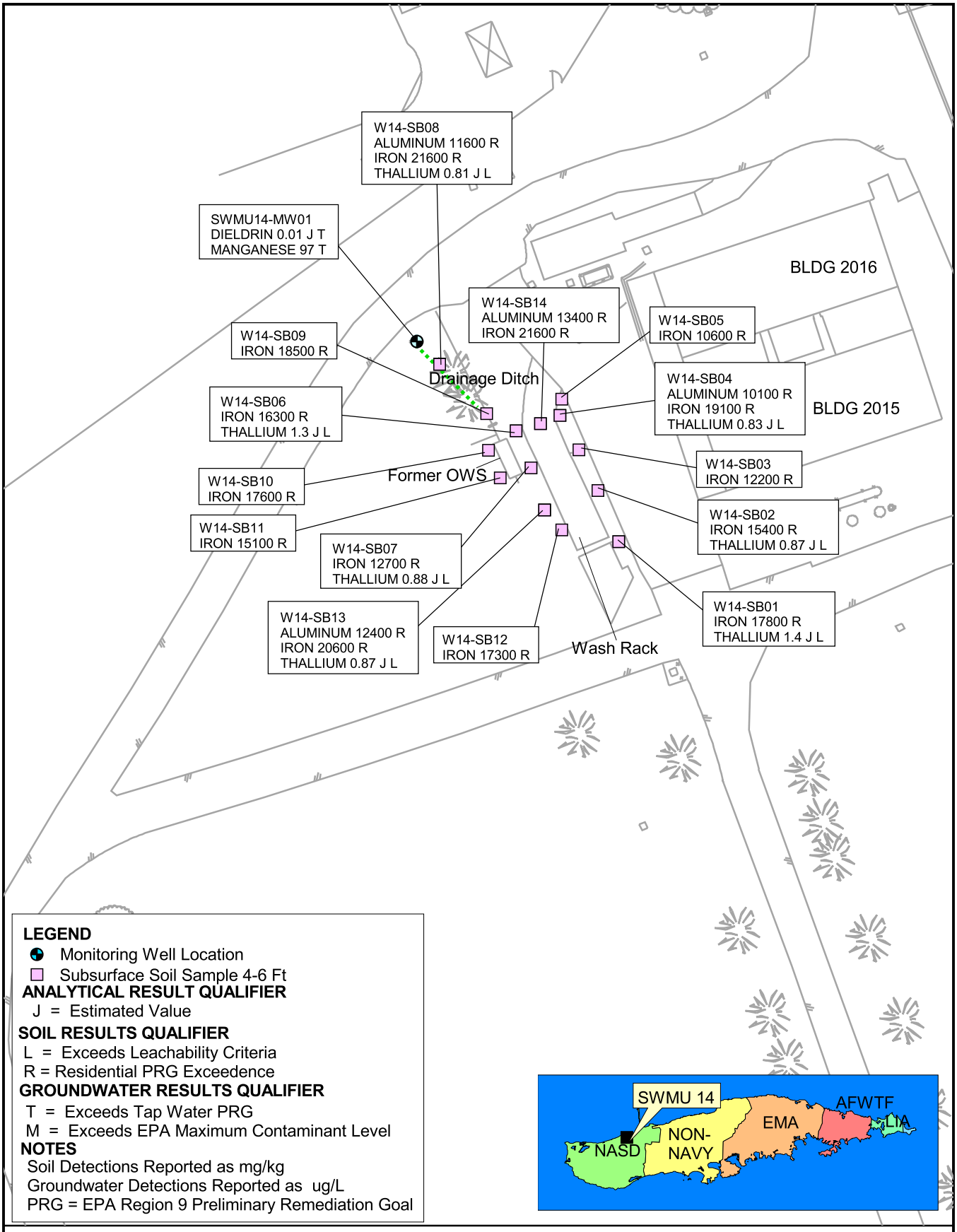


Figure 4-5

SWMU 14 Subsurface Soil and Groundwater Detections Above Screening Criteria

NFA Report for Nine Sites

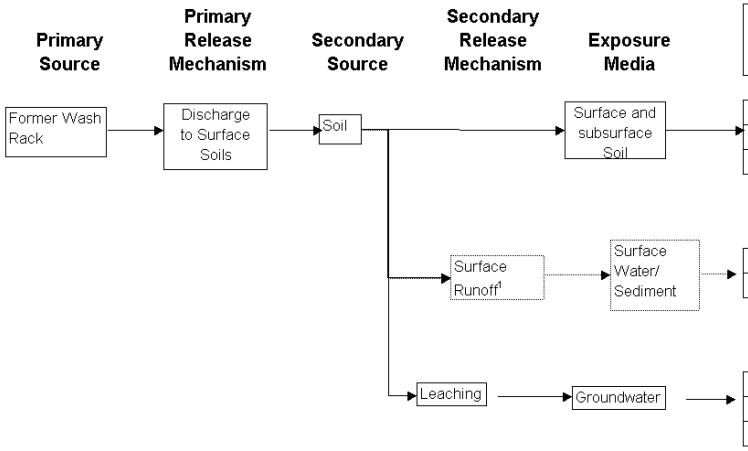
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 4-6

Conceptual Site Model for SWMU 14

NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Exposure Route	Maintenance Worker	Industrial Worker	Construction Worker[2]	Residential Adult	Residential Child	Recreational Adult	Recreational Child
Ingestion	X	X	X	X	X	X	X
Dermal Contact	X	X	X	X	X	X	X
Dust Inhalation	X	X	X	X	X	X	X
Ingestion							
Dermal Contact							
Ingestion		X		X	X		
Dermal Contact		X		X	X		
Inhalation							

X - Quantitatively evaluated exposure pathway

Note:

[1] Considered a minor pathway due to absence of runoff ditches with flow

[2] Construction worker expsorue was evaluated for surface and subsurface soil

SECTION 5

Site-Specific Decision Summary for SWMU 15 – Former Waste Transportation Vehicle Parking Area

5.1 Description

SWMU 15 is the Former Waste Transportation Vehicle Parking Area located in the Public Works Area, on the northern half of the former NASD near the Transportation Shop (A.T. Kearney, Inc. and K.W. Bruin & Associates, Inc., 1988). The precise location of the truck parking was not identified in the EBS, however the general area was identified as the triangular area included for investigation in the Expanded PA/SI.

A truck in the parking area was reported to have contained 55-gallon metal drums and overpack drums of a waste labeled as caustic D002 (EPA code for corrosive waste). The drums allegedly contained Napalm from the NSRR. Based on the technical reports for Napalm, it is a jelly-like mixture of gasoline and palm oils that is designed to stick to its target until it burns out. The use of overpack drums suggests that the material inside the drum may have leaked at one time. Interviews conducted during the EBS indicated that drums were kept on the truck for more than four months (PMC, 2000). No physical evidence of a leakage was observed at the site at the time of the investigation. The yard is no longer used for any truck storage, and the reported vehicle is no longer at the site. The entire area where trucks were parked was investigated as SWMU 15, as the vehicle may have been moved around the area. Historical records did not identify the specific location of the potential release. The investigations conducted to date at the site were reported in the Phase I PA/SI Report (CH2M HILL, October 2000). This section reevaluates much of the existing information to determine the potential risks to human health and the environment from current site conditions and future unrestricted land use. Figure 5-1/5-2 is a photo depicting the site when it was still partially active in 2000, later photos can be reviewed of the conditions of the site in 2002 after all activities ceased and the area was fenced in. SWMU 15 is the grassy area where the vehicles were parked.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including SWMU 15. The summary included the site background information, physical characteristics, site hydrogeological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

5.2 Site Characterization

5.2.1 Nature and Extent of Contamination

The Expanded PA/SI field investigation at SWMU 15 included the installation and sampling of one monitoring well, and the collection of 16 surface soil samples from 0 to 6 inches bls. No subsurface soil samples were collected from this site. As the first step during the PA/SI, only surface soil samples were proposed for collection. If surface soil had indicated that contamination levels were greater than screening criteria for leachability, then subsurface soils would have been collected. The basis for not including subsurface soil sampling as the first step was because no contamination was expected in this medium because of the soil-binding nature of most of the suspected contamination (i.e., Napalm). However, the groundwater was sampled as a conservative assessment measure. Also, OVM measurements were taken from the subsurface soils from the core material during the monitoring well installation all the way to a depth of 53 ft bls. The results were included in Appendix B of the Phase I PA/SI report, which indicated that there were no VOCs detected (the maximum positive results were near the instrument detection limit, at 0.4 ppm OVM units). Therefore, subsurface soil samples were not collected from the SWMU 15 parking area. Surface soil samples were collected from grid locations evenly placed from each other across the site to ensure that the entire area was uniformly investigated.

The monitoring well associated with SMWU 14, which is northeast of this site, is located in the general downgradient location of the SWMU 15 area. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs. Figure 5-3 shows the soil sampling locations for SWMU 15, and shows its proximity to SWMU 14. Figure 5-4 presents any chemical exceedances identified for surface soil and groundwater samples. The data are presented for each sample result for all detected chemicals in Appendix B, and a statistical summary indicating the range of detected concentrations is presented in Appendix C. All samples analyzed, including detected and non-detected concentrations, were included in Section 9.0 of the Phase I Expanded PA/SI Report (CH2M HILL, October 2000).

Surface Soil Results

A total of 16 surface soil samples (0 to 6 inches bls) were collected on a grid within the former vehicle parking lot to evaluate whether a release of Napalm or any other hazardous materials to surface soil occurred as a result of a potential leak from the stacked drums on the previously parked truck.

Soil samples contained mostly inorganic chemicals, with two samples containing benzo[a]pyrene, a PAH, above screening criteria. All detected chemicals were screened against PRGs. Several inorganic chemicals (aluminum, arsenic, chromium, iron, manganese, vanadium, and thallium) were detected in surface soil samples at concentrations exceeding either the residential PRG (HI=0.1) and/or leachability screening criteria (i.e., SSLs). The total chromium concentrations were compared against hexavalent chromium PRG values for a conservative evaluation. Additionally, one sample had benzo[a]pyrene at 0.071J, which exceeded the criteria, compared to a PRG value of 0.062 mg/kg. Potential sources for the detected PAHs are either the leaked vehicle oils or asphalt material mixed in with material from the partially graveled parking lot, considering the site is a former vehicle parking area. PAHs are commonly present in burned oils and asphalt material. The metals were detected in all surface soil samples at relatively similar concentrations between samples from this

site, and similar concentrations were also detected at other sites within the former NASD. A comparison of surface soil inorganic chemicals against background are included at the end of risk assessment section below. Table 5-1 summarizes surface soil screening results, which are shown in Figure 5-4. Appendix B contains sample-specific detections compared with criteria, and Appendix C presents the statistical summaries of the data.

Groundwater Results

Groundwater generally flows to the north toward the ocean from the Public Works Area. One monitoring well was installed downgradient of the location in which the truck reportedly was parked to evaluate whether a release of hazardous materials to groundwater had occurred as a result of a potential leak from the drums. The soil boring was analyzed for presence of volatile chemicals during field work using a field OVM measurement; the results did not indicate the presence of VOCs in the subsurface. Appendices B and D include the groundwater data for the well. There were no organic chemicals detected in the groundwater sample. Only inorganic chemicals were reported above the detection limits. Of the detected parameters, aluminum, antimony, chromium, iron, manganese, and vanadium were greater than tap water PRGs (HI=0.1) or MCLs. Filtered samples showed these metals to be 3 to 10 times less than unfiltered samples, indicating these metals concentrations are likely associated with turbidity in the samples. As previously discussed in the PA/SI reports and in Section 1.0 of this report, most of the well samples from the sites within the Public Works Area had relatively high turbidity due to low yield of the water table in the shallow depths at about 40 to 50 ft screen intervals. Table 5-2 presents the COPC selection for groundwater.

The nearby well from SMWU 14 also had only metals detected, and concentrations were similar to those detected in the SWMU 15 well. The site groundwater did not have any petroleum constituents expected from Napalm-related contamination. All the detected chemicals above screening criteria are included for risk assessment as COPCs. A comparison of site groundwater levels with background levels is included at the end of this section.

5.2.2 Contaminant Fate and Transport

If a Napalm release had occurred, detections of VOCs or SVOCs would be expected in the surface soil, in the subsurface soil OVM readings during well installation, or in the groundwater at the site. Soil concentrations of chemicals expected from the potential source material were all less than screening criteria, indicating that either a release did not occur, or that the chemicals have attenuated with time from surface soil. Napalm is a combination of polystyrene, gasoline, benzene, and palm oils, thus potential COPCs are mostly petroleum hydrocarbons. Only metals were detected in soil and groundwater at SWMU 15 at concentrations greater than screening criteria; these detected concentrations are similar to those found across the former NASD. Of the 16 surface soil samples, two indicated the presence of PAH constituents at concentrations ranging between 0.30 and 0.42 mg/kg, compared to a typical reporting limit level of 0.33 mg/kg. The detected PAHs tend to remain in surface soil and slowly undergo photodegradation with time. The area of the site is a former parking lot, and these chemicals could be associated with engine oil leaks from the parked vehicles, or from asphalt material in the gravel present at the site. The infrequent low-level detections are not likely to pose a threat by migration in the future.

The groundwater at the site is approximately 50 ft bls, and soils in the unsaturated zone consist of clayey sands and sandy clays (see Section 1.0). Lenses of poorly sorted sands were

also observed during geological investigations at AOC E, in proximity to SWMUs 15 and 14, slightly northeast, within the fenced area of this former facility maintenance area. Groundwater from this area flows in general northerly direction toward the ocean following the topography. Because the unsaturated soils are thick (40 to 50 ft), releases had to be large and soluble, thus mobile enough to penetrate through unsaturated soils to reach sufficient depths to be measurable in subsurface soil and groundwater. Any direct exposure concerns are addressed in the human health risk assessment included in this evaluation.

5.2.3 Summary of Data Evaluation

Surface soil and groundwater samples from SWMU 15 were analyzed for VOCs, SVOCs, pesticides, PCBs, and metals. Only metals were detected above screening criteria in soil and groundwater at this site which are included for risk assessment as COPCs. None of the organic chemicals associated with a potential release of Napalm or other drummed hazardous wastes were detected above criteria in either soil or groundwater, indicating that site environmental media are not impacted from past potential releases, as suspected. Future migration potential is not identified as significant based on nature and extent of the detected chemicals as discussed previously.

5.2.4 Conceptual Site Model

Figure 5-5 presents the exposure CSM for SWMU 15. This area is characterized by flat land and is triangular in shape. The site is within the fenced area, southwest corner of the Public Works Area, directly west of the former vehicle wash rack area (SWMU 14). The entire site is currently overgrown with weeds and grass, with patches of gravel still visible during the site inspection. The suspected source of contamination at SWMU 15 is potentially leaking drums stacked in the back of an open bed pickup truck parked in the area, as identified by old photographs.

Napalm is generally a combination of polystyrene, gasoline, benzene, and palm oils, thus potential COPCs are mostly petroleum hydrocarbons. Past releases may have contributed to surface soil contamination with petroleum hydrocarbons and polystyrene emulsified with palm oils. Any release of this jelly-like substance, which is designed to stick to a target, is likely to bind to surface soil, and degrade with time due to photo-oxidation. Lighter portions of the petroleum constituents tend to volatilize, though at a possibly altered rate because of the presence of palm oils. Potential migration through soil to the subsurface is possible given the palm oils in Napalm, which in turn trap more volatile components of the mixture and prevent them from migrating further. Thus, subsurface migration is not a significant pathway based on the nature of this unique material.

The primary medium of interest at SWMU 15 is the surface soil. Subsurface soil did not have any detectable volatile chemicals in the field measurement techniques used through OVM measurements. The groundwater has the least likelihood of being contaminated, based on the site characterization and nature of the reported release (i.e., Napalm), as previously discussed. However, all detected chemicals were screened against criteria and chemicals identified above criteria are included in the risk assessment. There are no drainage features associated with the site. Therefore, no surface water/sediment contamination is expected from surface runoff.

The potential ecological receptors are described in Section 5.3 below, and include terrestrial plants and animals, and human receptors include workers, trespassers/recreational visitors, and under unrestricted land use, residential receptors. Table 5-3 presents the potentially

complete exposure pathways and receptors for the site. The site is much smaller than the typical exposure unit size of 0.5 acres. Groundwater is evaluated for potential potable use by unrestricted land use-based receptors such as future industrial workers and residents. The following section presents further details on the receptors evaluated in the risk assessment.

5.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F

An ecological assessment and survey was conducted as part of the Phase I and Phase II PA/SI for all the sites within PWA area as one evaluation summary. Both plant and animal communities were surveyed during this assessment.

The plant communities were similar among all these sites and were all located in the former NASD Public Works Area/Main Operations Area. The plant communities mainly consisted of herbaceous species typical of mowed/maintained areas. Ground ,maintenance appeared to be main factor effecting the plant community composition and structure within this area at the time of the ecological survey conducted in 2000. A comparison was made by selecting a control plot outside of the sites, located southeast of Public Works Area and comparing the habitat from the control area with the sites within Main Operations Area of the former NASD. The ecological assessment concluded that there was no significant difference between any of the sites and the control area.

SWMU 15, which is an old parking lot was reported to have stressed vegetation, with domination by an exotic and invasive grass which is not significant. The stress and decumbent growth is thought to be due to heavy vehicles parked in this area at the time of the survey (see Figure 4-2). The soil compaction also limits the species diversity of the site, and small patches of oil stains in the soil were reported in the south central portion of the site.

Wildlife observed at these sites is typical for developed areas on Vieques. Horses and mongoose were the mammal species observed, and several species of birds were also observed. No federally protected species observed in this area. Nearby Naval Station Roosevelt Roads located on the main Island of Puerto Rico is identified as habitat for Arctic perigrine falcon which prefers feeding in open areas. Since the Main Operations Area is an open area, it could be a feeding habitat for these falcon, though none were observed at the site during the survey.

5.4 Human Health Risk Assessment

Section 1.0 presents the general approach used for the risk assessment. The risk calculations were included in tables using the RAGS Part D format for all the sites in this NFA report, including SWMU 15. This section summarizes the pertinent information contained in the risk assessment for this site. The complete risk assessment and accompanying tables can be found in Appendix E.

The data used in this risk assessment was collected as part of the Phase I expanded PA/SI, which included data validation and DQE. A summary of the DQE was included in Section 1.0 of this report. A total of 16 surface soil locations and one monitoring well were sampled during the PA/SI for SWMU 15. A semi-quantitative volatile monitoring using an OVM did not indicate presence of volatile organic chemicals in the subsurface soils at this site.

Analytical results for surface soil and groundwater were screened against the appropriate criteria, and chemicals detected above criteria were considered COPCs. Aluminum, arsenic, chromium, iron, manganese, thallium, vanadium, and benzo[a]pyrene were selected as surface soil COPCs (see Table 5-1). In groundwater, the following metals exceeded screening criteria and were selected as groundwater COPCs: aluminum, antimony, chromium, iron, manganese, and vanadium (see Table 5-2).

The exposure pathways evaluated included maintenance workers, industrial workers, recreational users, and residential receptors at SWMU 15 (see Table 5-3). All receptors were assumed to be exposed to surface soils. Groundwater exposures were evaluated for industrial workers and residents. This site is within the fenced compound area, which also includes SWMU 14, SWMU 15, AOC C, and AOC E. Because these sites are located within a 1 to 2-acre area, exposure is likely to be uniform and divided between the sites for workers. The upgradient well located across the street from SWMUs 14 and 15, and installed in association with SWMU 14 investigations can be considered a background well for all the sites within this complex listed above. A comparison of site well inorganic chemical concentrations with background inorganic chemical concentrations are included at the end of this section. Table 5-4 presents the risk characterization summary for the quantitatively evaluated receptors at SWMU 15.

Maintenance Worker

For a maintenance worker, the ELCR for exposure to surface soils is 3.1E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.02 and is less than the target HI of 1.0 for noncarcinogenic exposure. Thus, site media do not present unacceptable health risks to maintenance workers.

Industrial Worker

The estimated combined ELCR for an industrial worker exposed to surface soils and groundwater is 1.5E-6. Benzo[a]pyrene and arsenic were the only carcinogenic COPCs in soils; there were no carcinogenic COPCs in groundwater. The estimated ELCR is within the acceptable risk range for carcinogenic effects. The estimated HI of 0.77 for exposure to surface soils and groundwater is less than the target HI of 1.0. Thus, the site is suitable for altered industrial uses where workers may spend longer period of time at the site, as exposures to soil and groundwater would not result in excessive risk.

Recreational Receptors

The estimated ELCR for a recreational adult and child (e.g., nearby residents visiting the site, trespassers, visitors) exposed to surface soils is 6.9E-7 and 1.2E-6, respectively, and is within the acceptable risk range. The HI of 0.052 and 0.4, respectively, is less than the target HI of 1.0. Thus, the exposures to site media for offsite public receptors visiting the site, as conservative exposure assumptions evaluated in this risk assessment did not result in unacceptable risks.

Residential Receptors

For a residential adult and child, the ELCR is 1.8E-6 and 4.0E-6, respectively, which is within the EPA acceptable risk range of 1E-4 to 1E-6. The HI for an adult is 2.1 and for a child is 6.0. The target organ-specific HI is at a value of 1.0 for iron in groundwater for an adult. For a child, target organ totals were at a value of 1.0 for respiratory tract-based HI, and at 2.95 for gastrointestinal tract endpoint, as presented in Appendix D-4.

5.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The concentrations of inorganic chemicals identified as COPC in site soil are compared against the range of background concentrations, as presented in Table 5-5.

As can be observed from Table 5-5, SWMU 15 soil inorganic chemicals are well within background levels, with a slight exceedence for arsenic and thallium. The levels of arsenic, thallium and other inorganic chemicals are similar in concentrations to surface and subsurface soil concentrations from other sites in the area, indicating area soil mineralogy contains these chemicals at the observed concentrations. Thus, these concentration differences between offsite background and sites within the former Public Works Area are attributable to soil natural variability and analytical data reproducibility. Site soil inorganic chemical concentrations are similar to the background soil inorganic chemical levels.

Aluminum, antimony, chromium, iron, manganese and vanadium were identified as inorganic COPCs in groundwater. Of these, aluminum, chromium, and iron were higher in SWMU 15 wells than the general background wells. However, these levels are lower than those detected in upgradient well from SWMU 14 (see Table 4-7). As described in the PA/SI reports groundwater in the shallow water table has low yield and presents a challenge in obtaining low turbidity samples. Wells were pumped dry during sampling due low water yields. Most of the groundwater samples had high suspended particulates which may be responsible for the measured metals. Since potable water is likely to be from much deeper aquifer, and the shallow groundwater is separated from it by soil and thick rock this may not be an issue for a future exposures for the deeper potable aquifer. The dissolved metals levels are much lower, and concentrations are similar across various sites and background wells. Thus, observed metals in shallow groundwater are not considered natural to the area, and are partially resulting from sampling difficulty.

5.4 Summary of Site Risks

Samples were collected across the entire suspected area from evenly placed grids. Site soil samples had mostly inorganic chemicals greater than screening criteria, with two samples reported near detection limit concentrations of PAHs. Because the PRG values are also near the detection limit, these PAHs were selected as COPCs. Groundwater had only inorganic chemicals detected. Except for aluminum, all other detected inorganic chemicals were within the range of concentrations detected at other sites within the former NASD, as well as the background investigation reported concentration ranges. Similar elevated aluminum and iron were detected in a well upgradient of SWMU 14 adjacent to SWMU 15 (see Appendix E).

No future contaminant migration concerns were identified for the site environmental media, as no Napalm-related contamination was identified, and detected concentrations were within the screening levels for all organic chemicals for cross media migration.

The human health risks were estimated assuming future unrestricted as well as industrial land use. All the carcinogenic risks were within acceptable limit ranges, between 1 to 100 in a million (10^{-6} to 10^{-4}) levels. The HI was above a value of 1.0, for a future residential child consuming soils at an ingestion rate of 200 mg/day, and drinking groundwater from the shallow aquifer at 1 L/day, exclusively from SWMU 15 area. This estimated HI greater than 1.0 is primarily from iron in soil and groundwater.

The cancer risks and health hazard effects for SWMU 15 are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential receptors. The overall risk to future residents is within the range of acceptable risks. For a residential adult and child, the HI exceeds a value of 1.0, primarily from iron in groundwater. However, there is no historical evidence to suggest any activities at this site would have resulted in the release of metals to surface soils. Iron concentrations in soils are within the range of background soil iron concentrations for former NASD and may be related to iron-rich ores widely reported for Vieques Island (CH2M HILL, July 2001).

The groundwater in well SWMU14-MW01 is upgradient of sites within this maintenance complex area. The groundwater iron level in this upgradient well is higher than the site wells at SWMU 15, indicating iron in general in the regional groundwater is above risk-based concentrations, however, represents background conditions for the area. Therefore, the health hazard index estimated for soil at SWMU 15 should not be considered site-related. No further investigation or remedial action for the soils or groundwater is necessary for the protection of human health or the environment at SWMU 15, and the selected remedial alternative for the soils and groundwater at the site is NFA.

5.5 Conclusions and Recommendations

The absence of human health risks above acceptable limits for any of the receptors evaluated under conservative exposure assumptions indicates that restricted access is not warranted for this site to protect human health from exposure to site media. Specifically, no further investigation or remedial action for the soils or groundwater is necessary for the protection of human health or the environment based on an analysis of available soil and groundwater sample results and pertinent information for the site. In addition, no further groundwater monitoring will be required under CERCLA as a result of the recommended NFA alternative. Therefore, the selected remedial alternative for the soils and groundwater at SWMU 15 is NFA.

TABLE 5-1
SWMU 15 COPC Selection for Surface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of Mean[a]	Residential PRG[b] (HI = 0.1)	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
Benzo[a]Pyrene	17	2	0.071	0.053	0.062	0.404	0.062	0.21	8.0
Aluminum	16	16	21,400	5,030	8,161	8,161	7,614	10,000	NA
Arsenic	16	15	4.8	0.45	1.29	1.22	0.39	1.6	29
Chromium, Total	16	16	47.5	6.6	14.6	14.6	30.1	64.0	38
Iron	16	16	30,100	11,900	16,381	16,381	2,346	10,000	NA
Manganese	16	16	786	370	632	632	176	1,946	NA
Thallium	16	11	0.85	0.33	0.546	0.422	0.52	6.75	0.70
Vanadium	16	16	95.9	34.6	47.9	47.9	55	715	6,000

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
N -- Number of samples
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 5-2
SWMU 15 COPC Selection for Groundwater
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration (µg/L)	Minimum Detected Concentration (µg/L)	Mean Concentration of Detects	Best Estimate of the Mean[a]	Tap Water PRG[b] (HI=0.1)	MCL[c]
Aluminum	1	1	8,700	8,700	8,700	8,700	3,650	NA
Antimony	1	1	1.5	1.5	1.5	1.5	1.5	6.0
Chromium	2	2	30.8	2	16.4	16.4	11.0	100.0
Iron	1	1	10,100	10,100	10,100	10,100	1,095	NA
Manganese	1	1	458	458	458	458	88	NA
Vanadium	1	1	43.5	43.5	43.5	43.5	26	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] Maximum Contaminant Levels. EPA Office of Water. http://www.epa.gov/safewater/mcl.html
Units in µg/L (ppb)
HI -- Hazard Index
MCL -- Maximum contaminant level
NA -- Not available
PRG -- Preliminary remediation goal

TABLE 5-3
SWMU 15 Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Scenario is protective of any occasional maintenance work such as lawn moving.
Industrial Worker	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater	Yes	Area could be developed in the future for industrial use. Both site soil and groundwater exposure is assumed. Inhalation exposure to groundwater is not significant as no volatile COPCs are identified.
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Area could be developed in the future for recreational use and would be protective of any occasional trespasser.
Residents	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater	Yes	Although the site is unlikely to be considered for residential development, this is a worst-case scenario for comparison purposes. Inhalation exposure to groundwater is not significant as no volatile COPCs are identified.

TABLE 5-4
SWMU 15 Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Maintenance Worker								
	Surface Soil				*Surface Soil*			
	1.8E-07	2.9E-10	7.2E-08	2.6E-07	0.0208	0.0019	0.0019	0.02453
	Total				*Total*			
	1.8E-07	**2.9E-10**	**7.2E-08**	**2.6E-07**	**0.0208**	**0.0019**	**0.0019**	**0.0245**
Industrial Worker								
	Surface Soil				*Surface Soil*			
	1.1E-06	1.4E-09	3.5E-07	1.5E-06	0.094	0.009	0.007	0.11
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.645	0.000	0.018	0.662
	Total				*Total*			
	1.1E-06	**1.4E-09**	**3.5E-07**	**1.5E-06**	**0.09**	**0.009**	**0.01**	**0.11**
Recreational Adult								
	Surface Soil				*Surface Soil*			
	4.6E-07	5.6E-10	2.4E-07	6.9E-07	0.042	0.004	0.006	0.05
	Total				*Total*			
	4.6E-07	**5.6E-10**	**2.4E-07**	**6.9E-07**	**0.04**	**0.004**	**0.01**	**0.05**
Recreational Youth								
	Surface Soil				*Surface Soil*			
	1.1E-06	6.6E-10	1.4E-07	1.2E-06	0.388	0.017	0.015	0.42
	Total				*Total*			
	1.1E-06	**6.6E-10**	**1.4E-07**	**1.2E-06**	**0.39**	**0.017**	**0.01**	**0.42**
Residential Adult								
	Surface Soil				*Surface Soil*			
	1.5E-06	1.9E-09	2.8E-07	1.8E-06	0.140	0.013	0.008	0.16
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.805	0.000	0.134	1.939
	Total				*Total*			
	1.5E-06	**1.9E-09**	**2.8E-07**	**1.8E-06**	**0.14**	**0.013**	**0.01**	**0.16**
Residential Child								
	Surface Soil				*Surface Soil*			
	3.6E-06	2.2E-09	4.6E-07	4.0E-06	1.306	0.059	0.050	1.41
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.211	0.000	0.413	4.624
	Total				*Total*			
	3.6E-06	**2.2E-09**	**4.6E-07**	**4.0E-06**	**1.31**	**0.059**	**0.05**	**1.41**

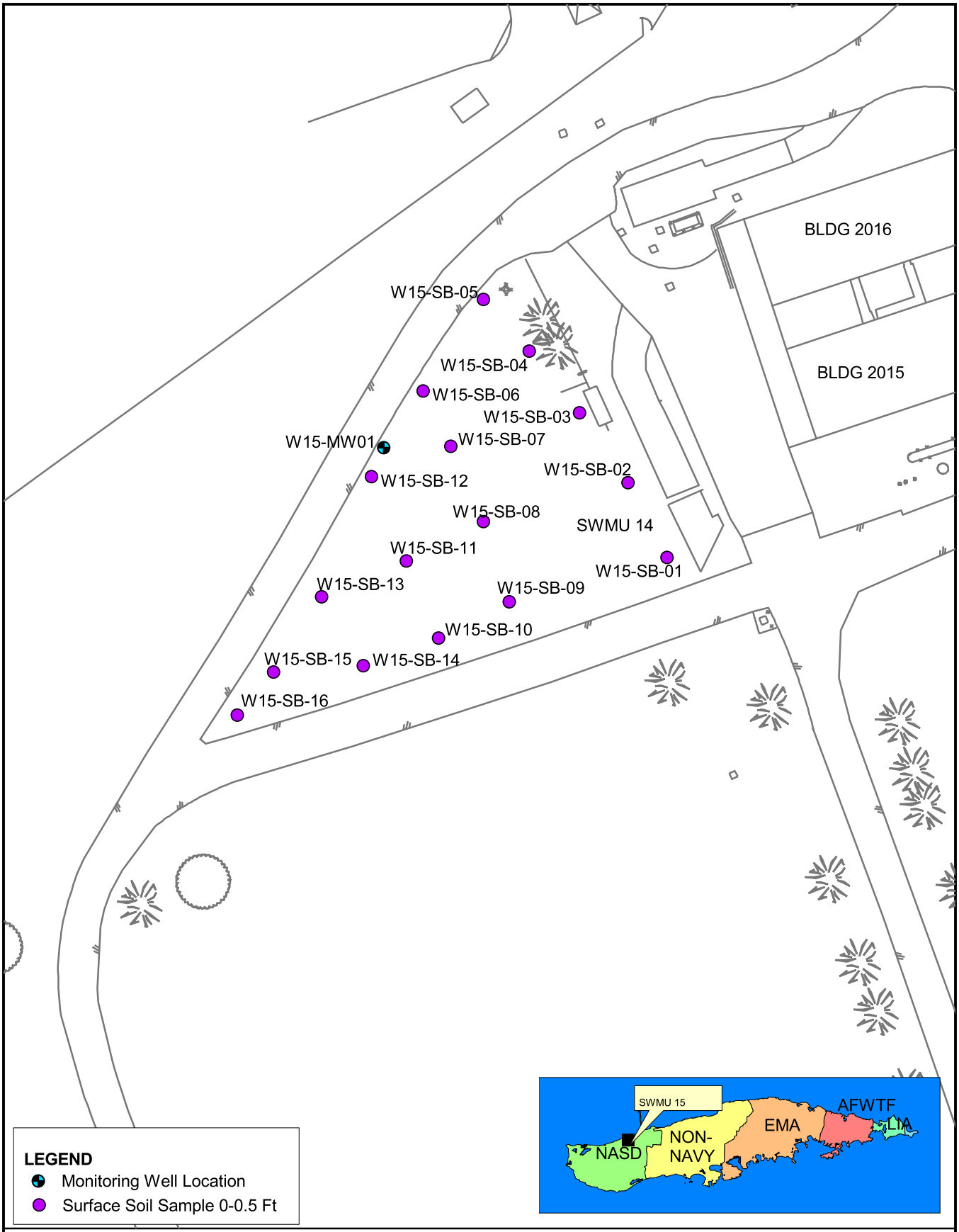
TABLE 5-5
Background Concentrations in Site Media Compared to Site Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Parameter	Units	Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Detected Site Concentration
		Minimum	Maximum			
Surface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	21,400	8,161
Arsenic	mg/kg	0.57	2.5	2.3	4.8	1.3
Chromium	mg/kg	2.2	74	74	48	15
Iron	mg/kg	2,500	39,000	37,531	30,100	16,381
Manganese	mg/kg	48	1,200	1,167	786	632
Thallium	mg/kg	0.45	0.67	0.67	0.85	0.55
Vanadium	mg/kg	9.0	130	130	96	48
Groundwater						
Aluminum	µg/L	130	3,500	3,500	8,700	8,700
Antimony	µg/L	5.1	5.2	5.2	1.5	1.5
Chromium	µg/L	3.7	6.8	6.8	30.8	NA
Iron	µg/L	480	4,800	4,800	10,100	10,100
Manganese	µg/L	100	17,000	17,000	458	458
Vanadium	µg/L	1.8	75	75	44	44

mg/kg = milligrams per kilogram or part per million (ppm)
µg/L = micrograms per liter or parts per billion (ppb)
NA Not available
UTL Upper tolerance limit

FIGURE 5-1/5-2
SWMU 15 Waste Transportation Vehicle Parking Area

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr



N

0 40 80 120 Feet

Figure 5-3
SWMU 15 Soil and Groundwater Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr

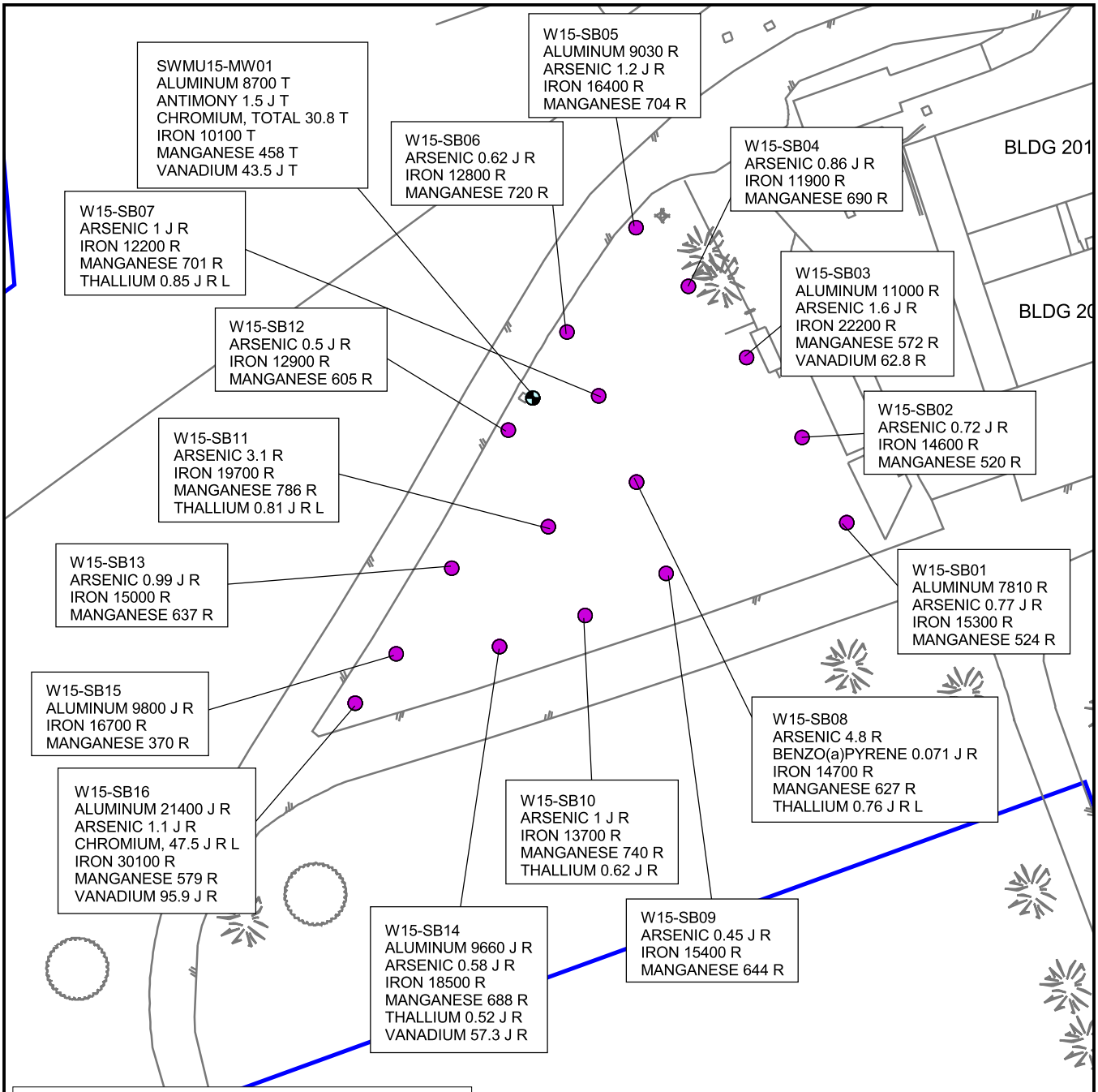
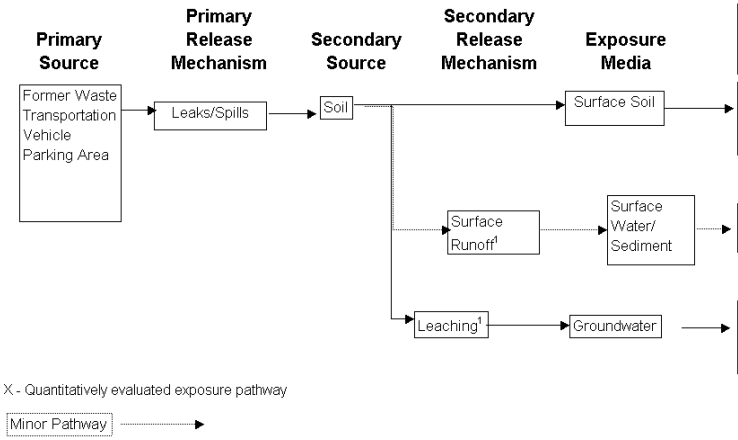


Figure 5-4
SWMU 15 Soil and Groundwater Detections Above Screening Criteria
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 5-5
Conceptual Site Model for SWMU 15
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Exposure Route	Maintenance Worker	Industrial Worker	Construction Worker[2]	Residential Adult	Residential Child	Recreational Adult	Recreational Child
Ingestion	X	X		X	X	X	X
Dermal Contact	X	X		X	X	X	X
Dust Inhalation	X	X		X	X	X	X
Ingestion							
Dermal Contact							
Ingestion		X		X	X		
Dermal Contact		X		X	X		
Inhalation							

X - Quantitatively evaluated exposure pathway

Minor Pathway

Note:
[1] Considered a minor pathway based on the nature of suspected contaminant release
[2] Construction worker exposure pathway is incomplete subsurface soil was not sampled

SECTION 6

Site-Specific Decision Summary for AOC B – Former Wastewater Treatment Plant

6.1 Description

AOC B is the Former Wastewater Treatment Plant (WWTP) that served the officers' quarters and other administrative buildings for municipal sewage-types of discharges at the former NASD. The WWTP was in operation from 1983 to 2000. AOC B is located at the southwest end of the former Public Works Area, and the WWTP served as the primary domestic wastewater treatment system. The WWTP consisted of one aeration tank and one separation tank with two blowers to supply air for biological treatment. As the WWTP is no longer in service, the treatment lagoons are now dried up and overgrown with shrubs and tall grasses. The area is only wet during occasional heavy rainfall. Photographs of the site are provided as Figures 6-1 and 6-2.

Effluent from the WWTP drained into a series of four self-contained lagoons with no discharge point. The lagoons were lined with compacted clay. The lagoon area is surrounded by an 8-ft-high cyclone fence as an access control measure to limit wildlife access to the site. According to the EBS (PMC, 2000), an anomaly was noted in this area, indicating former Navy use. The site was then investigated as part of the Phase II PA/SI for the potential presence of hazardous waste. There are no releases of wastes to AOC B other than municipal wastes. The Final Expanded PA/SI Report – Phase II (CH2M HILL, November 2002) found no evidence of the presence of hazardous wastes, and recommended that this site be considered for NFA status. This section includes a risk assessment for various exposure scenarios at the site under future land use, including unrestricted (residential) land use.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including AOC B. The summary included the site background information, physical characteristics, site hydro-geological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

6.2 Site Characterization

6.2.1 Nature and Extent of Contamination

Figure 6-3 presents the location of the soil boring samples collected at AOC B. A total of 16 surface soil (0 to 0.5 ft bls) and 16 subsurface soil (4.5 to 6 ft bls) samples were collected in two sampling phases from 16 locations (within the dried-up lagoons) at AOC B as part of the Phase II PA/SI investigation. The details of the PA/SI findings and data collected were included in Section 3.0 of the Phase II PA/SI Report (CH2M HILL, 2002). The samples were

collected from soil boring locations within the lagoons, as shown on Figure 6-3. The samples were analyzed for a complete TCL/TAL list including, metals, VOCs, SVOCs, pesticides, and PCBs. Surface and subsurface data soil screening tables are presented in Appendix B. In addition, one sample from the aereation tank was collected and analyzed for the full TCL/TAL list (see Appendix B). This water sample had trace levels of SVOCs and metals, none of which were above their respective MCLs or PRGs. The set of screening criteria used for comparison is presented in Appendix I of this report.

Detections of metals in surface and subsurface soils from the bottom of the lagoons were compared against the background soil concentrations at the end of risk assessment discussions below. Some of the VOCs and SVOCs were detected at concentrations near detection limits, as presented in Appendix B and in Appendix D-5 in RAGS Part D format. None of the detected organic chemicals were above the applicable screening criteria. Summaries of surface and subsurface soil exceedances are presented in Tables 6-1 and 6-2, respectively, and are shown on Figure 6-4.

Surface Soil Results

Surface soil samples were collected with stainless-steel hand augers and bowls to a depth of 6 inches (0.5 ft) bls. In general, these soils were dark brown-colored silty clay. Soils were dry during sampling. The analytical results indicated detections of aluminum, arsenic, iron, manganese, thallium, and vanadium in surface soil samples at concentrations above the residential PRGs (HI =0.1) for noncarcinogenic chemicals.

Subsurface Soil Results

Subsurface soil samples were collected from depths ranging between 4.5 to 6 ft bls. These soils were observed to be light-colored, with soil type consisting of sand or sandy silt, and dry. They were collected below the surface soils at the same boring location just below the lagoon compacted clay liner. Detected chemicals were screened against industrial worker PRGs and the screening criteria for leachability (i.e., SSLs). Trace levels of VOCs detected in surface soil were not detected in subsurface soil from the same sample locations. None of the detected VOCs were above screening criteria (see Appendix D-5). Of the detected inorganic chemicals, aluminum and iron were selected as COPCs in subsurface soil, as they were above industrial PRG values, and were included for a construction worker exposure evaluation. All detected subsurface soil inorganic chemicals were compared against background levels. A description of these levels is found at the end of this section.

6.2.2 Contaminant Fate and Transport

Site surface soil and subsurface soil data did not indicate the presence of a contamination source suspected during the EBS. Some organic chemicals were detected in surface soil, but were well below any of the screening criteria. These chemicals were not detected in subsurface soil samples from the same location, thus indicating they are not leaching. Also, as summarized in Section 1.0 of this report, during the DQE some of these chemicals were identified as being present in blank samples as well, and thus my not be specific to the site at these trace levels. Some of the inorganic chemicals that were detected were above PRGs in both surface and subsurface soils. These chemicals are also common to background soils, and are compared against background levels at the end of this section. The detected

inorganic chemicals in surface soil are aluminum, arsenic, iron, manganese, thallium, and vanadium. The detected chemicals in subsurface soil are aluminum and iron.

The site soils at AOC B are clayey at the bottom of the lagoon, with silty-sands in the deeper samples collected up to 6 ft bls. Groundwater in this area is greater than 40 ft bls. The organic chemicals detected in site surface soil were not detected in subsurface soil from the same location, with the exception of phthalates, which are also common laboratory contaminants (see DQE summary in Section 1.0). These chemicals do not present a leachability concern due to their infrequent detection at concentrations much lower than screening criteria for leachability (see Appendix B and Appendix D-5).

Inorganic chemicals were not detected above their respective SSLs, when the criterion is available from EPA. The dissolved portions of these inorganic chemicals are likely to be retarded from migrating to the water table due to the dry clay soils that are more than 40 ft thick above the water table. Thus, the vertical migration through the soil column is not significant at the site. Because there are no site-specific migration pathways, offsite migration is not likely. Potential exposure points consist of direct contact lagoon soils, and the exposure pathways for these soils are evaluated in a risk assessment summarized below, and detailed in Appendix E.

6.2.3 Summary of Data Evaluation

Analytical results of the surface and subsurface soil samples indicate detections of metals above the EPA Region 9 residential PRGs, and subsurface soil metals concentrations above industrial PRG criteria. These constituents will therefore be evaluated as COPCs in the risk assessment included below. No constituents were detected above leachability or risk-based criteria in subsurface soils. All other surface and subsurface soil parameters analyzed were either not detected, or were detected below their applicable screening criteria.

Based on the sampling data, there is no evidence indicating that a hazardous waste release has occurred at AOC B, as was suspected during the EBS (PMC, 2000). No site-specific contamination was identified during the extensive sampling conducted at this site.

6.2.4 Conceptual Site Model

Figure 6-5 presents the CSM for AOC B following the methodology described in Section 1.0. The CSM for AOC B is based on the nature of contamination identified during the study conducted as part of Phase II PA/SI. Possible contaminant migration pathways, potential receptors, and routes of exposure based on future potential land uses (i.e., unrestricted) were evaluated.

AOC B is likely to have received domestic wastewater releases during its operation. The EBS recommended further investigation due to the suspicion that potential releases of hazardous wastes may have occurred (PMC, 2000). However, there were no documented releases of any hazardous substances at the site. The domestic wastewater released in the past was from nearby residential buildings used by Navy personnel. Any releases to the drainage system of the WWTP likely reached the aeration and separation tank, and the overflow may have been released to the four lagoons. The fate of wastes entering the lagoon depended on the nature of the wastes. If the wastes had low solubilities, such as metals or SVOCs, they would have likely settled in the tanks and may have been released to the lagoons through

suspended particulates from the sediment material. If the wastes were released to the lagoons directly, they would be present most likely in surface soils/sediments at the bottom of the ponds.

Secondary migration pathways for highly soluble chemicals, if released to the lagoons, could include infiltration to subsurface soils and groundwater. Surface runoff and offsite release to drainage ways is not an important migration pathway for this site because releases would have been directly discharged into the lagoon.

Analytical results of the surface and subsurface soil samples collected from this site had only inorganic chemicals above the screening criteria for direct exposure and leachability to groundwater. No organic chemicals were identified above screening criteria. Based on the analytical data, potential exposure pathways could be identified as exposures to surface soil, while leachability was not considered significant because of the lack of soluble/mobile chemicals in site media as indicted in the screening against SSL values.

Potential exposure points included areas where human activities are likely and could result in physical contact with contaminated media. Overgrown vegetation at this site indicates that the facility is inactive, with no human receptors present at the site. If the former WWTP is reused, the workers involved with vegetation control and maintenance may be exposed to soils lining the low-lying areas. A future industrial worker is likely to be exposed in a manner similar to a maintenance worker, assuming the site remains a WWTP. If the site is classified for unrestricted land use in the future, exposure to other receptors is possible and could include residential receptors. Residential exposure routes include direct contact with the soils lining the dry lagoons. None of the contents of tanks, drain pipes, or other enclosed structures are available for direct contact.

6.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F

An ecological survey was conducted for the sites located within the Main Operations Area (or Public Works Area). The sites investigated included SWMUs 10, 14, 15, and AOCs C and F. AOC B was not specifically mentioned in the ecological survey reports, which could be an inadvertent omission during reporting, however, because AOC B is reported within the PWA, all discussion for the sites in this area is pertinent for this site also.

The plant communities are similar among all these sites. The plant communities mainly consist of herbaceous species typical of mowed/maintained areas. Maintenance of the grounds appeared to be main factor effecting the plant community composition and structure within this area at the time the ecological survey was conducted in 2000.

To determine the relative health of the ecological community within the Main Operations Area, a comparison was made by selecting a control plot outside of the sites, which is located southeast of SWMU 14, and comparing the habitat with the sites identified above. The ecological assessment concluded that there was no significant difference between any of the sites and the control site, however it was noted that SWMU 10 presented a greater abundance of some plant species than the control site.

AOC C had higher abundance of hydrophytic vegetation than the other sites because it is a drainage ditch. SWMU 15, which is an old parking lot was reported to have stressed vegetation, with domination by an exotic and invasive grass which is not significant. The stress and decumbent growth is thought to be due to heavy vehicles parked in this area at the time of the survey (see Figure 4-2). The soil compaction also limits the species diversity of the site, and small patches of oil stains in the soil were reported in the south central portion of the site.

The wildlife observed at these sites is typical for developed areas on Vieques Island. Horses and mongoose were the mammal species observed, and several species of birds were also observed. No federally protected species were observed in this area. The nearby NSRR located on the main Island of Puerto Rico is identified as habitat for Arctic perigrine falcon, which prefers to feed in open areas. Since the Main Operations Area is an open area, it could be a feeding habitat for this species, although none were observed at the site during the ecological survey.

6.4 Human Health Risk Assessment

This section summarizes the pertinent information contained in the risk assessment for AOC B. Screening data for all of the exposure routes and potential human receptors are provided in Appendix D-5 in the RAGS Part D format. A more detailed discussion and accompanying tables of the risk assessment conducted are presented in Appendix E.

As previously discussed, a total of 16 surface soil samples (0 to 0.5 ft bls) and 16 subsurface soil samples (4.5 to 6 ft bls) were collected at AOC B. Analytical results were screened against the appropriate screening criteria, by comparing maximum detected concentration against criteria. Chemicals detected above criteria were considered COPCs. In surface soil, aluminum, arsenic, iron, manganese, thallium, and vanadium exceeded the screening criteria and were selected as COPCs (see Table 6-1). In subsurface soil, aluminum and iron were identified as COPCs when compared against industrial PRGs (see Table 6-2). The exposure pathways to surface soils for future hypothetical maintenance workers, industrial workers, recreational receptors, and residential receptors were considered complete at AOC B (see Table 6-3).

Table 6-4 and the RAGS Part D formatted tables in Appendix D-5 present the risk characterization summary for the quantitatively evaluated receptors at AOC B. The estimated cancer risks and hazard indices for the receptors identified are summarized below:

Maintenance Worker

For a maintenance worker, the ELCR for exposure to surface soils is 6E-8, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.02, and is less than the target HI of 1.0 for noncarcinogenic exposure.

Industrial Worker

For an industrial worker, the ELCR for exposure to surface soils is 2.9E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.088, and is less than the target HI of 1.0 for noncarcinogenic exposure.

Construction Worker

The subsurface soil was evaluated for potential exposure to construction workers, with aluminum and iron as COPCs. No carcinogenic COPCs were identified. The EPCs included both surface and subsurface soil sample concentrations. The HI for a future construction worker is estimated to be 0.249, which is less than the target HI of 1.0.

Recreational Receptors

The estimated ELCRs for a recreational adult and child exposed to surface soils are 1.3E-7 and 2.4E-7, respectively, and is less than the acceptable risk range. The HIs of 0.04 and 0.35, respectively, are less than the target HI of 1.0.

Residential Receptors

For a residential adult and child, the ELCRs are 3.6E-7 and 8.2E-7, respectively, which are below the EPA acceptable risk range of 1E-4 to 1E-6. The HI of 0.13 for an adult is less than the target value of 1.0. For a residential child, the HI for exposure to surface soils is 1.2, which slightly exceeds the target HI of 1.0. However, the target organ-specific HI, primarily because of iron, was 0.75 and did not exceed a value of 1.0 for any target organs. Therefore, no COCs were identified. The detected arsenic and iron levels in site soils were compared with background surface soil levels, as discussed below.

6.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The inorganic COPCs that were identified in soil at AOC B were compared against the range of background concentrations, and are presented in Table 6-5. As can be observed from the table, the inorganic chemicals in AOC B soil are well within background levels. The estimated risks are likely from background inorganic chemicals, and site concentrations are not different from background levels.

6.6 Summary of Site Risks

There was no site-specific hazardous waste identified by the extensive sampling conducted at AOC B. The detected chemicals were screened against criteria, as described in Section 1.0 and presented in Appendices B and D. All chemicals that were identified as COPCs were inorganic chemicals.

6.7 Conclusions and Recommendations

Because the no human health ecological risks are identified above acceptable limits under unrestricted land use scenario, and no contamination was identified specific to WWTP operations at AOC B, NFA is recommended for AOC B. No additional sampling or monitoring of the soil will be necessary because the conditions related to the site are protective of human health and the environment.

TABLE 6-1
AOC B COPC Selection for Surface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of Mean[a]	Residential PRG[b] (HI = 0.1)	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
Aluminum	16	16	14,000	4,300	8,538	8,538	7,614	10,000	NA
Arsenic	16	3	1.1	0.66	0.873	0.348	0.39	1.6	29
Iron	16	16	26,000	11,000	15,775	15,775	2,346	10,000	NA
Manganese	16	16	818	54	247	247	176	1,946	NA
Thallium	4	2	0.68	0.51	0.595	0.4	0.52	7	0.70
Vanadium	16	16	73	34	47.3	47.3	55	715	6,000

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 6-2
AOC B COPC Selection for Subsurface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of the Mean[a]	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
Aluminum	8	8	14,000	4,300	6,800	6,800	10,000	NA
Iron	8	8	26,000	11,000	16,125	16,125	10,000	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 6-3
AOC B Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Scenario is protective of any occasional maintenance work such as lawn moving.
Industrial Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Area could be developed in the future for industrial use. Both site soil and groundwater exposure is assumed.
Construction Worker	Subsurface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Scenario is protective of any occasional construction activities at the site.
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Area could be developed in the future for recreational use and would be protective of any occasional trespasser.
Residents	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Although the site is unlikely to be considered for residential development, this is a worst-case scenario for comparison purposes.

TABLE 6-4
AOC B Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Maintenance Worker								
	Surface Soil				*Surface Soil*			
	5.0E-08	7.4E-11	9.9E-09	6.0E-08	0.0179	0.0010	0.0009	0.01980
	Total				*Total*			
	5.0E-08	**7.4E-11**	**9.9E-09**	**6.0E-08**	**0.0179**	**0.0010**	**0.0009**	**0.0198**
Industrial Worker								
	Surface Soil				*Surface Soil*			
	2.4E-07	3.5E-10	4.8E-08	2.9E-07	0.080	0.005	0.003	0.09
	Total				*Total*			
	2.4E-07	**3.5E-10**	**4.8E-08**	**2.9E-07**	**0.08**	**0.005**	**0.00**	**0.09**
Recreational Adult								
	Surface Soil				*Surface Soil*			
	9.6E-08	1.4E-10	3.3E-08	1.3E-07	0.036	0.002	0.003	0.04
	Total				*Total*			
	9.6E-08	**1.4E-10**	**3.3E-08**	**1.3E-07**	**0.04**	**0.002**	**0.00**	**0.04**
Recreational Youth								
	Surface Soil				*Surface Soil*			
	2.2E-07	1.7E-10	1.9E-08	2.4E-07	0.334	0.009	0.007	0.35
	Total				*Total*			
	2.2E-07	**1.7E-10**	**1.9E-08**	**2.4E-07**	**0.33**	**0.009**	**0.01**	**0.35**
Construction Worker								
	Surface Soil				*Surface Soil*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.245	0.001	0.003	0.25
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.25**	**0.001**	**0.00**	**0.25**
Residential Adult								
	Surface Soil				*Surface Soil*			
	3.2E-07	4.8E-10	3.9E-08	3.6E-07	0.120	0.007	0.004	0.13
	Total				*Total*			
	3.2E-07	**4.8E-10**	**3.9E-08**	**3.6E-07**	**0.12**	**0.007**	**0.00**	**0.13**
Residential Child								
	Surface Soil				*Surface Soil*			
	7.6E-07	5.6E-10	6.4E-08	8.2E-07	1.123	0.031	0.025	1.18
	Total				*Total*			
	7.6E-07	**5.6E-10**	**6.4E-08**	**8.2E-07**	**1.12**	**0.031**	**0.03**	**1.18**

TABLE 6-5
Background Concentrations in Site Soils Compared to Site Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

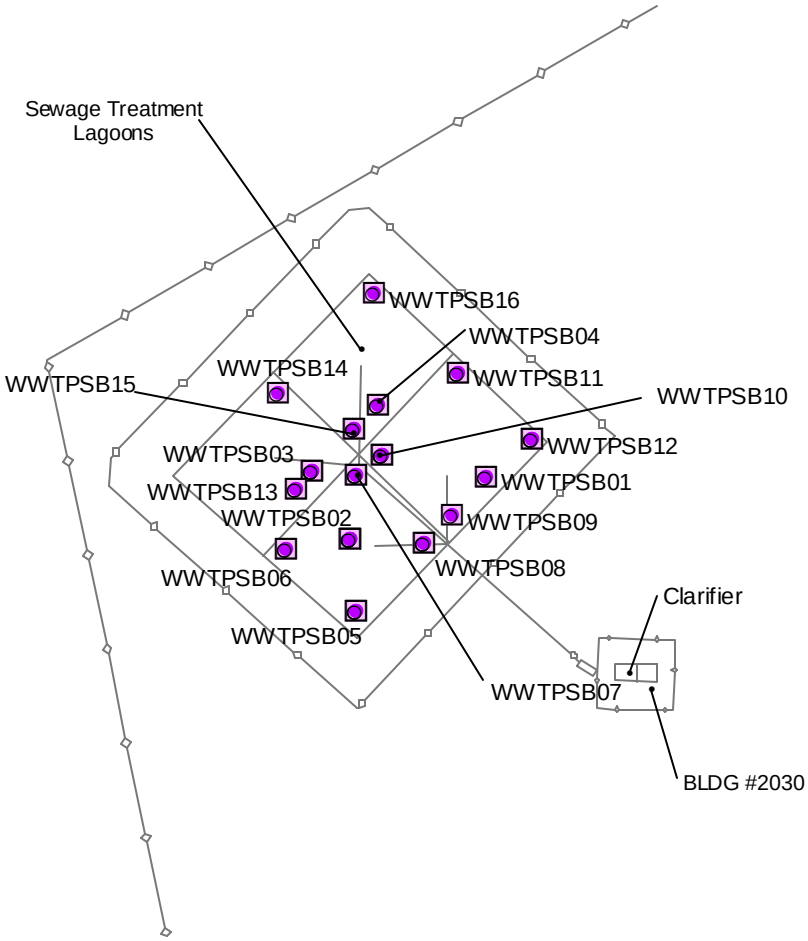
Parameter	Units	Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Detected Site Concentration
		Minimum	Maximum			
Surface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	14,000	8,538
Arsenic	mg/kg	0.57	2.5	2.3	1.1	0.87
Iron	mg/kg	2,500	39,000	37,531	26,000	15,775
Manganese	mg/kg	48	1,200	1,167	818	247
Thallium	mg/kg	0.45	0.67	0.67	0.68	0.60
Vanadium	mg/kg	9.0	130	130	73	47
Subsurface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	17,600	10,261
Iron	mg/kg	2,500	39,000	37,531	30,300	19,763

mg/kg = milligrams per kilogram or part per million (ppm)
NA Not available
UTL Upper tolerance limit

FIGURE 6-1
AOC B Former Wastewater Treatment Plant Equipment (2002)

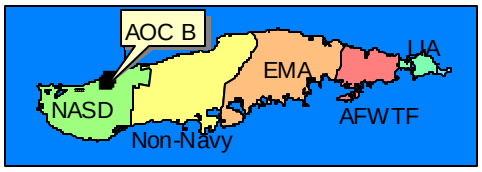
FIGURE 6-2
AOC B Former Wastewater Treatment Plan Showing the Fence (2002)

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr



Soil Boring Location
- -Surface Soil 0-0.5 Ft
- -Subsurface Soil 4-6 Ft

Drainage Pipes into Lagoons

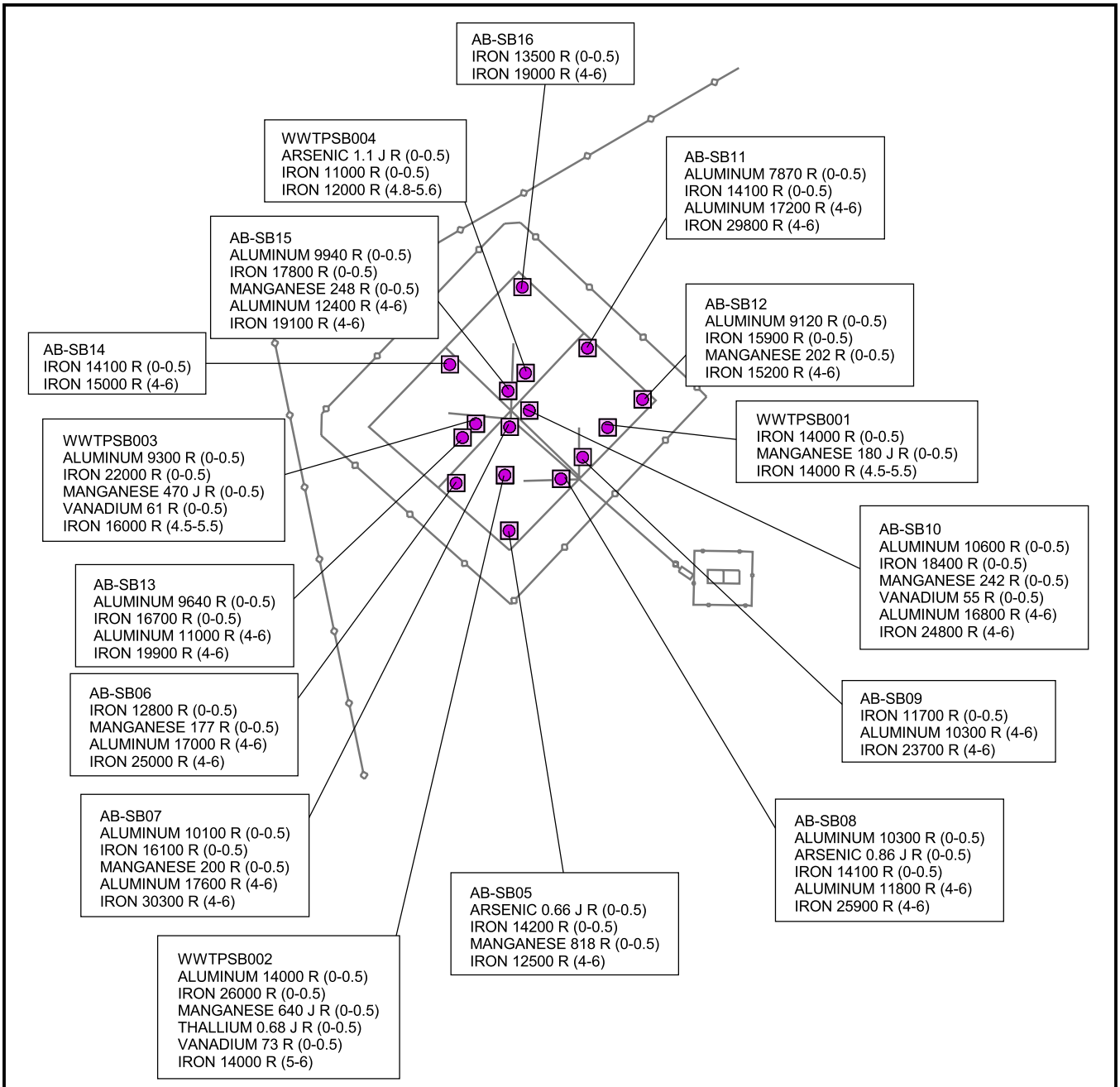


N
Not to Scale

Figure 6-3
AOC B Soil Sample Locations
NFA Report for Nine Sites
Fomer NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr



LEGEND

● Surface Soil Sample Location

⟶ Drainage Pipes into Lagoons

ANALYTICAL RESULT QUALIFIER

J = Estimated Value

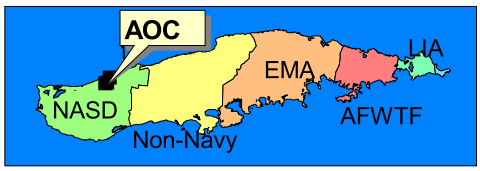
SOIL RESULTS QUALIFIER

R = Residential PRG Exceedence

NOTES

All Detections Reported as mg/kg

PRG = EPA Region 9 Preliminary Remediation Goal



N

Not to Scale

Figure 6-4

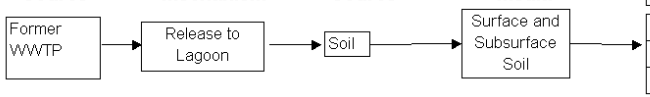
AOC B Surface Soil Detections Above Screening Criteria

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 6-5
Conceptual Site Model for AOC B
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Exposure Route	Maintenance Worker	Industrial Worker	Construction Worker[1]	Residential Adult	Residential Child	Recreational Adult	Recreational Child
Ingestion	X	X	X	X	X	X	X
Dermal Contact	X	X	X	X	X	X	X
Dust Inhalation	X	X	X	X	X	X	X

X - Quantitatively evaluated exposure pathway

Note:
[1] Construction worker exposure pathway is evaluated for surface and subsurface soil exposure

SECTION 7

Site-Specific Decision Summary for AOC C – Drainage Ditches at the Former Transportation Shop

7.1 Description

AOC C refers to the drainage ditches located in the Public Works Area of the former NASD near the Former Transportation Shop (Building 2016). This site consists of two grass-lined drainage ditches on both sides of the main road leading to the Public Works Area and an old buried septic tank. It previously handled wastes from a sink in the former Transportation Shop. There is one channel on the east side of the road to the Main Operations Area, and the second one is to the west of the road. The ditches originate near the former Transportation Shop and travel north, parallel to the road, and merge at the main road that runs through the former NASD. The ditches eventually drain under Highway 200 and end about 50 ft north of the highway in a diffuse area that could eventually drain to the Atlantic Ocean. These unlined ditches consist of a slight depression in the surface designed to drain stormwater runoff during rain events. The ditch to the west of the road may have received overflow in the past from the septic tank that handled sanitary waste from a sink in the former Transportation Shop, if there was an overflow. Photographs of AOC C are presented in Figures 7-1 and 7-2. The groundwater at the site flows to the north towards the ocean.

Most of the rainwater flow in the ditches is likely the general surface runoff from the surrounding area. The ditches also collect water from the adjacent horse-grazing fields and stormwater runoff from an asphalt road, which leads to the former Public Works Area compound and the Enlisted Men's Club. The ditches remain dry most of the year.

An oily sheen was observed in one of the ditches during a site inspection in 1988. It is unknown whether the observed sheen was from any wastes discharged to the ditch or from natural plant debris/vehicle oil leaks from general traffic. Therefore, the site was identified for investigation as an AOC.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including AOC C. The summary included the site background information, physical characteristics, site hydrogeological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

7.2 Site Characterization

7.2.1 Nature and Extent of Contamination

A total of 15 surface soil samples were collected. Seven samples were taken from each of the two ditches and one was collected in the downstream release point past the road. Twenty subsurface soil samples were collected from four locations (around the former septic tank). One groundwater sample was collected at AOC C. All samples were collected as part of the Expanded PA/SI investigation. The sample locations at AOC C are presented in Figure 7-3.

The ditches also collect water from the adjacent grass fields and stormwater runoff from an asphalt road. Surface soil samples were collected along the two ditches approximately every 100 ft. Subsurface soil samples were collected along all four sides of the septic tank at depths of 5, 10, 15, 20, and 25 ft bls. The groundwater sample was collected from a newly installed monitoring well immediately downgradient from the septic tank. The presence of volatiles in subsurface soils at different depths was also evaluated using an OVM at three soil borings (AOC-C-SB16, AOC-C-SB17 and AOC-C-SB18) and at the monitoring well at different depths during installation. None of the readings had detectable OVM readings. The details of the sampling were provided in Appendix B of the Phase I Expanded PA/SI Report (CH2M HILL, October 2000).

All sampled media were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs. All samples have been rescreened to the latest EPA Region 9 PRGs (see Appendix I), as discussed in Section 1.0. The DQE results from the PA/SI are summarized in Section 1.0. The surface soil, subsurface soil, and groundwater screening tables are presented in Appendix B. The tables in Appendix D-6 include statistical summaries of data for AOC C comparing maximum site concentrations with the criteria. A discussion of the results is presented below.

Surface Soil Results

Aluminum, arsenic, iron, manganese, thallium, and vanadium were detected in surface soil samples at concentrations exceeding the residential PRG screening criteria (at HI=0.1). Metals were detected in most surface soil samples. A comparison of inorganic chemicals in surface soil with background inorganic levels is presented at the end of this section. Low levels of VOCs, xylenes, and a trace level of trichloroethene (TCE) were well below any screening criteria. Detections of phthalates, DDT, DDD, and DDE were also well below the screening criteria. All of these chemicals were also detected at similar trace levels in some of the blank samples, while meeting all of the DQE requirements, as presented in Section 1.0. A summary of the surface soil exceedances is presented in Table 7-1. Figure 7-4 depicts the locations of the surface soil exceedances.

Subsurface Soil Results

Aluminum and iron exceeded the industrial PRGs in subsurface soil, and were therefore included as COPCs for risk assessment (see Table 7-2). Thallium exceeded the leachability criteria SSL value with concentrations ranging from 0.73 to 1.9 mg/kg in soil borings AC-SB16, AC-SB17, and AC-SB19. The thallium leachability criteria for soil is 0.7 mg/kg. In AC-SB16, thallium was found above 0.7 mg/kg at depths of 4 to 26 ft bls; in AC-SB19, a thallium exceedance was found at depths between 14 and 26 ft bls; and in AC-SB17, it was found only at depths of 24 to 26 ft bls. All these detections of thallium are near the instrument detection limits, and are thus likely prone to Type I errors, as discussed in the DQE summary in

Section 1.0, and in the individual appendices of the PA/SI reports. A comparison of subsurface soil inorganic chemicals with background soils is presented at the end of this section.

No other subsurface soil metals exceeded the soil leachability criteria for soil or applicable PRG screening levels. VOCs, SVOCs, pesticides, and PCBs were either not detected or were detected at concentrations below their applicable screening criteria. A summary of the subsurface soil exceedances is presented in Table 7-2. All detections is subsurface soil are presented in Appendix D-6. Subsurface soil exceedances by sample location are presented in Figure 7-4.

Groundwater Results

The groundwater results for total metals from the single well indicated detections of aluminum, iron, manganese, and vanadium in groundwater samples at concentrations exceeding the PRGs. Dissolved metals were screened against criteria only for comparison purposes, these data were not used for the risk assessment. The results show no organic chemicals were detected in groundwater, though the sample was analyzed for VOCs, SVOCs, pesticides, and PCBs. A summary of the groundwater exceedances is presented in Table 7-3. Groundwater exceedances from the well at AOC C are presented in Figure 7-4. Aluminum, chromium, iron, manganese, and vanadium were identified as exceeding PRG values used for screening. The total chromium result was conservatively evaluated by comparing with the hexavalent chromium PRG value. A comparison of AOC C groundwater with background is included at the end of this section to determine if the detected inorganic chemicals are similar in site and background levels.

7.2.2 Contaminant Fate and Transport

The site is an old septic tank and the downgradient drainage ditches. The drainage ditches had a sheen in 1988 during the site inspection. The ditches are intermittent and do not have constant water, therefore such a sheen is not visible. There is no continuing source for contamination at this site.

Among the many surface and subsurface soil samples collected, no organic chemicals were detected that present an offsite migration concern. None were above screening criteria for leachability. Some inorganic chemicals were detected above direct exposure-based protection criteria (i.e., PRGs). Only thallium was above leachability criteria. Thallium concentrations were relatively similar among all soil samples from this site as well as other sites in the area (e.g., SWMU 10, SWMU 14, SWMU 15), indicating that thallium may not be specific to AOC C. Also, it only slightly exceeded the leachability criteria. Because all other sites within the same geological unit have similar thallium levels, it is likely that surface and subsurface soil thallium levels are representative of background soil conditions. Furthermore, thallium was not detected in the groundwater above MCLs or PRGs. Thus, thallium has not leached to groundwater during historical operations and it is not likely to pose future leachbility concerns at this site. In general, most identified inorganic chemicals in the soils at AOC C have low solubility, tend to remain bound to the soil matrix, and are not readily leachable. Dissolved metals concentrations were much lower than the total metals levels.

Surface runoff is also not a significant migration pathway due to absence of surface soil contamination at the site. Soil-bound inorganic chemicals could have been carried to

downstream locations through suspended soil surface runoff during storm events. The downstream locations were sampled to determine such migration.

All the COPCs identified based on comparison with PRGs in surface and subsurface soil and groundwater are included for risk assessments, as presented below.

7.2.3 Summary of Data Evaluation

The surface soil results indicate that some inorganic chemicals are greater than residential PRGs, and as such were identified as potential COPCs. Among the subsurface chemicals, aluminum and iron were above industrial PRGs. Therefore aluminum and iron were selected as COPCs for a construction worker exposure evaluation. Thallium exceeded the screening leachability criteria (SSL) for soil. However, based on its absence in site well data above PRGs, it was not identified as a leachbility concern. The groundwater results indicated that some total metals concentrations were greater than the tap water PRGs. These concentrations were included as COPCs in the risk assessment that is summarized below. All detected metals in soil and groundwater are also common to the background soil and groundwater, and the levels at which they were detected also appear to be within background levels. Therefore, they were compared against background levels, as presented at the end of this section.

7.2.4 Conceptual Site Model

Figure 7-5 presents the CSM for AOC C. Past discharges and runoff from the surface soils in the area surrounding AOC C could run off and settle in the low-lying bottom of the ditches. Additionally, any discharges from the former Transportation Shop area would drain into the septic system. If the septic system overflowed in the past, the surface discharge may have flowed into the ditch to the west of the road. The ditches along the road were included for investigation due to a sheen observed during the site visit. Any other unintentional releases (e.g., sheen) in the vicinity of AOC C could also reach these two ditches.

Any contamination in the ditches could migrate downstream with the rainwater flow in the form of suspended solids or as dissolved contamination. If dissolved contamination is present in this rainwater, to a smaller extent, it can infiltrate the subsurface with rainwater through percolation, and also volatilize into the air.

Any releases to the surface from the drain field are likely to attenuate prior to reaching these drainage ditches. An occasional release of oily material during shop operations could become sorbed to soils at the point of release. Attenuation from degradation could occur to any oils/petroleum hydrocarbons that tend to bind to surface soil particles with time. The potential flow downstream to the ditches would only result in a release to the land surface at the end of the ditches, as there is no direct connection between the ditches and other surface water bodies or the ocean.

The entire lengths of the ditches were sampled to determine any possible contamination. A groundwater sample was collected immediately downgradient from the septic tank to determine any releases to the subsurface from former Transportation Shop releases to the septic tank. The soils from the drainage ditches were sampled, and a well was installed to investigate potential subsurface releases to groundwater during historical operations.

Potential exposures to the contamination at AOC C could occur through physical contact with soils in the ditches by workers mowing the grass in this maintained area, or anyone visiting/trespassing the ditches. Subsurface soil exposures were assumed for a future construction worker. Currently, this area of the former NASD does not have natural ecology because of the occasional grass cutting. Future human receptors for the site could include those currently anticipated at the site. For the human health risk assessment, the future potential exposure points and receptors were conservatively assumed to include recreational, industrial (including construction work) or residential use. Soil data were evaluated for risks to maintenance workers, construction workers, and recreational visitors. Soil and groundwater data were evaluated for exposures to industrial workers and residents.

7.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F

An ecological survey was conducted for the sites located within the Main Operations Area (or Public Works Area) during the two PA/SIs. The sites investigated included SWMUs 10, 14, 15, and AOCs C and F.

The plant communities are similar among all these sites. The plant communities mainly consist of herbaceous species typical of mowed/maintained areas. Maintenance of the grounds appeared to be main factor effecting the plant community composition and structure within this area at the time the ecological survey was conducted in 2000.
To determine the relative health of the ecological community within the Main Operations Area, a comparison was made by selecting a control plot outside of the sites, which is located southeast of SWMU 14, and comparing the habitat with the sites identified above. The ecological assessment concluded that there was no significant difference between any of the sites and the control site, however it was noted that SWMU 10 presented a greater abundance of some plant species than the control site.

AOC C had higher abundance of hydrophytic vegetation than the other sites because it is a drainage ditch. SWMU 15, which is an old parking lot was reported to have stressed vegetation, with domination by an exotic and invasive grass which is not significant. The stress and decumbent growth is thought to be due to heavy vehicles parked in this area at the time of the survey (see Figure 4-2). The soil compaction also limits the species diversity of the site, and small patches of oil stains in the soil were reported in the south central portion of the site.

The wildlife observed at these sites is typical for developed areas on Vieques Island. Horses and mongoose were the mammal species observed, and several species of birds were also observed. No federally protected species were observed in this area. The nearby NSRR located on the main Island of Puerto Rico is identified as habitat for Arctic perigrine falcon, which prefers to feed in open areas. Since the Main Operations Area is an open area, it could be a feeding habitat for this species, although none were observed at the site during the ecological survey.

7.4 Human Health Risk Assessment

This section summarizes the pertinent information contained in the risk assessment for AOC C. Screening data for all exposure routes and potential human receptors are presented in Appendix D-6 in RAGS Part D formatted tables. The complete risk assessment and accompanying tables can be found in Appendix E.

As discussed above in the nature and extent of contamination discussion, a total of 15 surface soil samples (0 to 0.5 ft bls) and 20 subsurface soil samples (depths ranging from 4 to 26 ft bls) were collected at AOC C. The details of the sampling and analysis can be found in Section 10 of Phase I Expanded PA/SI (CH2M HILL, October 2000). One monitoring well at AOC C was sampled. The analytical results, using the maximum detected concentration for chemical, were screened against the comparison criteria, and the chemicals that were detected above criteria were identified as COPCs. In surface soils, six metals exceeded the screening criteria and were selected as COPCs. They are aluminum, arsenic, iron, manganese, thallium, and vanadium (see Table 7-1). Aluminum and iron were identified as COPCs for subsurface soils up to 10-ft depths (see Table 7-2), and were evaluated for future construction worker exposure. Groundwater COPCs included aluminum, iron, manganese, and vanadium (see Table 7-3).

Table 7-4 presented the potentially complete exposure pathways, receptors, and exposure routes for AOC C. Exposure pathways to surface soils for future hypothetical maintenance workers, industrial workers, recreational receptors, and residential receptors were considered complete at AOC C. Section 1.0 presents a more detailed description of the receptor population exposure assumption. The subsurface soil were evaluated for future exposures to construction workers using soils from 0 to 10 ft bls for EPC estimations. The groundwater at the site is deep (more than 40 ft bls), thus groundwater exposure for recreational visitors and construction workers is not a complete pathway. This site consists of narrow, dry drainage ditches and an old septic tank that has been removed. Given the small size and features of this site, future residential or industrial use is highly unlikely. However, exposure of these receptors was included for comparison purposes.

Table 7-5 presents the risk characterization summary for the exposure scenarios discussed above for the complete exposure pathways at AOC C.

Maintenance Worker

For a maintenance worker, the ELCR for exposure to surface soils is 1.4E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.02 and is less than the target HI of 1.0 for noncarcinogenic exposure.

Industrial Worker

The estimated combined ELCR for an industrial worker exposed to surface soils and groundwater is 6.7E-7. The ELCR is less than the acceptable risk range for carcinogenic effects. The estimated HI of 0.4 for exposure to surface soils and groundwater is less than the target HI of 1.0.

Construction Worker

Subsurface soil, up to 10 ft bls (a conservative assumption considering the typical construction depths are up to 6 ft bls), was evaluated for potential exposure to construction workers. Subsurface soil had aluminum and iron as COPCs; no carcinogenic COPCs were identified. The EPCs included both surface and subsurface soil sample concentrations. The HI for a future construction worker is estimated to be 0.23, which is less than the target HI of 1.0.

Recreational Receptors

The estimated combined ELCR for a future recreational adult and child exposed to surface soils is 3.0E-7 and 5.6E-7, respectively, and is less than the acceptable risk range. The HI of 0.04 and 0.35, respectively, is less than the target HI of 1.0.

Residential Receptors

For a future residential adult and child, the ELCR is 8.4E-7 and 1.9E-6, respectively. These cancer risks are within the EPA acceptable risk range of 1E-4 to 1E-6. Carcinogenic risk greater than the 1E-6 level was associated with arsenic in surface soils. The HI for an adult of 1.1 is greater than the target HI of 1.0. However, the maximum target organ-specific HI of 0.59 is well below 1.0 for an adult. For a residential child, the combined HI for exposure to groundwater and surface soils is 3.6, which is above a value of 1.0. The maximum target organ-specific HI is 1.9, which is also above 1.0, primarily from iron in soil and groundwater.

7.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The arsenic and iron in site soil were compared against the range of background concentrations as presented in Table 7-6. As can be observed from the table, most of the soil and groundwater inorganic chemicals are well within background levels. Only manganese in surface soil, and thallium in subsurface soil were slightly above the background range. The detected manganese in surface soil and thallium in subsurface soil was similar to the levels found at several other sites within the Public Works Area. Manganese in subsurface soil or groundwater was not detected above background levels. Since thallium was not detected in groundwater, it is not likely leaching. The reported levels for thallium are within the instrument detection limit ranges. As described in the Section 1.0 DQE summary, any low level metals concentrations are prone to false positives and negative errors. Thus, the thallium detection could be a false positive (i.e., Type I error), as it is uniformly reported with similar levels across all soil samples. All of the detected soil and groundwater inorganic chemicals are therefore likely the result of background conditions for the area, and are not attributable to the site-specific activities.

7.6 Summary of Site Risks

The cancer risks and health hazard effects for AOC C are within the acceptable limits for maintenance workers, construction workers, industrial workers, and recreational receptors. The cancer risk for residential receptors is within acceptable limits and the HI exceeds 1.0, primarily from iron in soil and groundwater. However, there is no evidence of site-related releases of iron, as indicated in Table 7-6. Similar iron concentrations were found at all other sites within this area. There is no contamination specific to past operations at AOC C. No additional sampling or monitoring of the soil or groundwater will be necessary because the conditions at the site are protective of human health and the environment.

7.7 Conclusions and Recommendations

No further investigation or remedial action for the soil or groundwater is necessary for the protection of human health based on the absence of site-related contamination. Health risks estimated using conservative exposure assumptions do not present unacceptable risks to human health greater than background levels. Therefore, AOC C is recommended for NFA, due to absence of human health or ecological impacts from its past operations.

TABLE 7-1
AOC C COPC Selection for Surface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of Mean[a]	Residential PRG[b] (HI = 0.1)	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
1	Aluminum	15	15	9,600	4,130	7,516	7516	7,614	10,000	NA
1	Arsenic	15	11	2.1	0.36	0.82	0.65	0.39	1.6	29
1	Iron	15	15	21,100	9,770	15,011	15,011	2,346	10,000	NA
1	Manganese	15	15	2,190	249	546	546	176	1,946	NA
1	Thallium	15	9	0.65	0.31	0.47	0.34	0.52	6.75	0.7
1	Vanadium	15	15	68.4	32.1	46.4	46.4	55	715	6,000

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 7-2
AOC C COPC Selection for Subsurface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of the Mean[a]	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
1	Aluminum	23	23	14,300	4,130	8,478	8,478	10,000	NA
1	Iron	23	23	26,500	9,770	16,616	16,616	10,000	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG, EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996).
http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 7-3
AOC C COPC Selection for Groundwater
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean Concentration of Detects	Best Estimate of the Mean[a]	Tap Water PRG[b] (HI=0.1)	MCL[c]
1	Aluminum	1	1	4,390	4,390	4,390	4,390	3,650	NA
1	Chromium	1	1	16.7	16.7	16.7	16.7	10.9	100
1	Iron	1	1	5,720	5,720	5,720	5,720	1,095	NA
1	Manganese	1	1	177	177	177	177	88	NA
1	Vanadium	1	1	27.6	27.6	27.6	27.6	26	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.

[b] Region 9 Preliminary Remediation Goals (PRG, EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] Maximum Contaminant Levels. EPA Office of Water. http://www.epa.gov/safewater/mcl.html
Units in µg/L (ppb)
HI -- Hazard Index
MCL -- Maximum contaminant level
NA -- Not available
PRG -- Preliminary remediation goal

TABLE 7-4
AOC C Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Scenario is protective of any occasional maintenance work such as lawn moving.
Industrial Worker	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater	Yes	Area could be developed in the future for industrial use. Both site soil and groundwater exposure is assumed. Inhalation exposure to groundwater is not significant as no volatile COPCs are identified.
Construction Worker	Subsurface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Scenario is protective of any occasional construction activities at the site.
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Area could be developed in the future for recreational use and would be protective of any occasional trespasser.
Residents	Surface Soil and groundwater	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils and groundwater	Yes	Although the site is unlikely to be considered for residential development, this is a worst-case scenario for comparison purposes. Inhalation exposure to groundwater is not significant as no volatile COPCs are identified.

TABLE 7-5
AOC C Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Maintenance Worker								
	Surface Soil				*Surface Soil*			
	1.2E-07	1.7E-10	2.3E-08	1.4E-07	0.0172	0.0017	0.0011	0.01998
	Total				*Total*			
	1.2E-07	**1.7E-10**	**2.3E-08**	**1.4E-07**	**0.0172**	**0.0017**	**0.0011**	**0.0200**
Industrial Worker								
	Surface Soil				*Surface Soil*			
	5.6E-07	8.2E-10	1.1E-07	6.7E-07	0.077	0.008	0.004	0.09
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.335	0.000	0.009	0.344
	Total				*Total*			
	5.6E-07	**8.2E-10**	**1.1E-07**	**6.7E-07**	**0.08**	**0.008**	**0.00**	**0.09**
Recreational Adult								
	Surface Soil				*Surface Soil*			
	2.2E-07	3.3E-10	7.6E-08	3.0E-07	0.034	0.003	0.004	0.04
	Total				*Total*			
	2.2E-07	**3.3E-10**	**7.6E-08**	**3.0E-07**	**0.03**	**0.003**	**0.00**	**0.04**
Recreational Youth								
	Surface Soil				*Surface Soil*			
	5.2E-07	3.8E-10	4.3E-08	5.6E-07	0.321	0.016	0.008	0.35
	Total				*Total*			
	5.2E-07	**3.8E-10**	**4.3E-08**	**5.6E-07**	**0.32**	**0.016**	**0.01**	**0.35**
Construction Worker								
	Surface Soil				*Surface Soil*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.227	0.001	0.003	0.23
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.23**	**0.001**	**0.00**	**0.23**
Residential Adult								
	Surface Soil				*Surface Soil*			
	7.5E-07	1.1E-09	8.9E-08	8.4E-07	0.116	0.012	0.004	0.13
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.938	0.000	0.072	1.010
	Total				*Total*			
	7.5E-07	**1.1E-09**	**8.9E-08**	**8.4E-07**	**0.12**	**0.012**	**0.00**	**0.13**
Residential Child								
	Surface Soil				*Surface Soil*			
	1.7E-06	1.3E-09	1.5E-07	1.9E-06	1.080	0.054	0.028	1.16
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.188	0.000	0.222	2.410
	Total				*Total*			
	1.7E-06	**1.3E-09**	**1.5E-07**	**1.9E-06**	**1.08**	**0.054**	**0.03**	**1.16**

TABLE 7-6
Background Concentrations in Site Media Compared to Site Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

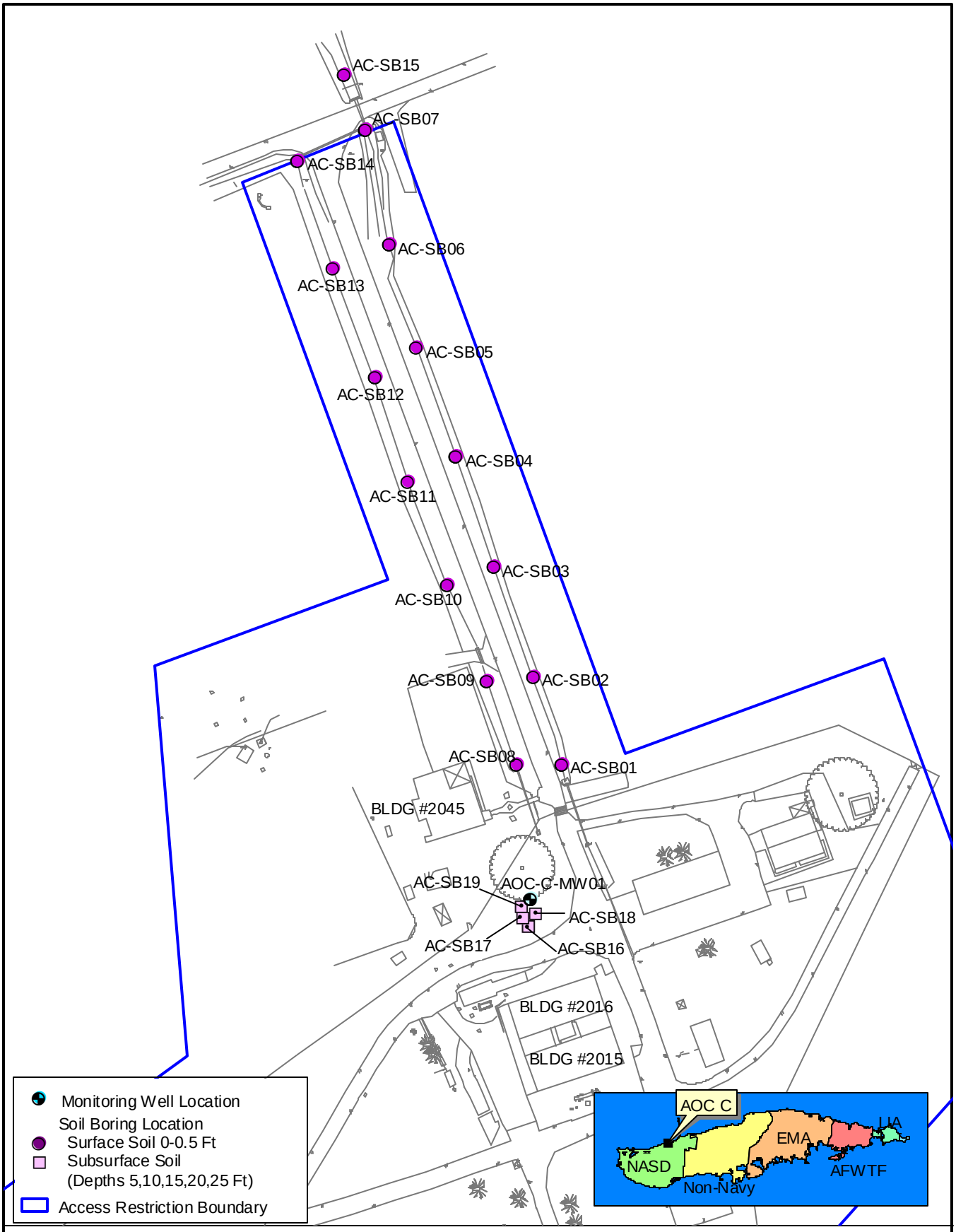
Parameter	Units	Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Site Detected Concentration
		Minimum	Maximum			
Surface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	9,600	7,516
Arsenic	mg/kg	0.57	2.5	2.3	2.1	0.82
Iron	mg/kg	2,500	39,000	37,531	21,100	15,011
Manganese	mg/kg	48	1,200	1,167	2,190	546
Thallium	mg/kg	0.45	0.67	0.67	0.65	0.47
Vanadium	mg/kg	9.0	130	130	68	46
Subsurface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	14,300	7,908
Iron	mg/kg	2,500	39,000	37,531	26,500	16,713
Thallium	mg/kg	0.45	0.67	0.67	1.9	0.77
Groundwater						
Aluminum	µg/L	130	3,500	3,500	4,390	4,390
Iron	µg/L	480	4,800	4,800	5,720	5,720
Manganese	µg/L	100	17,000	17,000	177	177
Vanadium	µg/L	1.8	75	75	28	28

mg/kg = milligrams per kilogram or part per million (ppm)
µg/L = micrograms per liter or parts per billion (ppb)
UTL Upper tolerance limit

FIGURE 7-1
AOC C Drainage Ditch Looking North (2000)

FIGURE 7-2
AOC C Drainage Ditch Looking North (2002)

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr



N

0 200 400 Feet

Figure 7-3
AOC C Soil and Groundwater Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr

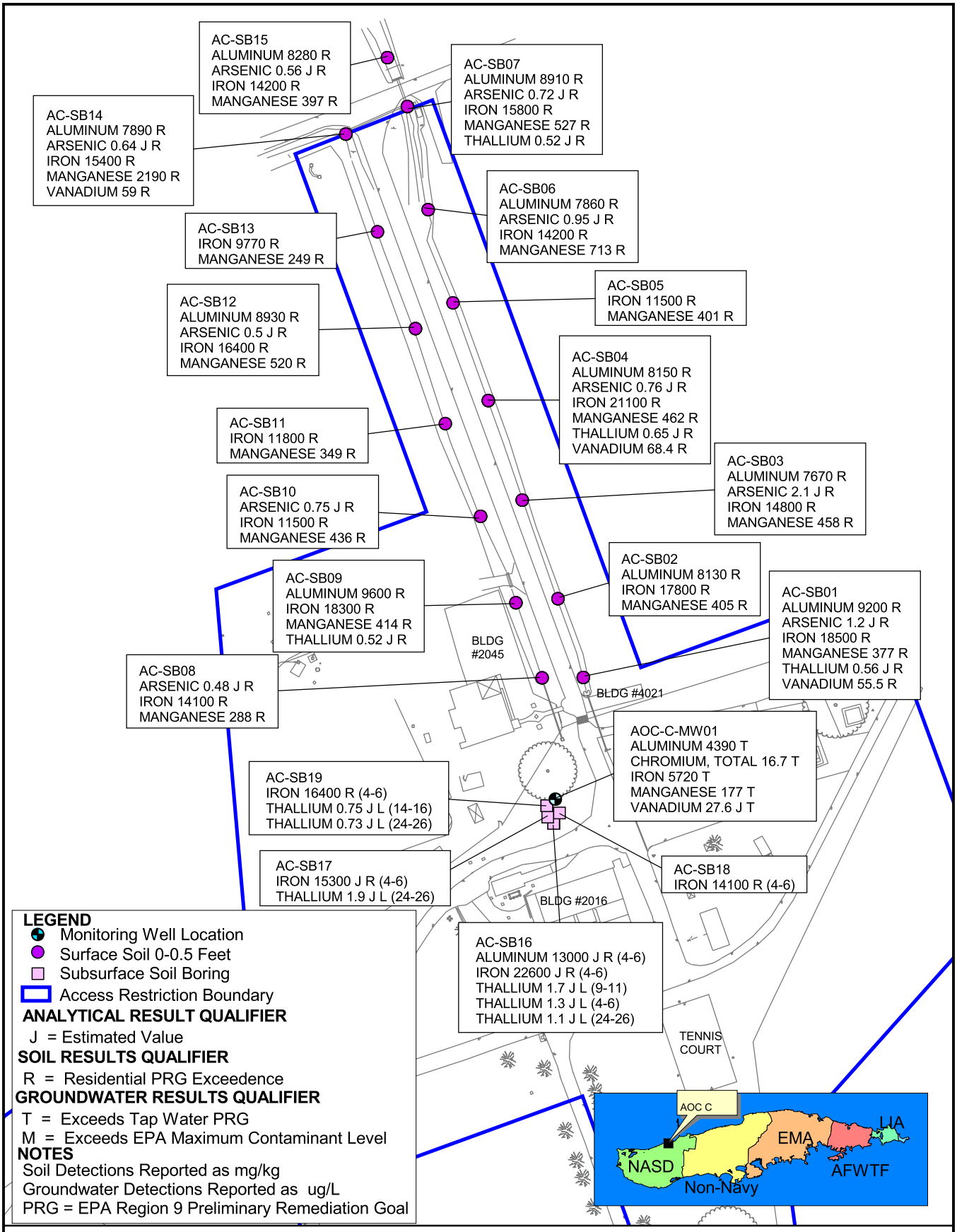


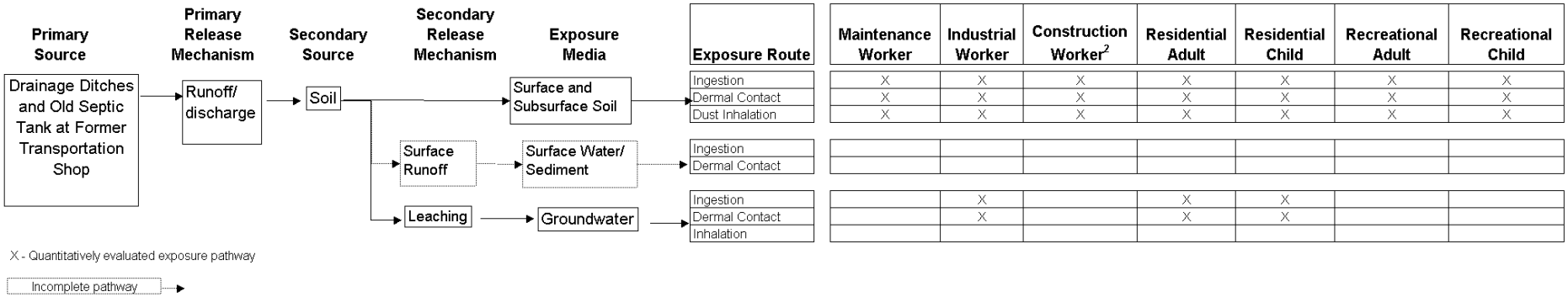
Figure 7-4
AOC C Soil and Groundwater Detections Above Screening Criteria
NFA Report for Nine Sites
NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 7-5

Conceptual Site Model for AOC C

NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Notes:

[1] Considered an incomplete pathway based on the nature of suspected contaminant release and detected chemicals

[2] Construction worker exposure pathway is evaluated for surface and subsurface soil exposure

SECTION 8

Site-Specific Decision Summary for AOC F– Former UIC Septic Tank

8.1 Description

AOC F is the former Underground Injection Control (UIC) septic tank area. AOC F is near the former Enlisted Men's Club in the Main Operations Area of the former NASD. This buried (subsurface) septic tank had a capacity of 1,500 gallons, and was used to service the domestic waste from the Enlisted Men's Club when the facility was in use. The tank was closed in 1997, and was replaced with an aboveground tank. A sampling investigation was conducted at AOC F during July 1997 as part of the UIC program to gather data and serve as a preliminary evaluation of potential contamination regarding possible septic tank leakage. To facilitate PREQB review, the site was transferred from the UIC program to the CERCLA program during 2000. Previous investigations showed several metals at concentrations that exceeded the applicable UIC screening criteria. This site was subsequently investigated as part of the Expanded PA/SI in April 2000. No evidence was found of hazardous waste being disposed of at the site. Figures 8-1 and 8-2 are photographs of the site. The groundwater at this site flows to the north, with localized flow slightly in a northwesterly direction. The wells were installed upgradient and downgradient from the site in the groundwater flow direction.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including AOC C. The summary includes the site background information, physical characteristics, site hydrogeological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

8.2 Site Characterization

8.2.1. Nature and Extent of Contamination

Since the site is a buried septic tank, only subsurface soil and groundwater were monitored. A total of 17 subsurface soil samples were collected from four soil borings, and five groundwater samples were collected as part of the Phase I Expanded PA/SI field investigation (CH2M HILL, October 2000). Figure 8-3 illustrates the location of the septic tank, the nearby building used as the Enlisted Men's Club, and the sampling locations around the tank. The subsurface soil samples were collected on all four sides of the septic tank at depths of 4 to 6 ft bls, 9 to 11 ft bls, 14 to 16 ft bls, 19 to 21 ft bls, and 24 to 26ft bls, to characterize any potential wastewater release from this buried septic tank. In addition, groundwater samples were collected from five newly installed monitoring wells. One well was installed upgradient of the septic tank, and four wells were installed downgradient, as shown on Figure 8-3. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and

PCBs, and have been screened against PRGs and SSL values, as described in Section 1.0. The analytical results for subsurface soil and groundwater are presented in Appendix B.

The presence of volatiles in subsurface soils was also evaluated during sampling using an OVM at the four soil borings and the five groundwater borings during well installation at various depths. None of the OVM readings had positive detections. The details of this investigation are included in Appendix B of the Phase I Expanded PA/SI Report (CH2M HILL, October 2000).

Subsurface Soil Results

The analytical results indicated the detection of several inorganic concentrations in the subsurface soil samples. When subsurface soil samples of up to 10 ft depths with inorganic chemical detections were compared against industrial PRGs for protection of future construction workers, aluminum and iron were identified as COPCs, similar to the other sites included in this NFA report. Aluminum and iron are included for the risk analysis as presented below.

Of the detected inorganic chemicals, chromium and thallium exceeded the leachability criteria. The chromium concentrations in subsurface soil samples SB-01 and SB-04, at depths of 14 to 26 ft bls and 19 to 21 ft bls, respectively, exceeded the leachability criteria for soil (38 mg/kg; conservatively assuming that all detected chromium is hexavalent chromium). Samples from shallower locations from the same borings did not have chromium greater than criteria. Chromium concentrations detected greater than criteria ranged between 59 and 129 mg/kg in these two borings, compared to a range of background soil chromium concentrations of 2.2 mg/kg to 74 mg/kg. The site average chromium level (34 mg/kg) was below the SSL value of 38 mg/kg. Additionally, chromium was not detected in the groundwater at levels greater than PRGs. The well closest to the site (AF-MW02) did not have chromium above detection limits. A well farther away from the site had total chromium, but dissolved chromium in this well is low, and most of these well samples were turbid. Chromium levels in these wells are similar to other wells within the Public Works Area. Therefore, leachability of chromium from soils to groundwater does not appear to be a concern, though chromium is slightly elevated at two of the soil borings located north and east of the former UIC septic tank.

The detected inorganic chemicals in the subsurface soil are compared against background inorganic chemical levels at the end of this section. A total of 14 thallium detections were reported in the 16 samples. Concentrations ranged between 0.76 and 1.7 mg/kg, compared to an SSL value of 0.7 mg/kg, a detection limit of 0.3 mg/kg, and a reporting limit of 2 mg/kg. This means low-level thallium detections are reported with uncertain concentration levels, and as mentioned in the DQE summary (see Section 1.0), are prone to be false positives at these low levels. The sample with the highest reported thallium concentration of 1.7 mg/kg was detected at SB-02 at 9 to 21 ft bls, and the second highest level was found in SB-01 at 1 mg/kg. These concentrations are similar to the concentrations found at other sites within the former NASD, indicating that thallium is likely from the soil's natural minerals and not due to site-specific historical activities. However, thallium was not detected in the groundwater greater than PRGs. Therefore, leachability of thallium from soils to groundwater does not appear to be a concern.

No organic chemicals (VOCs, SVOCs, pesticides, or PCBs) were detected at concentrations greater than the leachability-based screening criteria. A summary of subsurface soil exceedances is presented in Table 8-1. The exceedances and their locations are presented in Figure 8-4.

Groundwater Results

Groundwater sampling resulted in detections of only inorganic chemicals in all five wells; no organic chemicals were detected. The only exception was diethyl phthalate, which is a constituent of plastic ware and analytical instruments (as discussed in DQE in Section 1.0). Groundwater samples from all five wells were analyzed for both total and dissolved metals. As shown in Figure 8-4, the analytical results for total metals in groundwater samples indicated detections of aluminum, chromium, iron, manganese, and vanadium that exceeded the tap water PRGs (none exceeded the MCLs). No dissolved metals exceeded screening criteria, indicating that observed total metals concentrations might be associated with suspended solids in groundwater, and are possibly from background conditions. The dissolved metals concentrations were not used for the risk assessment. A comparison of inorganic chemicals in AOC F site wells with background wells is included at the end of this section. A summary of groundwater exceedances is presented in Table 8-2. A summary of groundwater exceedances by sample location is presented in Figure 8-4.

8.2.2 Contaminant Fate and Transport

Subsurface soils did not indicate the presence of any organic hazardous material in the relatively large number of samples collected. The OVM readings also did not indicate the presence of VOCs that are specific to the site. Only inorganic chemicals that are commonly detected within the background soils at the former NASD were detected in subsurface soil at AOC F. The discrete depth samples indicated elevated metals at some depths; however, shallower samples from the same boring did not indicate elevated metals. The closest well to the elevated soil chromium area did not have elevated levels of chromium. The well with the site maximum chromium concentration is farther downgradient from this well. The groundwater chromium concentrations at AOC F are similar to those found at other wells within the former Public Works Area. The groundwater samples from wells within this area did not contain dissolved chromium greater than any of the criteria, and the average chromium levels across the area are less than the SSL level of 38 mg/kg, indicating that chromium leaching is not a significant threat to the groundwater in the area. The lack of chromium in groundwater greater than other area groundwater within the Public Works Area, and chromium levels below the screening criteria from this site indicate that these levels are not a long-term future leachability or groundwater contamination concern.

In addition, the observed thallium levels are within the range of background levels detected in the soils at the former NASD. As with chromium, soil detections were at sporadic depths and were not indicative of contamination patterns. Thallium levels were not detected at levels higher than the PRGs in the groundwater. Thus, they do not present a significant leachability concern to groundwater at the reported concentrations. Overall, as discussed previously, subsurface soils at AOC F do not present a future migration or leachability concern for any chemicals.

8.2.3 Summary of Data Evaluation

Aluminum and iron were selected as COPCs for the exposure scenario for future construction workers. Chromium and thallium were the only subsurface metals that exceeded their soil leachability criteria. All other subsurface metals were either not detected or were detected at levels less than the applicable screening criteria. Analytical results for these constituents in groundwater did not show detections greater than other wells in this area or greater than the PRGs, thereby indicating that these constituents are not of leachability or contamination concern at the site. In addition, detections of other total metals in groundwater were within the background levels across the former NASD (see Appendices B and C). Furthermore, no dissolved metals exceeded the applicable screening criteria, indicating that the existence of total metals is likely the result of suspended material and not from true dissolved metals. Subsurface soil and groundwater inorganic COPCs were included for the direct exposure-based human health risk assessment. No hazardous waste release was indicated.

8.2.4 Conceptual Site Model

Figure 8-5 presents the exposure CSM for AOC F. Because the site consists of a buried septic tank, no surface releases were anticipated from site operations. Leaks from the septic system could potentially impact the subsurface soils and groundwater underneath the subsurface soil, though domestic waste is not expected to include any chemical releases. However, if the site had been used for disposal of unauthorized wastes, such as hazardous waste, contamination may have occurred as a result of any possible tank leaks or overflows. Based on sampling conducted at various depths around the former UIC septic tank, none of the suspected contamination was identified at the site.

The direct exposures were evaluated for exposure of future construction workers to subsurface soil. Exposures to groundwater were assumed under a hypothetical future land use scenario, for conservative investigation purposes, and included assumed industrial worker and residential receptor exposures. The exposure routes assumed ingestion and dermal contact. Inhalation exposure to groundwater is not complete because of the absence of VOCs/organic chemicals in groundwater wells.

8.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F

An ecological survey was conducted for the sites located within the Main Operations Area (or Public Works Area). The sites investigated included SWMUs 10, 14, 15, and AOCs C and F. As there is no surface contamination at AOC F, it is an incomplete pathway for all ecological receptors from this site.

The plant communities are similar among all these sites. The plant communities mainly consist of herbaceous species typical of mowed/maintained areas. Maintenance of the grounds appeared to be main factor effecting the plant community composition and structure within this area at the time the ecological survey was conducted in 2000.

To determine the relative health of the ecological community within the Main Operations Area, a comparison was made by selecting a control plot outside of the sites, which is located southeast of SWMU 14, and comparing the habitat with the sites identified above. The ecological assessment concluded that there was no significant difference between any of the sites and the control site, however it was noted that SWMU 10 presented a greater abundance of some plant species than the control site.

AOC C had higher abundance of hydrophytic vegetation than the other sites because it is a drainage ditch. SWMU 15, which is an old parking lot was reported to have stressed vegetation, with domination by an exotic and invasive grass which is not significant. The stress and decumbent growth is thought to be due to heavy vehicles parked in this area at the time of the survey (see Figure 4-2). The soil compaction also limits the species diversity of the site, and small patches of oil stains in the soil were reported in the south central portion of the site.

The wildlife observed at these sites is typical for developed areas on Vieques Island. Horses and mongoose were the mammal species observed, and several species of birds were also observed. No federally protected species were observed in this area. The nearby NSRR located on the main Island of Puerto Rico is identified as habitat for Arctic perigrine falcon, which prefers to feed in open areas. Since the Main Operations Area is an open area, it could be a feeding habitat for this species, although none were observed at the site during the ecological survey.

8.4 Human Health Risk Assessment

The risk assessment tables for AOC F were formatted according to the RAGS Part D guidelines and are presented in Appendix D-7. This section summarizes the pertinent information contained in the risk assessment for AOC F. Screening data for all of the exposure rates and potential human receptors are provided in Appendix D-7. The uncertainty assessment and more details of the risk assessment are found in Appendix E.

A total of 17 subsurface soil samples were collected at AOC F. One sample from each of five monitoring wells was collected and analyzed. Maximum concentrations detected in subsurface soil samples of up to 10 ft depths (to represent conservative construction depths which are typically 6 ft bls) were screened against industrial PRGs. Aluminum and iron were identified as COPCs for subsurface soil (see Table 8-1).

The analytical results for groundwater were screened against the tap water PRGs (HI=0.1 for noncarcinogens), and chemicals detected greater than criteria were selected as COPCs. The groundwater COPCs included aluminum, antimony, chromium, iron, manganese, and vanadium (see Table 8-2).

There is no surface soil contamination at this former buried septic tank site, therefore exposure pathways for any future receptors in this area are incomplete for surface soil. The future site development is assumed to have construction workers excavating soils up to 10 ft bls for construction in this area. The exposures to subsurface soil to future construction workers were evaluated. Exposure pathways to groundwater for future hypothetical industrial workers and residential receptors were considered complete at AOC F (see Table 8-3). Given the nature of the past use of this site as a buried septic tank area, it is highly improbable that it would be utilized as a source of potable groundwater, and shallow

groundwater is of low yield capacity. However, water use by future receptors was evaluated for comparison purposes in the conservative risk assessment. Table 8-4 presents the risk characterization summary for the quantitatively evaluated pathways and receptors at AOC F.

Industrial Worker

The estimated HI for an industrial worker exposed to groundwater is 1.3. However, no target organ-specific HI exceeded a value of 1.0.

Construction Worker

A construction worker scenario was evaluated for direct exposure to subsurface soil. There were no carcinogenic COPCs in subsurface soil. The HI calculated for a future construction worker exposure to subsurface soil was 0.255, which is below a target HI value of 1.0. No groundwater COPCs are considered carcinogens and therefore, there is no carcinogenic risk estimated for COPCs identified in groundwater.

Residential Receptors

For a residential adult, the HI is 3.7, which exceeded the target value of 1.0. For a residential child, the combined HI for exposure to groundwater is 8.7, which exceeds the target HI of 1.0. The HI greater than 1.0 for an adult and child is due to the maximum detected aluminum and iron, both in one well, AOC-F-MW05. All the wells at this site have high turbidity, which is the likely reason for the detected metals. A comparison of the inorganic chemicals detected in site soils and groundwater was made against background concentrations below.

8.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The detected levels of aluminum and iron in site soil are compared against the range of background concentrations, as presented in Table 8-5. Subsurface soil inorganic chemicals were within the range of background soil inorganic chemical concentrations. Site soils were sampled from depths ranging between 4 to 26 ft below surface. Thallium was detected above background levels (0.67 mg/kg) at all four sample locations at various depths. However, the ranges of concentrations between the samples from different locations and individual sample depths had similar thallium levels. In addition, similar thallium concentrations were reported in soils at all other sites within the former NASD. As described in the DQE summary provided in Section 1.0, any low-level metals concentrations are prone to false positive and negative errors. Thus, the thallium detection could be a false positive, as it is reported with similar levels across all soil samples.

The subsurface soil samples collected at AOC-F-SB01 had aluminum, chromium, cobalt, copper and iron above background concentration ranges in the deep samples. The shallower depth samples from the same locations did not have elevated metals. The presence of these metals in soils at these depths is unusual, since metals have low solubility, and thus mobility. If these are associated with the septic tank releases, some levels of elevated metals would be expected to be present at shallower depths as well, which was not observed at the site. The soil metals could be from the natural mineral composition at these depths for the

sites. Background subsurface soils were collected from 4 to 6 ft bls, and no background soil samples were collected from 19 to 26 ft bls to observe if this type of mineralogy is present in the background locations as well at deeper soil depths. The nearest downgradient well did not have any elevated metals. The highest observed metals at this site are in a slightly farther downgradient well, which also had the highest turbidity at the site. The dissolved aluminum, cobalt, and iron were below detection limits in all the wells at the site. The dissolved chromium and copper were similar to levels in the background wells (see Appendix B). The total metals levels in AOC F wells are similar to those found at other site wells (e.g., SWMU 14, SWMU 15 and AOC C) within the former NASD. This is due to the high turbidity of groundwater samples, as indicated by metals absence in dissolved metals measurements.

8.4 Summary of Site Risks

Based on the lack of contamination in surface soil at the site, and given that the site is a former buried septic tank, there are no exposure pathways to the site under the current conditions. Future altered land use would presumably expose future users to the groundwater at this site, though this scenario is unlikely because of the existing septic system and because shallow groundwater does not provide adequate yield to be a productive supply well for domestic use. The subsurface soils do not present exposure concerns to future construction workers, as there are no carcinogenic chemicals above criteria, and the noncarcinogenic HI is well below the target HI of 1.0.

There were no carcinogenic COPCs in the groundwater at AOC F; therefore, a cancer risk was not calculated. The health hazard effects are within acceptable limits for a future worker using groundwater for potable use while at work. The HI for a residential adult and a child is greater than a target HI of 1.0 because of the maximum detected iron and aluminum used as EPCs in the groundwater. Metals detected in the deep subsurface soil are likely natural soil mineralogy, and no background soil samples were collected at these depths for appropriate comparison. The groundwater well in the nearest location to the soil boring with elevated metals did not have elevated metals concentrations. The detected metals concentrations in the groundwater well were similar in concentration to other site wells, and are from turbidity in water samples, as the dissolved metals levels in groundwater samples did not indicate the presence of iron or aluminum. This indicated that detected metals were from suspended particles in turbid groundwater samples. Chromium and other metals were detected at similar concentrations within the Public Works Area at other sites. Thus, no site-specific contamination is detected in soils or groundwater at this site. The estimated HIs are from background levels of aluminum and iron in the groundwater. Therefore, any elevated health hazard that may be present in AOC F groundwater from iron is attributed to background conditions, and no site-specific elevated hazards are occurring.

No particular hazardous waste releases were identified from this domestic waste management septic system. All the samples were analyzed for the full list of analytes. Only inorganic chemicals were detected at levels greater than the PRG and leachability (i.e., SSL) screening criteria. The analytical results were not compared against background levels when determining COPCs. The COPCs identified in subsurface soil are based on leachability and are all inorganic chemicals. No direct exposure is expected for these deep subsurface soils.

The groundwater COPCs are also inorganic chemicals that occur widely in background groundwater wells. Overall, exposure to site groundwater does not indicate any cancer risks. No carcinogenic chemicals were identified as COPCs, and the HI was within acceptable levels for workers, though it exceeded the levels for future residents because of the iron in groundwater. As noted previously, iron concentrations in groundwater at one of the closest wells (MW05) exceeded the criteria and the updated background groundwater levels, however, these exceedances were due to high turbidity during sampling. No dissolved aluminum or iron was detected in this well, indicating that the detected iron is likely associated with particulates in the water sample.

8.5 Conclusions and Recommendations

No evidence exists to suggest that a release of hazardous materials to soil or groundwater occurred at AOC F as a result of site-related activities. No further investigation or remedial action for the soil or groundwater is necessary for the protection of human health, based on an analysis of the available soil and groundwater sample results and the pertinent information for the site. Therefore, the selected remedial alternative for the soil and groundwater at AOC F is NFA. No additional sampling or monitoring of the soil or groundwater will be required under CERCLA as a result of the NFA alternative.

TABLE 8-1
AOC F COPC Selection for Subsurface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of the Mean[a]	Industrial PRG[b] (HI = 0.1)	SSL[c] (DAF=20)
1	Aluminum	8	8	10,600	6,790	8,524	8,524	10,000	NA
1	Iron	8	8	23,700	12,500	18,363	18,363	10,000	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
NA -- Not available
SSL -- Soil screening level

TABLE 8-2
AOC F COPC Selection for Groundwater
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean Concentration of Detects	Best Estimate of the Mean[a]	Tap Water PRG[b] (HI=0.1)	MCL[c]
1	Aluminum	5	5	18,800	221	4,338	4,338	3,650	NA
1	Antimony	5	1	1.6	1.6	1.6	0.88	1.5	6.0
1	Chromium	5	5	28.4	1.8	9.5	9.5	10.95	100
1	Iron	5	5	2,900	257	5,496	5,496	1,095	NA
1	Manganese	5	5	819	28.8	273	273	88	NA
1	Vanadium	5	5	83.9	19.4	37	37	26	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] Maximum Contaminant Levels. EPA Office of Water. http://www.epa.gov/safewater/mcl.html
Units in µg/L (ppb)
HI -- Hazard Index
MCL -- Maximum contaminant level
NA -- Not available
PRG -- Preliminary remediation goal

TABLE 8-3
AOC F Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	None	No	The site is a subsurface septic tank, and no surface contamination is present at the site, making this an incomplete pathway.
Industrial Worker	Surface Soil	Direct contact with COPCs in site soils	No	The site is a subsurface tank, and no surface contamination is present at the site, making this an incomplete pathway.
	Groundwater	Ingestion of site groundwater	Yes	Although unlikely, pathway assumed for comparison purposes.
Construction Worker	Subsurface soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Scenario is protective of any occasional construction activities at the site.
Recreational Receptors	Surface Soil	None	No	The site is a subsurface septic tank, and no surface contamination is present at the site, making this an incomplete pathway.
Residential Receptors	Surface Soil	Direct contact with COPCs in site soils	No	The site is present in the subsurface, and no surface contamination is present at the site, making this an incomplete pathway.
	Groundwater	Ingestion of site groundwater	Yes	Although the site is unlikely to be considered for residential development, this is a worst-case scenario for comparison purposes.

TABLE 8-4
AOC F Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Industrial Worker								
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.259	0.000	0.021	1.280
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**1.26**	**0.00**	**0.02**	**1.28**
Construction Worker								
	Subsurface Soil				*Surface Soil*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.251	0.001	0.003	0.26
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**0.25**	**0.001**	**0.00**	**0.26**
Residential Adult								
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.525	0.000	0.162	3.687
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**3.53**	**0.00**	**0.16**	**3.69**
Residential Child								
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.225	0.000	0.500	8.725
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**8.23**	**0.00**	**0.50**	**8.73**

TABLE 8-5
Background Concentrations in Site Media Compared to Site Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

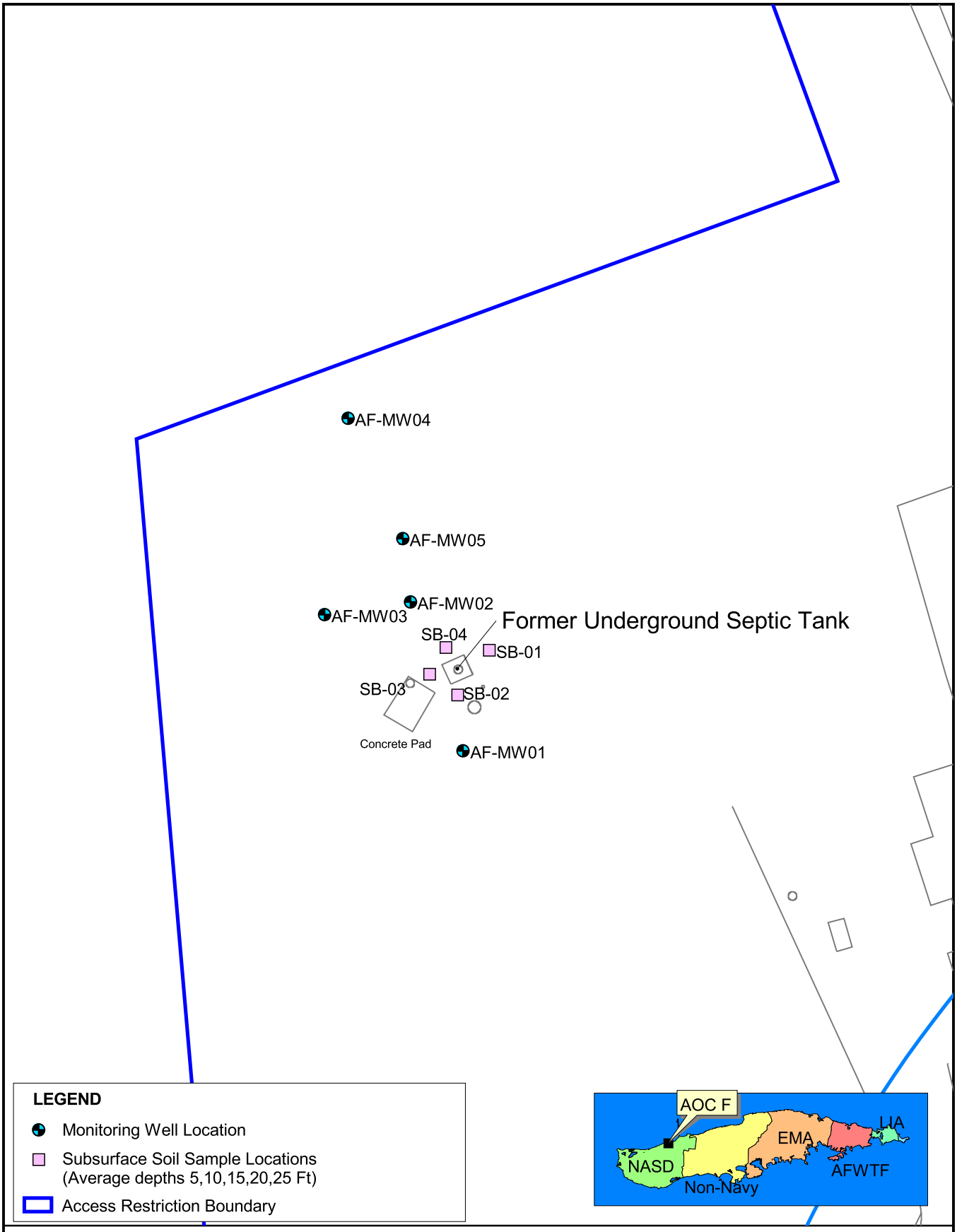
Parameter	Units	Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Site Detected Concentration
		Maximum	Minimum			
Subsurface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	25,900	14,458
Chromium	mg/kg	2.2	74	74	129	34
Cobalt	mg/kg	1.0	25	25	63	22
Copper	mg/kg	1.8	68	68	120	48
Iron	mg/kg	2,500	39,000	37,531	52,100	28,900
Manganese	mg/kg	48	1,200	1,167	3,490	1,014
Thallium	mg/kg	0.45	0.67	0.67	1.7	1.1
Groundwater						
Aluminum	µg/L	130	3,500	3,500	18,800	4,338
Antimony	µg/L	5.1	5.2	5.2	1.6	1.6
Chromium	µg/L	3.7	6.8	6.8	2.2	28.4
Iron	µg/L	480	4,800	4,800	23,900	5,496
Manganese	µg/L	100	17,000	17,000	819	273
Vanadium	µg/L	1.8	75	75	84	37

mg/kg = milligrams per kilogram or part per million (ppm)
µg/L = micrograms per liter or parts per billion (ppb)
UTL Upper tolerance limit

FIGURE 8-1
AOC F Former Septic Tank Area (Facing West)

FIGURE 8-2
AOC F Former Septic Tank Area (Facing North)

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr



N

0 30 60 Feet

Figure 8-3
AOC F Soil and Groundwater Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr

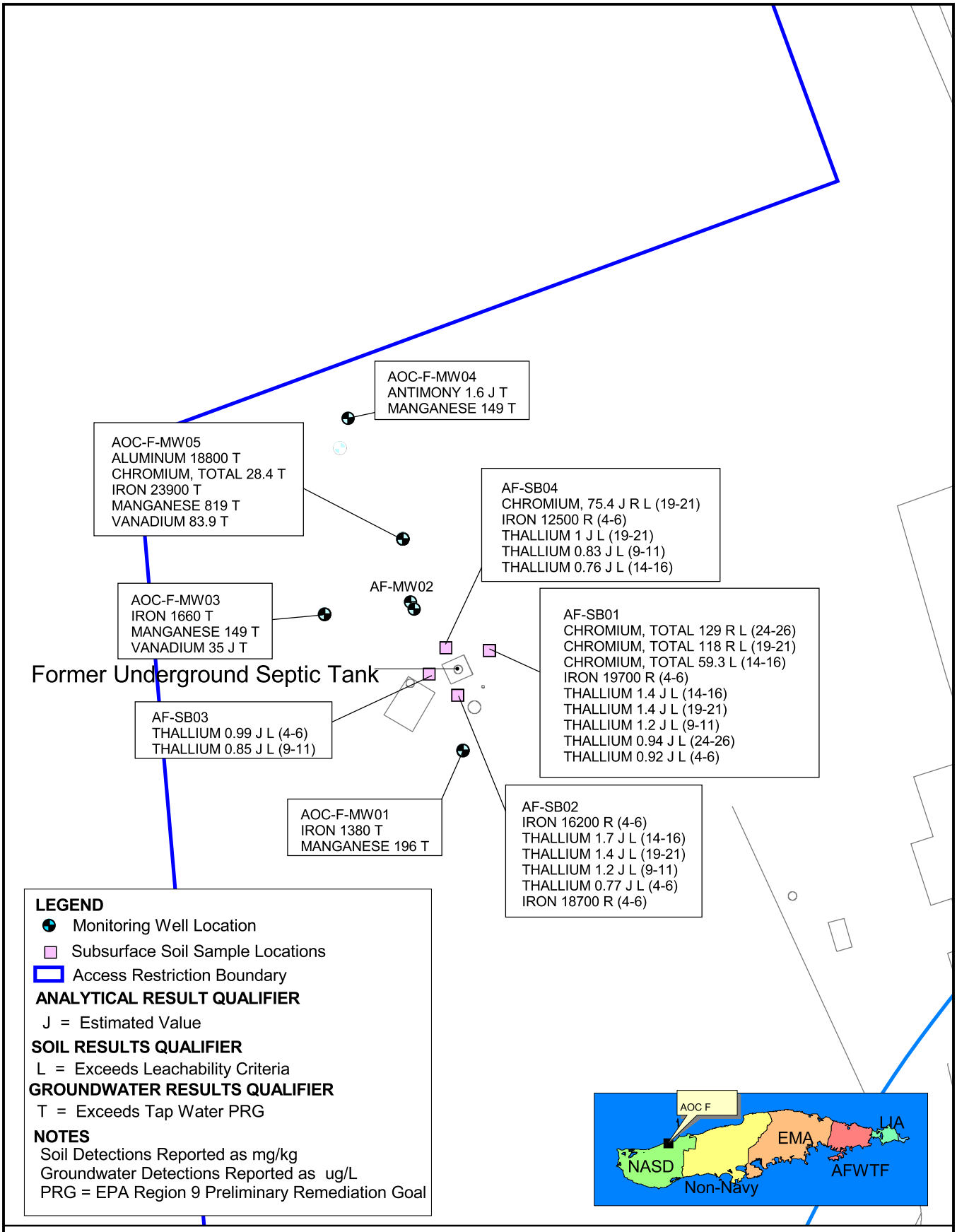
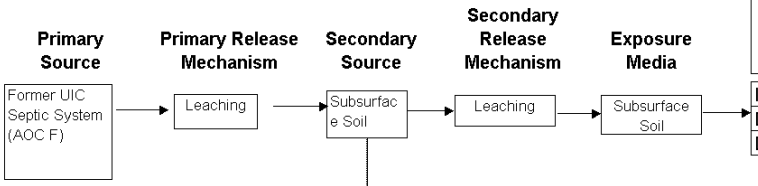


Figure 8-4
AOC F Soil and Groundwater Detections Above Screening Criteria
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 8-5
Conceptual Site Model for AOC F
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Exposure Route	Maintenance Worker	Industrial Worker	Construction Worker	Residential Adult	Residential Child	Recreational Adult	Recreational Child
Ingestion			X				
Dermal Contact			X				
Dust Inhalation			X				
Ingestion							
Dermal Contact							
Ingestion		X		X	X		
Dermal Contact		X		X	X		
Inhalation							

X - Quantitatively evaluated exposure pathway

Note:
Site is subsurface, so no surface soil contamination expected

SECTION 9

Site-Specific Decision Summary for AOC K – Former Water Well

9.1 Description

AOC K is the Former Water Well. The site consists of one 8-inch-diameter well completed to 69 ft bls, and near a tree just northeast of the Public Works Area barracks. The well was utilized as a potable water supply between 1941 and 1979, but has since been plugged and abandoned. Figures 9-1 and 9-2 show photos of this site and the area around the well.

The AOC K well was rehabilitated in 1997 as part of a water well investigation conducted by the U.S. Geological Survey (USGS). The USGS investigation included a total of 14 wells in the former NASD area, including the AOC K well. The results showed benzene detected at 21 µg/L, which is above the MCL level of 5 µg/L. Iron and manganese were found at levels greater than the screening criteria (secondary MCLs) in the sampled groundwater. This historical well, like other water supply wells, has a metal casing. The USGS investigation reported that the potential source for the observed iron and manganese is the volcanic rock near the western half of Vieques Island, which is enriched in iron and manganese. Therefore, it was determined that the likely source of these metals was from background conditions rather than site-related activities. The well has since been resampled, and benzene was not detected in any of the repeated samples. The laboratory datasheets which present analytical results are included in Appendix F of this report. The groundwater at this site flows to the north towards the ocean.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including AOC K. The summary includes the site background information, physical characteristics, site hydrogeological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

9.2 Site Characterization

9.2.1 Nature and Extent of Contamination

The Phase II PA/SI field investigation at AOC K included the installation and sampling of two groundwater monitoring wells upgradient, and three monitoring wells downgradient of the former water supply well. Groundwater samples were collected during the Phase II PA/SI and were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs. The groundwater screening table is presented in Appendix B. A discussion of the results is presented below.

The analytical results indicated the presence of commonly occurring metals—aluminum, barium, chromium, iron, manganese, thallium, and vanadium—in groundwater samples.

Exceedances of the screening criteria for some of the metals were reported at all five monitoring wells. The dissolved metals results show no detections greater than the applicable screening criteria, indicating that the total metals exceedances are likely the result of suspended particulates. A comparison against background concentrations for the metals in groundwater is included at the end of this section.

With the exception of the common lab contaminant, BEHP, no other organic chemicals VOCs, SVOCs, pesticides, or PCBs were detected at concentrations exceeding their applicable screening criteria. The BEHP exceedance (19 µg/L) was reported at monitoring well MW05 and appears to be an isolated incident as no other exceedances were reported for this parameter. Furthermore, BEHP is a constituent of plastics and is also recognized as a contaminant commonly resulting from well casing contamination, or use of plastic materials in sampling and analysis. As summarized in Section 1.0, the DQE does report the presence of phthalates in several of the blanks. As presented in Table 2 of Appendix I of Phase II Expanded PA/SI, BEHP was detected in one of the two samples analyzed for at a concentration of 4.5 µg/L, and as per EPA functional guidelines, any site concentrations less than 45 µg/L are not considered site-specific. By this convention, the detected BEHP at the site of 19 µg/L is not considered a COPC, though it was slightly above the tap water PRG value (4.8 µg/L).

A tabulated summary of groundwater exceedances is presented in Table 9-1. Figure 9-3 presents the location of all wells identified as AOC K. A summary of the groundwater exceedances by sample location is presented in Figure 9-4.

9.2.2 Contaminant Fate and Transport

No contamination source has been identified in the investigations conducted in the vicinity of AOC K. Though benzene was reported during 1996 investigation by USGS, no benzene was detected at the supply well or in the five wells installed immediately up- and downgradient. Therefore, no future offsite migration or releases to currently uncontaminated areas/media were expected from this site. The site wells were evaluated for direct exposure for the COPCs identified based on exceedance of screening criteria, though these chemicals are common in natural background, and similar concentrations of the same COPCs were detected at other sites within the former NASD.

9.2.3 Summary of Data Evaluation

Total metals were detected in groundwater samples at concentrations greater than the tap water PRG criteria and were identified as COPCs for risk assessment. A comparison of the detected groundwater inorganic concentrations against background is included at the end of this section.

9.2.4 Conceptual Site Model

Figure 9-5 presents the CSM for AOC K. This site consists of an inactive and abandoned historical potable water supply well in the former Public Works Area. The surrounding area at the ground level is covered with grass. Previous investigations by the USGS indicated that this well contained benzene greater than the federal MCL. The well was resampled in November 2000, and found that benzene was not detected at that time (see Appendix F).

Five new wells (three downgradient and two upgradient of the old supply well) were installed to investigate potential nature and extent of benzene contamination area around this well (see Figure 9-3) and none showed any benzene or related organic chemicals greater than detection limits, indicating that no source area is present at the old water supply well or its vicinity. Because no source area is present, no complete migration or exposure pathways were expected for the old well or the additional new wells. Groundwater at the site is 45 to 55 ft deep, and flows to the north toward the ocean.

As with other sites within the former NASD, several inorganic chemicals were detected in the newly installed wells, and were evaluated in the risk assessment. There is currently no potable groundwater use at or downgradient of this site. Thus, there are no complete exposure pathways for current receptors under the existing land use designation. Future potential exposures were evaluated assuming area water will be used for potable purposes, and worker and residential receptors were evaluated.

9.3 Ecological Assessment Summary for Main Operations Area (or Public Works Area) Sites: SWMUs 10, 14, 15, AOCs C and F

An ecological survey was conducted for the sites located within the Main Operations Area (or Public Works Area). The sites investigated included SWMUs 10, 14, 15, and AOCs C and F. There is no surface contamination at AOC K, making it an incomplete pathway for all ecological receptors from this site.

The plant communities are similar among all these sites. The plant communities mainly consist of herbaceous species typical of mowed/maintained areas. Maintenance of the grounds appeared to be main factor effecting the plant community composition and structure within this area at the time the ecological survey was conducted in 2000.
To determine the relative health of the ecological community within the Main Operations Area, a comparison was made by selecting a control plot outside of the sites, which is located southeast of SWMU 14, and comparing the habitat with the sites identified above. The ecological assessment concluded that there was no significant difference between any of the sites and the control site, however it was noted that SWMU 10 presented a greater abundance of some plant species than the control site.

AOC C had higher abundance of hydrophytic vegetation than the other sites because it is a drainage ditch. SWMU 15, which is an old parking lot was reported to have stressed vegetation, with domination by an exotic and invasive grass which is not significant. The stress and decumbent growth is thought to be due to heavy vehicles parked in this area at the time of the survey (see Figure 4-2). The soil compaction also limits the species diversity of the site, and small patches of oil stains in the soil were reported in the south central portion of the site.

The wildlife observed at these sites is typical for developed areas on Vieques Island. Horses and mongoose were the mammal species observed, and several species of birds were also observed. No federally protected species were observed in this area. The nearby NSRR located on the main Island of Puerto Rico is identified as habitat for Arctic perigrine falcon,

which prefers to feed in open areas. Since the Main Operations Area is an open area, it could be a feeding habitat for this species, although none were observed at the site during the ecological survey.

9.4 Human Health Risk Assessment

This section presents a summary of the pertinent information contained in the risk assessment for AOC K. Appendix D-8 includes the RAGS Part D formatted risk assessment table for this site wells. Screening data for all exposure routes and potential human receptors are provided in Appendix D-8 for AOC K. The complete risk assessment and accompanying tables are provided in Appendix E.

The source well did not have any detectable VOCs in samples collected in November 2000 (see Appendix F). The analytical results for the five groundwater well samples were screened against the tap water PRGs, and any chemicals detected above criteria were considered COPCs. These include aluminum, barium, chromium, iron, manganese, thallium, and vanadium (see Table 9-1).

Exposure pathways to groundwater for future hypothetical industrial workers and residential receptors were considered complete at AOC K (see Table 9-2). Potable water for Vieques Island is currently from a surface water source provided by the main Island of Puerto Rico, an arrangement that is expected to continue. Despite the low probability that this well would be used as a source of potable water, future receptors were assumed to be exposed to site groundwater, and risk was evaluated as conservative measure and for comparison purposes. Table 9-3 presents the risk characterization summary for the quantitatively evaluated receptors at AOC K. No groundwater COPCs are carcinogens, thus there was no carcinogenic risk estimated.

Industrial Worker

The estimated HI for an industrial worker exposed to groundwater is 1.53, which exceeded the target value of 1.0, primarily from thallium (HI=0.86). No target organ-specific HI was exceeded for a future industrial worker receptor using area groundwater for potable use. Thallium was detected in two of five samples, with a maximum detected concentration of 9.3 µg/L, compared to an MCL of 2 µg/L, and a background concentration range of 4.8 to 18 µg/L.

Residential Receptors

For a residential adult, the HI is 4.3, which is greater than the target HI value of 1.0. The ingestion of thallium in groundwater was the primary contributor to target organ-specific HI above 1.0, HI=2.4. For a residential child, the combined HI for exposure to groundwater is 10.1, which exceeds the target HI of 1.0, again due to thallium. The detected thallium maximum concentration is in the two upgradient wells (AOC-K-MW01 and AOC-KMW-03), where as none of the downgradient wells detectable thallium levels. A further discussion of comparison with background levels is included below.

9.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The site groundwater metals concentrations compared against the site-specific background concentrations and the general background well concentrations are presented in Table 9-4. As previously stated, the detected thallium is well within the thallium levels detected in background wells.

Aluminum, iron, and thallium detected in the AOC K wells are similar to those detected in the wells around former NASD. Detected thallium concentrations ranged from 8 µg/L to 9.3 µg/L compared to a range of 4.8 to 18 µg/L in the background wells. Iron concentrations ranged from 86 to 9,600 µg/L compared to a background range of 480 to 4,800 µg/L. However, groundwater iron levels in AOC K wells are similar to those observed across former NASD sites within the maintenance complex area and lower than the iron levels observed in SWMU 14 upgradient well SWMU14-MW02, indicating both iron and thallium are from background conditions and are not specific to the site (see Appendix E).

The detected inorganic chemical levels are due to high turbidity in groundwater samples, as with other sites within former NASD. Thus, the observed metal exceedances were likely the result of natural geochemical conditions at the site, and not specific to AOC K. Also, the dissolved metals samples did not differ from background samples. This indicates that detected metals were likely from suspended particulate matter within the groundwater samples. Based on this information, it is likely that the metals detected at AOC K are from background sources and are not site-related. The BEHP groundwater exceedance at monitoring well AOC-K-MW05 was an isolated occurrence and may be the result of plastic ware in the sampling and analysis process, as discussed above from DQE summary (see Section 1.0).

9.4 Summary of Site Risks

Five new wells were installed during the PA/SI to investigate USGS-reported benzene in the former water supply well. The well has been plugged and abandoned, and sampling conducted prior to closing the well revealed that benzene was no longer detected. The original USGS reported low level benzene was not confirmed in any of the five newly installed wells. No organic chemicals were identified in the site investigation, and inorganic chemicals were detected in unfiltered groundwater samples, which were included for COPC selection. Dissolved metals were below detection limits or detected concentrations are much lower and similar to background well dissolved metals levels, indicating that detected total metals could be associated with suspended particulates.

There were no carcinogenic COPCs identified in site groundwater. The target HI of 1.0 was exceeded for all receptors (industrial and residential) because of the presence of thallium in groundwater at an average concentration of 8.7 µg/L (in two wells with detects out of five). For a residential child, the HI exceeded the acceptable limit, primarily due to thallium in groundwater. Therefore, any elevated health hazard that may be present in AOC K groundwater from thallium should not be site-related, and this site should not be considered to present an excessive risk or hazard to human health. No remedial actions are needed for the site.

9.5 Conclusions and Recommendations

Site groundwater is free of any organic contamination, and detected inorganic chemicals are the same as those detected in background samples and other sites across former NASD, and concentrations are also similar. No evidence exists to suggest that a release of hazardous materials to groundwater has occurred at AOC K, as none were detected in any of the wells upgradient or downgradient from the site. No further investigation or remedial action for the groundwater is necessary for the protection of human health based on an analysis of available groundwater sample results and pertinent information for the site. Therefore, the selected remedial alternative for the groundwater at the site is NFA. No additional sampling or monitoring of the groundwater will be necessary because the conditions at the site are protective of human health and the environment. No further groundwater monitoring will be required under CERCLA as a result of the NFA alternative.

TABLE 9-1
AOC K COPC Selection for Groundwater
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean Concentration of Detects	Best Estimate of the Mean[a]	Tap Water PRG[b] (HI=0.1)	MCL[c]
2	Aluminum	5	4	9,100	680	3,172.5	2547.5	3,650	NA
2	Barium	5	5	390	94	204.8	204.8	255	2,000
2	Chromium	10	3	19	4.8	9.57	3.1745	10.95	NA
2	Iron	5	5	9,600	86	3,075.2	3,075.2	1,095	NA
2	Manganese	5	5	1,300	18	394	394	88	NA
2	Thallium	5	2	9.3	8	8.65	4.48	0.24	2.0
2	Vanadium	5	5	64	6.9	23.18	23.18	26	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] Maximum Contaminant Levels. EPA Office of Water. http://www.epa.gov/safewater/mcl.html
Units in µg/L (ppb)
HI -- Hazard Index
MCL -- Maximum contaminant level
NA -- Not available
PRG -- Preliminary remediation goal

TABLE 9-2
AOC K Potentially Complete Exposure Pathways and Receptors for Groundwater
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Industrial Worker	Groundwater	Ingestion and dermal contact with site groundwater	Yes	Although unlikely, pathway assumed for comparison purposes.
Residents	Groundwater	Ingestion and dermal contact with site groundwater	Yes	Although the site is unlikely to be considered for residential land use and well is abandoned and unusable, this is a worst-case scenario for comparison purposes.

TABLE 9-3
AOC K Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Industrial Worker								
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.516	0.000	0.010	1.526
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**1.52**	**0.00**	**0.01**	**1.53**
Residential Adult								
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.245	0.000	0.077	4.322
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**4.24**	**0.00**	**0.08**	**4.32**
Residential Child								
	Groundwater				*Groundwater*			
	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.904	0.000	0.239	10.143
	Total				*Total*			
	0.0E+00	**0.0E+00**	**0.0E+00**	**0.0E+00**	**9.90**	**0.00**	**0.24**	**10.14**

TABLE 9-4
Background Concentrations in Groundwater Compared to Site Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Parameter	Units	Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Site Detected Concentration
		Minimum	Maximum			
Aluminum	µg/L	130	3,500	3,500	9,100	3,173
Barium	µg/L	15	960	960	390	205
Iron	µg/L	480	4,800	4,800	9,600	3,075
Manganese	µg/L	100	17,000	17,000	1,300	394
Thallium[a]	µg/L	4.8	18	18	9.3	8.7
Vanadium	µg/L	1.8	75	75	64	23

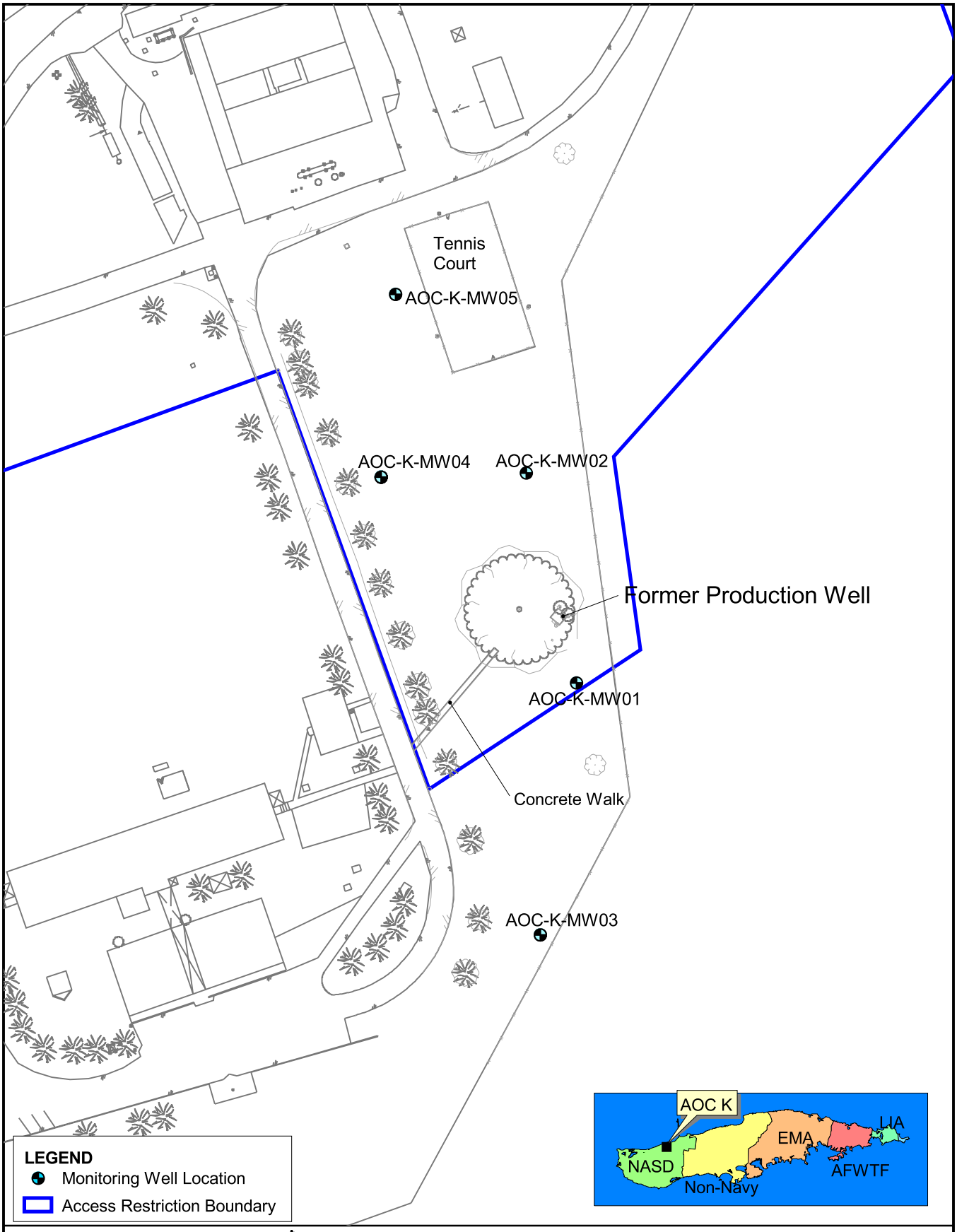
[a]Thallium was highest in upgradient wells AOC-K-MW-01 and AOC-K-MW-03.

µg/L = micrograms per liter or parts per billion (ppb)
UTL -Upper tolerance limit

FIGURE 9-1
AOC K Former Water Well Area (Well is Behind the Coconut Palms Across the Street)

FIGURE 9-2
AOC K Former Water Well (Closer View of Well Location)

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr



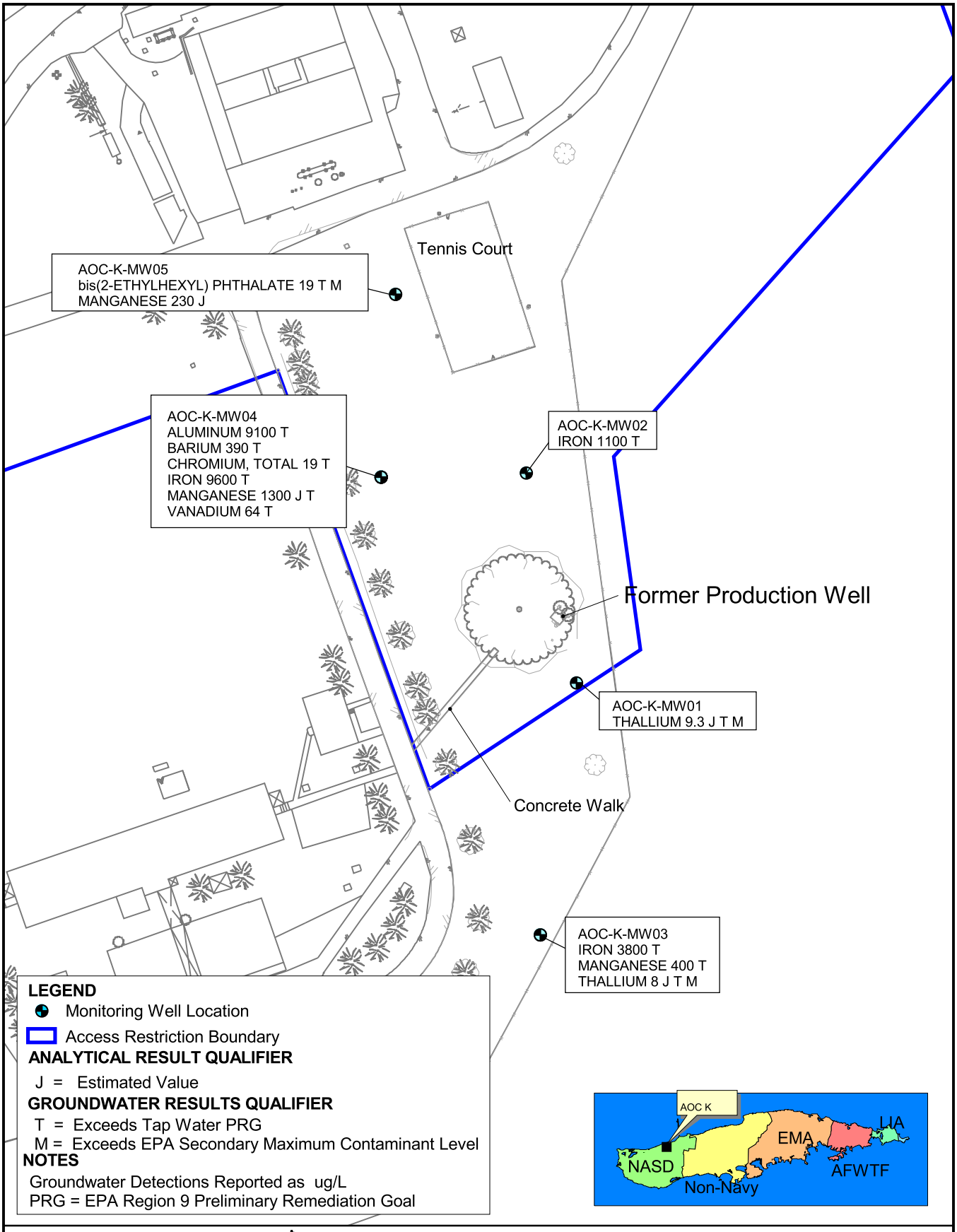
N

0 100 200 Feet

Figure 9-3
AOC K Groundwater Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr



N

0 100 200 Feet

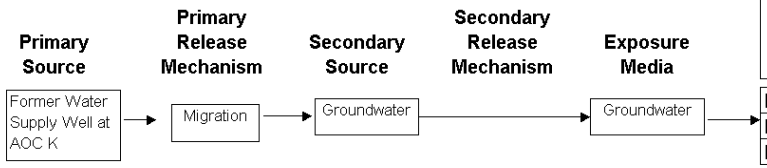
Figure 9-4
AOC K Groundwater Detections Above Screening Criteria
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 9-5

Conceptual Site Model for AOC K

NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Exposure Route	Maintenance Worker	Industrial Worker	Construction Worker	Residential Adult	Residential Child	Recreational Adult	Recreational Child
Ingestion		X		X	X		
Dermal Contact		X		X	X		
Inhalation							

X - Quantitatively evaluated exposure pathway

Note:
Groundwater is >40 ft deep, casual contact with groundwater to other receptors is not likely
Inhalation pathway is not complete. VOCs were not detected above screening criteria in site groundwater.

SECTION 10

Site-Specific Decision Summary for AOC L – Abandoned Septic Tank

10.1 Description

AOC L consists of a 25-ft by 40-ft concrete septic vault with separate compartments. The septic vault is partially buried to the south and three-quarters of the total length is exposed to the north. The vault is north of the Main Operations Area, north of the main road that crosses the former NASD, and approximately 200 ft from the beach. The area surrounding the vault consists of low-growing vegetation (grasses and shrubs). It is suspected that the vault was in existence when the area was used for sugarcane farming, or it may have been installed as a septic tank in 1941 to treat and dispose of sewage for the Navy administrative buildings that existed there. There was never a drain-field identified that was associated with the vault. The vault has been out of service since 1942. Currently, the vault consists of a dry cement container with an opening on the top. There is a spill overflow at the northeast corner of the vault. There are no indications that the vault was used for industrial purposes, but because the actual historical use of the site is unknown, the site was investigated. Figures 10-1 and 10-2 show photos of the site.

Section 1.0 of this NFA report summarizes the general issues related to all of the sites, including AOC L. The summary included the site background information, physical characteristics, site hydrogeological features, future land use, UXO/OE survey findings for the western portion of the island including the former NASD, data collection depths, types of data, DQE findings, and the general approach to the risk assessment. The following text presents the site-specific information.

10.2 Site Characterization

10.2.1 Nature and Extent of Contamination

Four surface soil (0 to 0.5 ft bls) and four subsurface soil samples (5 to 6 ft bls) were collected at AOC L as part of the Phase II Expanded PA/SI investigation. Surface soil samples were collected from all four sides of the old septic vault. One of the sampling locations was near the potential spill/overflow area. Subsurface samples were also collected from all four sides of the septic tank, at a depth between 5 and 6 ft bls. Soil samples were analyzed for chemicals, metals, VOCs, SVOCs, pesticides, and PCBs. The surface and subsurface soil screening tables are presented in Appendix B. Figure 10-3 includes the sample locations collected from AOC L. Figure 10-4 presents the chemicals identified as exceeding the screening criteria within the soil samples.

Surface Soil Results

No organic chemicals (i.e., VOCs, SVOCs, pesticides, PCBs) were reported at levels greater than detection limits in the soil samples, except for trace levels of a VOC that was also detected in the blanks (see DQE summary in Section 1.0). The analytical results indicated detections of aluminum, arsenic, iron, and manganese in surface soil at concentrations greater than the residential PRG criteria. One or more of these metal exceedances were reported at all four sampling points. The metal concentrations detected in surface soil are compared with the background concentrations for the former NASD at the end of this section. A summary of the surface soil exceedances is presented in Table 10-1. Appendices B and C provide data by sample and statistical summaries, respectively, for the detected chemicals at AOC L. Appendix D-9 presents a screening of all the detected chemicals against criteria at AOC L, in tables formatted according to RAGS Part D guidance.

Subsurface Soil Results

No VOCs (only trace levels of xylenes, as listed in Appendix B) were greater than screening criteria, and SVOCs, pesticides, and PCBs were not detected in subsurface soil samples. Arsenic and iron were detected above PRGs, but none were above SSLs. Table 10-2 presents the COPC selection for subsurface soil. EPA does not list SSLs for some of the commonly occurring metals. The detected inorganic chemicals in the subsurface soil were compared against background soil inorganic chemicals. This discussion is presented at the end of this section. Thus, site subsurface soil data collected from biased locations closest to the vault do not indicate the presence of releases, as no organic chemicals were detected.

10.2.2 Contaminant Fate and Transport

No contamination has been identified at levels greater than screening criteria in the surface and subsurface soil samples collected from all sides of the vault. There are no known reports of a release having occurred at this site. An analysis of site soils did not detect any organic contamination. Only inorganic chemicals were detected in surface soil samples greater than PRGs. The potential for site surface soil inorganic migration is mostly through surface runoff, as metals are not very soluble and thus are not mobile vertically through the soil column. The subsurface soil did not have any metals above screening criteria. In addition, the overall migration pathways are not significant for this site, as no organic contamination is identified and inorganic chemicals are similar to background levels. Because no contamination was identified specific to the site, no offsite migration through fate and transport processes was identified as a concern for this site. A comparison of background levels versus site inorganic chemicals is included at the end of this section.

10.2.3 Data Evaluation Summary

Only four surface soil metals exceeded residential screening criteria. No subsurface soil constituents were detected at levels greater than comparison criteria. The metals data reported are likely the result of soil background conditions. The data also show that there is no organic contamination at the AOC L site at the present time. All COPCs identified from exceedance of criteria, regardless of their origin, were included in the human health risk assessment (see Appendix E).

10.2.4 Conceptual Site Model

Figure 10-5 presents the CSM for AOC L. Currently, the site is an empty cement vault with compartments and an opening at the top. During the site visit, some bones were observed inside the vault, which apparently traps small animals that enter it but cannot climb out.

The site has not been a source of potential contamination since 1942, when the site was decommissioned. Any historical use-related organic chemicals would have migrated, degraded/attenuated with time. Inorganic chemicals are not expected from the reported past uses; however, if such chemicals were released to the subsurface soil, they may have either become bound to the subsurface soil or released to the groundwater. Chemicals leaching to groundwater could potentially migrate offsite to the north following the predominant downgradient flow direction. Surface releases, if they occurred, would have been at the overflow at the north side of the vault, as it is buried in the subsurface on three sides: fully to the south, and one-half to two-thirds on the east and west sides. The north side of the vault is buried approximately one-quarter of its height. Surface releases would have deposited on soils and runoff with rain water.

There were no direct exposures expected to subsurface soil or groundwater at the site, assuming normal conditions. However, site soil and groundwater data were conservatively evaluated for industrial (workers) or residential (adult and child) land use to represent a worst-case exposure scenario. A construction worker scenario used for other sites does not have complete exposure pathway at this site due to the absence of COPCs in subsurface soil at AOC L, as further discussed below.

10.3 Ecological Assessment Summary for AOC L

An ecological survey was conducted as part of the Phase II Expanded PA/SI for this site, and is presented in Appendix F of the Phase II Expanded PA/SI report (CH2M HILL, November 2002). The site is described to be located about 90 ft north of Highway 200, and approximately 180 ft south from the beach. The vault is approximately 0.1 acre in size. During the ecological survey, the septic vault had grates. The vegetation community at this site consists of herbaceous plant community, which is abundant and diverse; the immediate surrounding area included open grasslands, large shade trees, and the beach area. Hurricane grass dominated the site, covering approximately 70 percent of the area, and several vines were also reported. The ground maintenance was the primary factor effecting the plant community at AOC L. When compared with a control area located farther east of the site, the plant community at AOC L is similar to the reference sites.

In terms of area wildlife, a herd of horses was observed grazing on the adjacent grasslands, and rat holes were encountered on the eastern side of the vault. No birds or lizards were observed at the vault. However, additional species were observed in the adjacent beach habitat and the reference site. One cattle egret, a bananaquit, two common terns, a spotted sand piper, and a cattle egret were observed in the adjacent beach habitat. The bird species observed at this habitat type consisted of coastal forest and shore species due to the close proximity to the Caribbean. There is no evidence that the AOC L site had an impact on the wildlife or habitat in the area. Ground maintenance is the primary factor affecting the plant and animal species composition and structure at this site, similar to other developed sites in the area.

10.4 Human Health Risk Assessment

This section summarizes the pertinent information contained in the risk assessment for AOC L. Screening data for all exposure routes and potential human receptors are presented in Appendix D-9 in RAGS Part D formatted tables. The complete risk assessment and accompanying tables can be found in Appendix E.

Four surface and four subsurface soil samples were collected at AOC L. Aluminum, arsenic, iron, and manganese were selected as COPCs for surface soils. Arsenic and iron were identified as COPCs in subsurface soils. The exposure pathways in surface soils for future hypothetical workers, recreational users/trespassers, and residential receptors were considered complete at AOC L (see Table 10-3). The exposure pathway identified for subsurface soil at AOC L was a construction worker scenario where removal of the tank or building in the area may occur when the land is transferred from the Navy to private owners. Thus, the unrestricted land use scenario is evaluated for site management decisions. Because of the small size of the site, it is unlikely that any receptors would be exposed to this site at the frequency assumed by this risk assessment; the results are considered highly conservative and protective of any worst-case scenario. Table 10-4 presents the risk characterization summary for the quantitatively evaluated receptors at AOC L.

Maintenance Worker

For a maintenance worker, the ELCR for exposure to surface soils is 1.3E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI for exposure to surface soils is 0.017 and is less than the target HI of 1.0 for noncarcinogenic exposure.

Industrial Worker

The estimated combined ELCR for a industrial worker exposed to surface soils and groundwater is 6.3E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The noncarcinogenic HI is estimated to be 0.08, which is well below a value of 1.0.

Construction Worker

The subsurface soil was evaluated up to 10 ft-deep for potential exposure to construction workers; arsenic and iron were identified as COPCs. The EPCs included both surface and subsurface soil sample concentrations. The ELCR for a future construction worker is estimated at 4.8E-8, which is below the EPA acceptable risk range of 1E-4 to 1E-6. The HI to a future construction worker is estimated to be 0.169, which is less than the target HI of 1.0.

Recreational Receptors

The estimated combined ELCR for a recreational adult and child exposed to surface soils is 2.8E-7 and 5.3E-7, respectively, and is less than the acceptable risk range. The HI of 0.035 and 0.02, respectively, is less than the target HI of 1.0.

Residential Receptors

For a residential adult and a child, the ELCRs are 7.9E-7 and 1.8E-6, respectively, which are within the EPA acceptable risk range of 1E-4 to 1E-6. The combined cancer risk from exposure to a resident living in the same area as a child and an adult is 2.6E-6, which is also

within the EPA acceptable risk range. The HI for an adult was estimated to be 0.11, which is less than the target value of 1.0. For a residential child, the HI for exposure to surface soils is 1.0, which is at the acceptable HI of 1.0, with primary contribution to the health hazard from iron with an HI equal to 0.75. No single target organ HI was above a value of 1.0 (see Appendix D-9). As a result, residents would not be exposed to an unacceptable level of carcinogenic or noncarcinogenic risks from exposure to surface soils at this site. This conservative evaluation scenario indicates that the site is fit for unrestricted land use. A comparison of site inorganic chemicals with background levels is included below.

10.5 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The site soil inorganic chemical concentrations are compared against the range of background concentrations, as presented in Table 10-5. As can be observed from these tables, the surface soil and subsurface soil COPCs identified at AOC L have similar concentrations as the background levels.

10.6 Summary of Site Risks

The cancer risks and health hazard effects are within the acceptable limits for furture maintenance workers, industrial workers, construction workers, recreational receptors, and residential receptors. Metal concentrations detected in surface soils are well within the range of background concentrations found in soils across the former NASD. Because of the absence of elevated health risks and lack of site-specific contamination in AOC L soils, AOC L is recommended for NFA status.

10.7 Conclusions and Recommendations

The risk to human health resulting from a conservative evaluation assumed for exposure to AOC L is low, and within background levels. Current site and environmental testing data indicate that NFA is warranted at AOC L. Therefore, the NFA alternative is recommended for this site.

TABLE 10-1
AOC L COPC Selection for Surface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of Mean[a]	Residential PRG[b] (HI=0.1)	Industrial PRG[b] (HI=0.1)	SSL[c] (DAF=20)
2	Aluminum	4	4	9,150	6,350	7,748	7,748	7,614	10,000	NA
2	Arsenic	4	3	1.0	0.46	0.66	0.53	0.39	1.6	29
2	Iron	4	4	17,700	12,600	14,550	14,550	2,346	10,000	NA
2	Manganese	4	4	472	332	397	397	176	1,946	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). Http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 10-2
AOC L COPC Selection for Subsurface Soils
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

PA/SI Phase	Chemical	No. of Samples	No. of Detects	Maximum Detected Concentration	Minimum Detected Concentration	Mean of Detections	Best Estimate of the Mean[a]	Industrial PRG[b] (HI=0.1)	SSL[c] (DAF=20)
2	Arsenic	8	6	1.7	0.46	1.1	0.86	1.6	29
2	Iron	8	8	17,700	5,100	11,596	11,596	10,000	NA

[a] The best estimate of the mean includes non-detects at half the detection limit.
[b] Region 9 Preliminary Remediation Goals (PRG, EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[c] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996).
http://www.epa.gov/superfund/resources/soil/toc.htm
Units in mg/kg (ppm)
DAF -- Dilution attenuation factor
HI -- Hazard Index
NA -- Not available
PRG -- Preliminary remediation goal
SSL -- Soil screening level

TABLE 10-3
AOC L Potentially Complete Exposure Pathways and Receptors
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Maintenance Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Scenario is protective of any occasional maintenance work such as lawn moving.
Industrial Worker	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Area could be developed in the future for industrial use. Both site soil and groundwater exposure is assumed.
Construction Worker	Subsurface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site subsurface soils	Yes	Scenario is protective of any occasional construction activities at the site.
Recreational Users	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Area could be developed in the future for recreational use and would be protective of any occasional trespasser.
Residents	Surface Soil	Ingestion, dermal contact and inhalation exposure to COPCs in site surface soils	Yes	Although the site is unlikely to be considered for residential development, this is a worst-case scenario for comparison purposes.

TABLE 10-4
AOC L Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Maintenance Worker								
	Surface Soil				*Surface Soil*			
	1.1E-07	1.6E-10	2.2E-08	1.3E-07	0.0152	0.0012	0.0006	0.01705
	Total				*Total*			
	1.1E-07	**1.6E-10**	**2.2E-08**	**1.3E-07**	**0.0152**	**0.0012**	**0.0006**	**0.0170**
Industrial Worker								
	Surface Soil				*Surface Soil*			
	5.2E-07	7.7E-10	1.0E-07	6.3E-07	0.073	0.006	0.003	0.08
	Total				*Total*			
	5.2E-07	**7.7E-10**	**1.0E-07**	**6.3E-07**	**0.07**	**0.006**	**0.00**	**0.08**
Recreational Adult								
	Surface Soil				*Surface Soil*			
	2.1E-07	3.1E-10	7.2E-08	2.8E-07	0.030	0.002	0.002	0.04
	Total				*Total*			
	2.1E-07	**3.1E-10**	**7.2E-08**	**2.8E-07**	**0.03**	**0.002**	**0.00**	**0.04**
Recreational Youth								
	Surface Soil				*Surface Soil*			
	4.9E-07	3.6E-10	4.1E-08	5.3E-07	0.284	0.011	0.005	0.30
	Total				*Total*			
	4.9E-07	**3.6E-10**	**4.1E-08**	**5.3E-07**	**0.28**	**0.011**	**0.01**	**0.30**
Construction Worker								
	Surface Soil				*Surface Soil*			
	4.4E-08	2.0E-11	4.0E-09	4.8E-08	0.168	0.000	0.002	0.17
	Total				*Total*			
	4.4E-08	**2.0E-11**	**4.0E-09**	**4.8E-08**	**0.17**	**0.000**	**0.00**	**0.17**
Residential Adult								
	Surface Soil				*Surface Soil*			
	7.0E-07	1.0E-09	8.4E-08	7.9E-07	0.103	0.008	0.003	0.11
	Total				*Total*			
	7.0E-07	**1.0E-09**	**8.4E-08**	**7.9E-07**	**0.10**	**0.008**	**0.00**	**0.11**
Residential Child								
	Surface Soil				*Surface Soil*			
	1.6E-06	1.2E-09	1.4E-07	1.8E-06	0.957	0.037	0.017	1.01
	Total				*Total*			
	1.6E-06	**1.2E-09**	**1.4E-07**	**1.8E-06**	**0.96**	**0.037**	**0.02**	**1.01**

TABLE 10-5
Background Range of Concentrations for Soils Compared to Site Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Parameter	Units	Range of Background Concentrations		Background UTL	Maximum Detected Site Concentration	Average Site Detected Concentration
		Minimum	Maximum			
Surface Soil						
Aluminum	mg/kg	1,600	29,000	29,000	9,150	7,748
Arsenic	mg/kg	0.57	2.5	2.3	1.0	0.66
Iron	mg/kg	2,500	39,000	37,531	17,700	14,550
Manganese	mg/kg	48	1,200	1,167	472	397
Subsurface Soil						
Arsenic	mg/kg	0.57	2.5	2.3	1.7	1.2
Iron	mg/kg	2,500	39,000	37,531	12,500	8,643

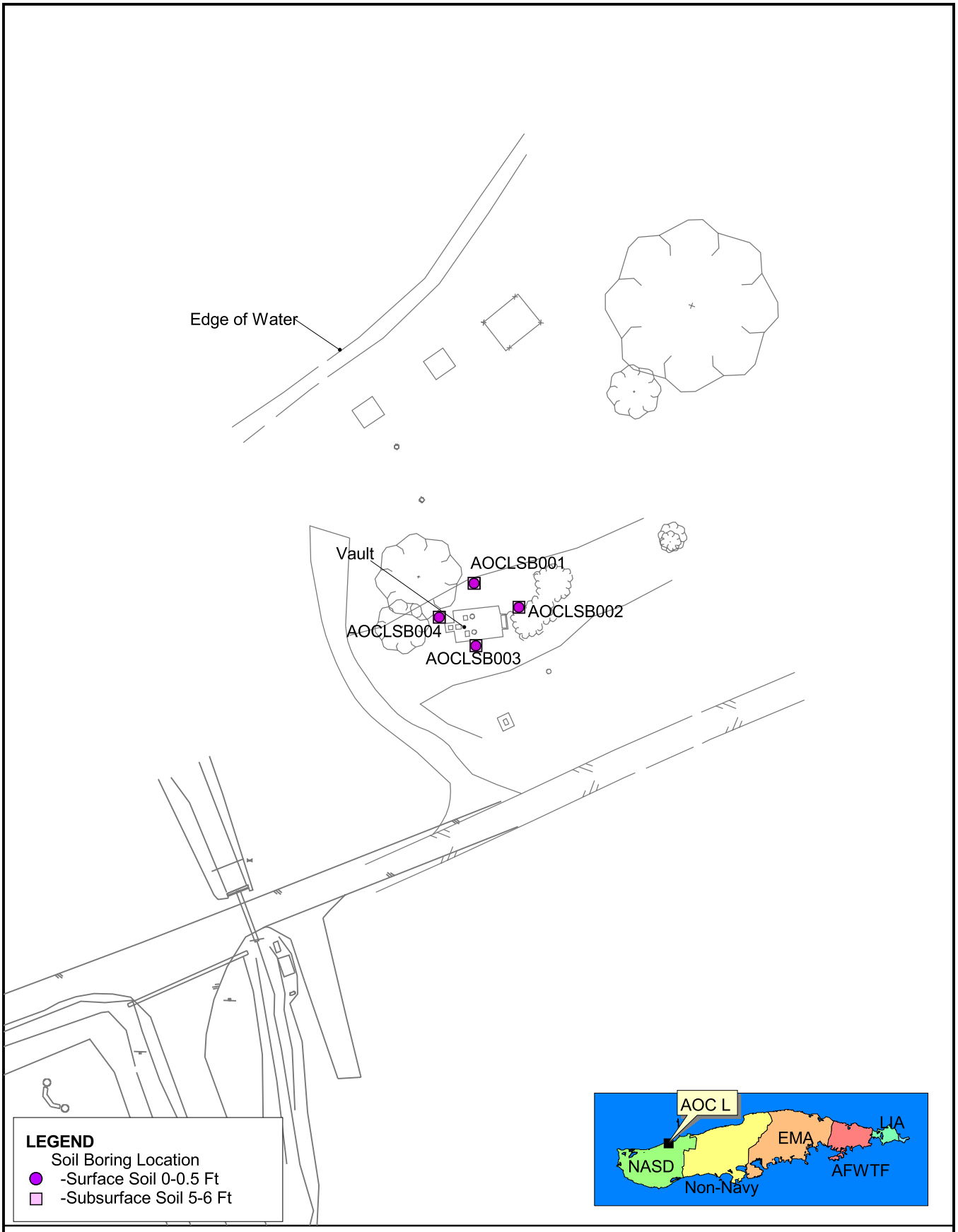
mg/kg = milligrams per kilogram or part per million (ppm)

UTL Upper tolerance limit

FIGURE 10-1
AOC L Abandoned Septic Tank Area (Facing North to Caribbean)

FIGURE 10-2
AOC L Abandoned Septic Tank Area (Vines Covering the Vault Grates and Adjacent Offsite Brush)

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr



N

0 80 160 Feet

Figure 10-3
AOC L Soil Sample Locations
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:\18gis\Vieques\aprs\nfaaocsites_nym.apr

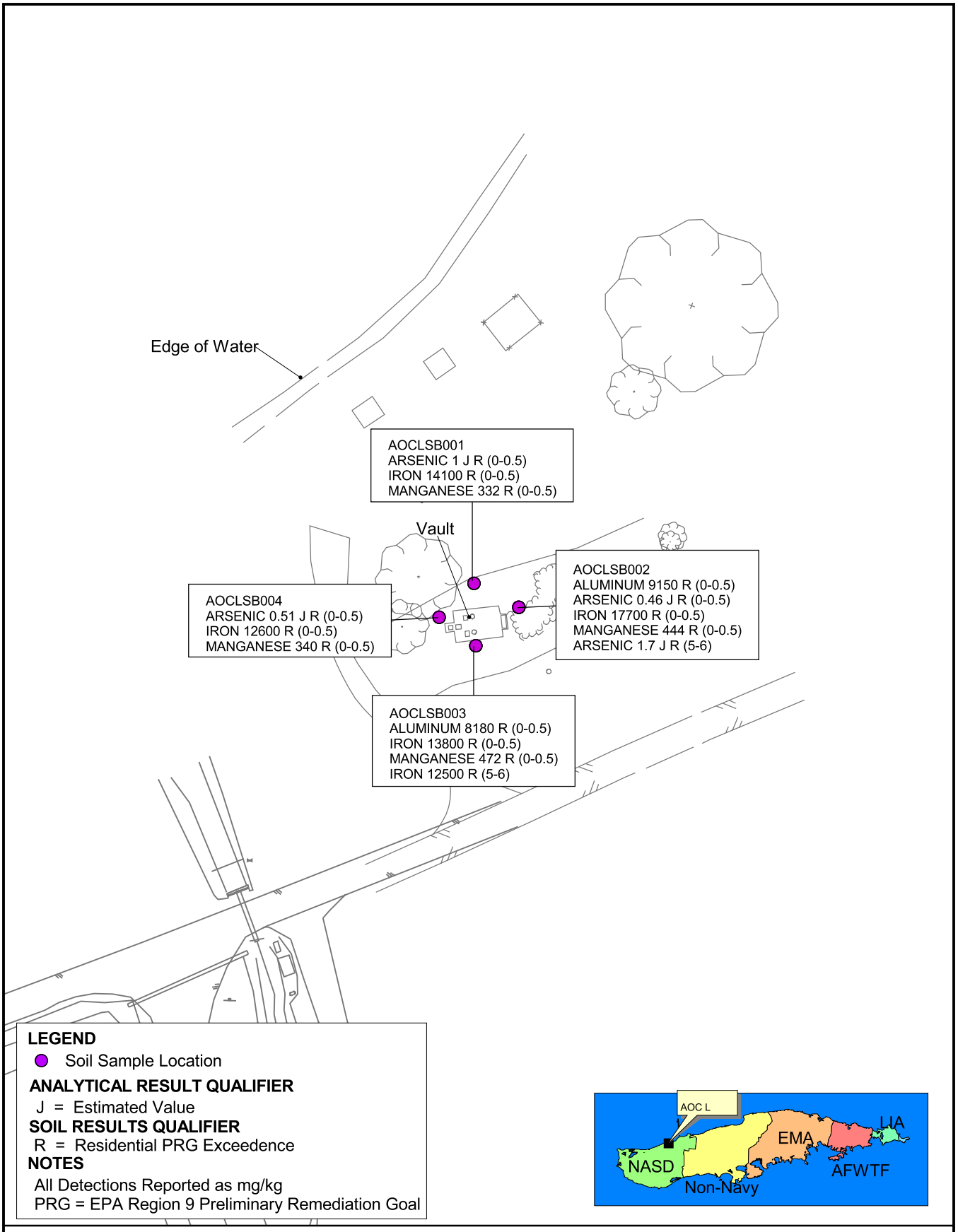
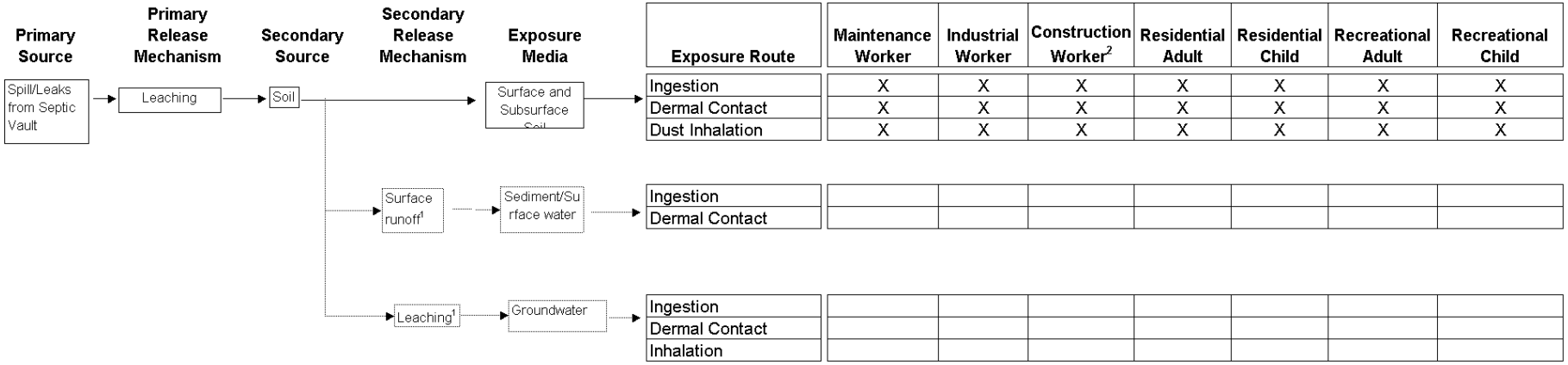


Figure 10-4
AOC L Soil Detections Above Screening Criteria
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

FIGURE 10-5
Conceptual Site Model for AOC L
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico



Exposure Route	Maintenance Worker	Industrial Worker	Construction Worker[2]	Residential Adult	Residential Child	Recreational Adult	Recreational Child
Ingestion	X	X	X	X	X	X	X
Dermal Contact	X	X	X	X	X	X	X
Dust Inhalation	X	X	X	X	X	X	X
Ingestion							
Dermal Contact							
Ingestion							
Dermal Contact							
Inhalation							

X - Quantitatively evaluated exposure pathway

[1] Leaching and surface runoff are considered minor pathways due to lack of drainage features and mobile COPCs in soils

[2] **Construction worker exposure pathway is evaluated for surface and subsurface soil exposure**

SECTION 11

Areawide Groundwater Evaluation for Former Main Operations Area

11.1 Groundwater Data Description

Groundwater samples were collected from several sites within the former Main Operations Area. The groundwater investigation was conducted at wells that were installed at six of the nine sites identified within the Main Operations/Public Works Area of the former NASD. Those sites include SWMUs 14, 15, AOC C, AOC E, AOC F and AOC K. Of these sites, AOC E is not addressed in this report, as that site is identified for further remedial investigations, and is addressed in a separate report.

The wells from SWMUs 14, 15, AOC C, AOC F, and AOC K are evaluated in this section to determine the areawide groundwater quality within the former Main Operations Area, and also to determine the potential exposure-related risks from potable use of the area groundwater. It is important to note that groundwater for potable use is typically from the deeper wells, which can produce sufficient water yield to serve for potable use. The shallow water table in this area is not of adequate production capacity to serve as a potable source; this was observed during well monitoring at different sites during the two phases of the Expanded PA/SI. As a result, this evaluation is primarily for comparison purposes.

A site-specific groundwater risk calculation was included for the individual sites where groundwater was sampled. In addition, the cumulative risks from exposures to this site medium were estimated and included in the earlier sections. The areawide groundwater evaluation is added as a new section to this revised report, upon the recommendation of the agencies during the review of the prior version submitted.

As mentioned previously, Section 1.0 of this NFA report includes the background information for the former NASD, physical characteristics of the area, site hydrogeological features, future land use, UXO/OE survey findings, and ecological assessment conducted for the western portion of the Vieques Island. Section 1.0 also includes data collection depths, types of data, DQE findings and the general approach to the risk assessment. Currently there are no Navy-related operations within this area of the former NASD.

11.2 Groundwater Characterization

The groundwater flows from higher topographic areas to the lower topographic areas, from south to north towards the ocean in the former Main Operations Area. A USGS topographic map of the western portion of Vieques Island and the relative location of the former Main Operations Area is presented in Figure 1-6. A CSM for the groundwater flow direction is presented in Figure 1-10.

The shallow groundwater occurs at about 50 ft bls. After stabilization of monitoring wells the water depths were measured at approximately 40 to 42 ft bls. The significant rainwater migration pathway in this clay-rich soil with relatively steep slopes towards the ocean, is the surface runoff with a relatively low recharge through infiltration of the rainwater. The shallow groundwater has very low yield and samples were difficult to obtain without turbidity; the wells were pumped dry during sampling. Thus, most of the detected inorganic chemicals were also from wells with high turbidity, and are thus likely associated with suspended particle in water samples. The dissolved metals measured in the same samples were at much lower concentrations, which supports the assumption that most of the inorganic chemicals are particulate-bound. The corresponding well logs were presented as appendices to the Expanded PA/SI reports.

11.2.1 Nature and Extent of Contamination

Figure 11-1 presents the location of all the wells included for this analysis. There are a total of 13 wells located within the former Main Operations Area, associated with five of the sites that are included in this report. A total of five of these wells (two wells at AOC K, one well at SWMU 14, and one well at AOC F) are site-specific upgradient wells. The wells associated with the AOC E, the site that is proposed for further remedial investigation are not included in this report.

Figure 11-2 presents a summary of the chemicals that were identified as exceeding the PRGs at these sample locations, although some of these were not COPCs as discussed below. Appendices B and C present all of the detected data for groundwater. Appendix D-10 presents the detected chemicals as compared to the PRGs (tap water) and the available MCLs. Toluene was the only VOC detected. It was detected at a range from 0.43 to 0.75 µg/L in three out of 13 samples. Two phthalates were also detected. Bis-2ethylhexyl-phthalate was detected at 19 µg/L in one out of 13 samples. Di-ethyl-phthalate was detected at 8 µg/L and 10 µg/L in two out of 13 samples. These were the only VOC and SVOC chemicals detected. One pesticide, dieldrin, was also reported at 0.001 µg/L in one out of 13 samples. All four of these organic chemicals were within the levels of the same chemicals detected in various blank samples, and are discussed in the DQE during the two phases of the Expanded PA/SI. A summary of this DQE is presented in Section 1.0. Dieldrin was selected as COPC for groundwater as it was detected in site well sample during the Phase I PA/SI. Dieldrin was detected in blanks from the Phase II PA/SI samples, but not in the Phase I sample blanks. The other three organic chemicals were detected in blanks for both phases of the PA/SI. According to the EPA functional guidelines for data evaluation, they were not identified as associated with the site. Thus, dieldrin is included as a COPC for the risk assessment as discussed below.

Several inorganic chemicals were detected in all the well samples. Of these, aluminum, antimony, barium, chromium, iron, manganese, thallium, and vanadium were identified as exceeding the tap water PRG values. Except for thallium, none of the inorganic chemicals were above their respective MCLs. All of the chemicals that were detected at levels exceeding the PRGs were included in a conservation risk evaluation, as presented below. Table 11-1 presents an analytical summary of the groundwater COPCs that were identified.

11.3 Human Health Risk Assessment

The results of the human health risk assessment are presented in Appendix D-10 for all the complete exposure pathways that were identified. The tables in Appendix D-10 were formatted according to the RAGS Part D guidance. This section summarizes the pertinent information contained in the risk assessment for groundwater at the site. Screening data for all exposure routes and potential human receptors are provided in Appendix D-10.

Dieldrin, aluminum, antimony, barium, chromium, iron, manganese, thallium, and vanadium were selected as COPCs for groundwater. Dieldrin was detected in only one sample out of 13 wells, and is the only organic COPC identified. The potential exposure pathways evaluated for groundwater are the future hypothetical workers, and residential receptors. Table 11-2 presents a summary of this information. Table 11-3 presents the risk characterization summary for the quantitatively evaluated receptors for groundwater.

Industrial Worker

The estimated combined ELCR for an industrial worker exposed to areawide groundwater is 5.6E-7, which is less than the acceptable risk range of 1E-4 to 1E-6. The estimated HI of 1.7 for exposure to groundwater is due to the thallium and iron levels. Thallium was only detected in the upgradient wells at AOC K.

Residential Receptors

For a residential adult and child**,** the ELCRs are 1.5E-6 and 8.8E-7, respectively, which are within the EPA acceptable risk range of 1E-4 to 1E-6. The combined cancer risk from exposure to a resident living in the same area as a child and an adult is 2.4E-6, which is also within the EPA acceptable risk range. The HI for a residential adult was estimated to be 5.0, and is above the target value of 1.0. For a residential child, the HI for exposure to areawide groundwater is 11.9, which is above the acceptable HI of 1.0, primarily from thallium and iron. All of the thallium was detected in the upgradient wells at AOC K (see Appendix D-8). A comparison of background wells versus the site wells is included below.

This risk assessment is very conservative and with a high level of uncertainty, as it is unlikely for the maximum concentrations of chemicals from different locations to be exposed to the same receptors (i.e., wells tend to be in a particular location). In addition, groundwater in the shallow aquifer is not usable for potable purposes. The measured inorganic chemicals were also associated with suspended particles in the groundwater. This risk assessment was conducted at the request of reviewing agencies for comparison purposes. Most of the estimated hazards are from inorganic chemicals from turbid samples collected from site-specific upgradient wells, and do not represent contamination from site operations, but rather represent the natural geochemical conditions in this area.

11.4 Comparison of Background Inorganic Chemical Concentrations to Site Concentrations

The site well inorganic chemicals were compared against the range of background concentrations, and are presented in Table 11-4. As can be observed from the table,

aluminum, chromium, and vanadium were higher in the site wells; all other chemicals were within background levels.

A comparison of the site-specific upgradient wells against the site wells is presented in Table 11-4, where well SWMU14-MW01 is upgradient of SWMUs 14 and 15 and AOC C. Wells AOC-K-MW01 and MW-03 are both upgradient of AOC K , and all other sites within the former Main Operations Area, and AOC F-MW01 is upgradient of AOC F. Figure 11-2 and Appendix B present the individual well concentrations for these wells. As can be noted from these individual well concentrations, the upgradient wells have the highest thallium levels at AOC K and several metals were elevated at the SWMU 14 upgradient well. All of these wells have high turbidity during sampling, while the methods followed for sampling are the standard protocols as per guidance.

11.5 Summary of Site Risks

The cancer risks from groundwater in the shallow water table are within acceptable limits for industrial workers and future residential receptors. Metals concentrations detected in the shallow groundwater resulted in hazards above acceptable limits. The primary contributor, thallium, was detected in the wells that are upgradient to the former Main Operations Area, and thus is not specific to any of the sites. Dissolved levels of all the metals are within the acceptable limits. None of the chemicals from site wells are above MCLs, and the observed metals are from suspended soil particles. Table 11-3 presents the risk summary for the areawide groundwater.

11.6 Conclusions and Recommendations

Health hazards that are associated with the potable use of the groundwater are not within acceptable limits. However, no chemicals exceeded the MCLs. There are no site-related chemicals in the groundwater, and the groundwater is located relatively deep (40 to 50 ft bls) at the site with very little possibility for soil-to-groundwater migration potential. The shallow wells are not fit for potable use due to low yield, and thus have little potential for actual exposure. NFA status is recommended for the site groundwater, due to the lack of MCL exceedances.

TABLE 11-1
COPC Selection for Areawide Groundwater
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Parameter	Units	Detects/No. of Samples	Maximum Detect	Minimum Detect	Mean of Detects	Tap Water PRG[a] (HI = 0.1)
Dieldrin	µg/L	1/13	0.01	0.01	0.01	0.0042
Aluminum	µg/L	12/13	18,800	152	3,667	3650
Antimony	µg/L	3/13	2.3	1.5	1.02	1.46
Barium	µg/L	1/13	390	20.2	143	255
Chromium	µg/L	12/13	30.8	2.2	9.85	10.9
Iron	µg/L	13/13	23,900	86	4,525	1,090
Manganese	µg/L	13/13	1,300	18	313	87.6
Thallium	µg/L	2/13	9.3	8	2.55	0.24
Vanadium	µg/L	13/13	83.9	6.9	30.2	25.5

[a] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002).
Http://www.epa.gov/region09/waste/sfund/prg/
Units are in µg/L (ppb)

TABLE 11-2

Potentially Complete Exposure Pathways and Receptors for Areawide Groundwater at the Former Main Operations Area

NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Future Receptor	Media	Exposure Route and Point of Exposure	Pathway Selected for Evaluation?	Reason for Selection or Exclusion
Industrial Worker	groundwater	Ingestion, and dermal contact exposures to COPCs in area groundwater	Yes	To assess the groundwater quality in the shallow aquifer across the PWA.
Residents (adult and child)	groundwater	Ingestion, and dermal contact exposures to COPCs in area groundwater	Yes	To assess the groundwater quality in the shallow aquifer across the PWA.

TABLE 11-3
Areawide Groundwater Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

	ELCR				HI			
Receptor	**Ingestion**	**Inhalation**	**Dermal**	**Total**	**Ingestion**	**Inhalation**	**Dermal**	**Total**
Industrial Worker								
	Groundwater				*Groundwater*			
	5.6E-07	0.0E+00	4.6E-10	5.6E-07	1.737	0.000	0.022	1.759
	Total				*Total*			
	5.6E-07	**0.0E+00**	**4.6E-10**	**5.6E-07**	**1.74**	**0.00**	**0.02**	**1.76**
Residential Adult								
	Groundwater				*Groundwater*			
	1.5E-06	0.0E+00	4.6E-10	1.5E-06	4.864	0.000	0.166	5.030
	Total				*Total*			
	1.5E-06	**0.0E+00**	**4.6E-10**	**1.5E-06**	**4.86**	**0.00**	**0.17**	**5.03**
Residential Child								
	Groundwater				*Groundwater*			
	8.8E-07	0.0E+00	4.6E-10	8.8E-07	11.349	0.000	0.511	11.860
	Total				*Total*			
	8.8E-07	**0.0E+00**	**4.6E-10**	**8.8E-07**	**11.35**	**0.00**	**0.51**	**11.86**

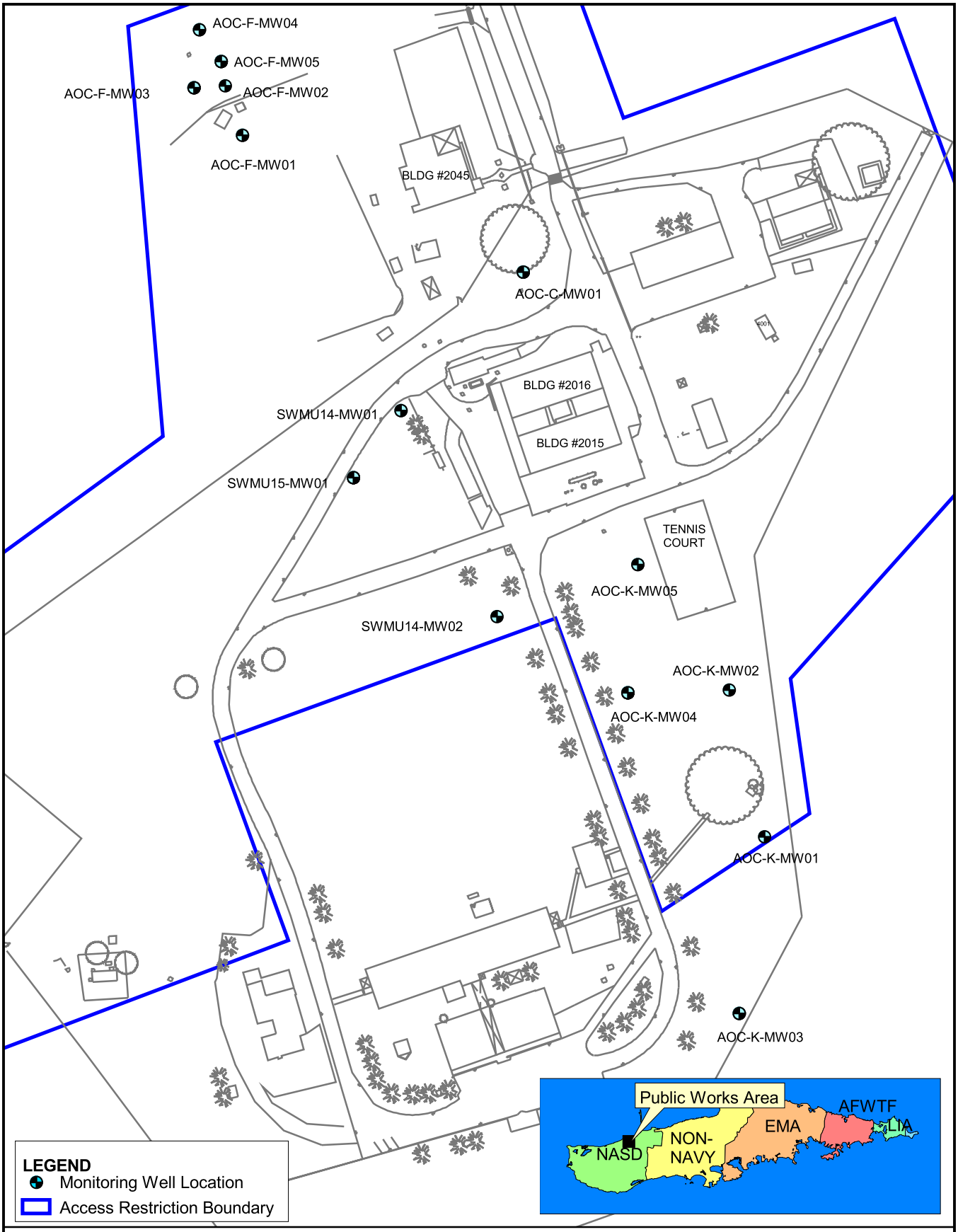
TABLE 11-4
Background Range of Concentrations for Groundwater Compared to Areawide Well Concentrations
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Parameter	Units	Range of Background Concentrations		Maximum Detected Site Concentration	Average Detected Site Concentration
		Minimum	Maximum		
Aluminum	µg/L	130	3,500	18,800	3,667
Antimony	µg/L	5.10	5.20	1.60	1.02
Barium	µg/L	15	960	390	142
Chromium	µg/L	3.7	6.8	31	9.85
Iron	µg/L	480	4,800	23,900	4,525
Manganese	µg/L	100	17,000	1,300	313
Thallium	µg/L	4.8	18	9.3	2.55
Vanadium	µg/L	1.8	75	83.9	30.2

µg/L = micrograms per liter or part per billion (ppb)

UTL Upper tolerance limit

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr



N

0 40000 80000 Feet

Figure 11-1
Monitoring Well Locations in the Public Works Area
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

File Path: c:/18GIS/Vieques/aprs/nfasites_may2003.apr

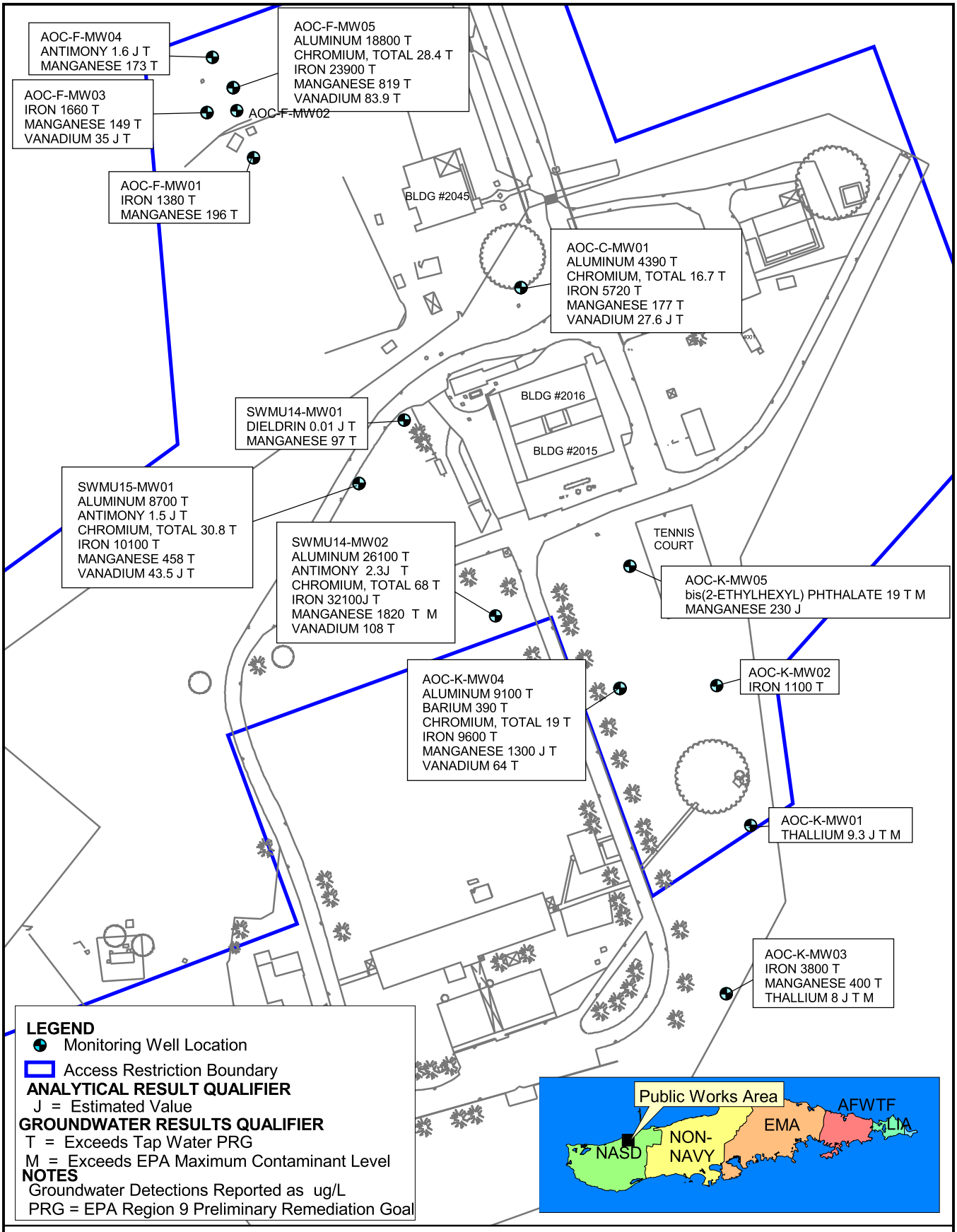


Figure 11-2
Groundwater Detections Above Screening Critieria
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

SECTION 12

Summary and Recommendations by Site

A screening levels evaluation for each site was conducted as part of the Expanded PA/SI reports. This report includes a risk-based evaluation for the data previously collected and presented in the PA/SI reports. A total of nine sites at the former NASD are recommended for NFA. Detailed site-specific recommendations for each site are provided in the previous sections and summarized in this section. An ecological assessment was conducted as part of the Expanded PA/SI, and concluded that the sites are similar to the control areas, and thus do not have significant impact from historical operations on ecological receptors in the area. The draft NFA report was reviewed by EPA Region 2 and PREQB, and during the comments it was recommended that a NASD-wide groundwater evaluation be conducted. Section 11.0 of this draft final report presents the areawide groundwater risk assessment.

The COPCs identified for all media including surface soil, subsurface soil, and groundwater are included in Table 12-1, and present the conclusions as to whether they are related to the site. The cancer risk and HI summary for various exposure scenarios is presented in Table 12-2. A comparison of the site metals COPCs against background metals is included at the end of each site-specific section. As can be noted from these tables, with the few exceptions of some metals in groundwater with high turbidity, all are within the range of background levels.

No evidence exists to suggest that a release of hazardous materials occurred at these sites as a result of historical site-related activities. All the cancer risks were well within acceptable limits. The HI estimate values greater than a value of 1.0 were all from inorganic chemicals that were detected in groundwater and soil. The inorganic chemicals in groundwater were from particulate matter in the water samples, which could not be avoided due to the natural conditions of the shallow water table in this area of the island. The potential sources of contamination near the former Main Operations Area have been removed. No further investigation or remedial action for the soils or groundwater is necessary for the protection of human health or the environment, based on an analysis of available soil and groundwater sample results and pertinent information for these sites. Therefore, the selected remedial alternative for the soils and groundwater at these sites is NFA. No additional sampling or monitoring of the soils or groundwater will be necessary because the site-related conditions at these sites are protective of human health and the environment. As a result of the NFA alternative, no further groundwater monitoring will be required for CERCLA.

12.1 SWMU 5 – Former IRFNA/MAF-4 Disposal Site

SWMU 5 is in the vicinity of the former NASD near Magazine Building 422. SWMU 5 is a location where, in 1975, approximately 7,000 lbs of fuel were emptied from leaking AQM-37A target drones into a low spot in a road near Building 422. The fuel contained 5,275 lbs of IRNFA and 1,775 lbs of MAF-4, which were emptied into an intermittent stream. No COPCs related to the disposal of IRFNA/MAF-4 were identified in surface or subsurface soil. The only COPC for SWMU 5, benzo[a]pyrene in surface soil, is not likely site-related and may be

associated with migration of PAHs from the asphalt road or vehicle emissions to the adjacent ditch. The risks at SWMU 5 are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential receptors. No COPCs were identified in the subsurface soil, thus there are no exposure pathways. SWMU 5 does not present a health risk to current or future receptors.

12.2 SWMU 10 – Former Waste Paint and Solvents Disposal Ground

SWMU 10 consists of an area of soil outside the Former Paint Locker, Building 4001, in the Public Works Area of the former NASD. SWMU 10 was in use from the mid-1970s . Small quantities (less than 1 gallon) of paints, solvents, and thinners which may have been disposed of on the ground outside Building 4001 from approximately 1971 to 1990. Signs were posted at SWMU 10 to restrict access until the CERCLA process is completed in the surrounding area.

Five metals (arsenic, chromium, manganese, thallium, aluminum, and iron) were selected as COPCs. The cancer risks and HI values are within acceptable limits for maintenance workers, industrial workers, construction workers, recreational receptors, and residential adult exposure. For a residential child, the HI slightly exceeds the target value, primarily from iron in surface soils. However the target organ-specific cumulative HI is less than 1.0, thus no exceedence is noted for future child exposure scenario. Iron concentrations in surface soils are within the range of background concentrations found at the former NASD. Therefore, any health hazard that may be estimated in SWMU 10 soils from iron is not site-specific.

12.3 SWMU 14 – Former Wash Rack

SWMU 14 is immediately west of the Transportation Shop (Building 2016) in the Public Works Area and had been in use from the late 1970s until December 2000. The area is a concrete driveway with 4-inch-high curbs on each side and ramps on each end, measuring approximately 20 ft long by 10 ft wide. The area was used primarily for cleaning Navy vehicles. The concrete bermed area drained into an OWS prior to discharge to an open ditch. A swale at the end of the unit facilitates the discharge of runoff water to the ditch, which eventually discharges to the Atlantic Ocean. The OWS associated with SWMU 14 was removed in December 2000. Field testing of soils during the removal activities indicated no evidence of contamination. A chain-link fence and signs were installed around SWMU 14 and will remain in place until the CERCLA process is completed for the surrounding area.

COPCs selected for SWMU 14 included six metals (aluminum, arsenic, iron, manganese, thallium, and vanadium) in surface soils, metals aluminum, iron, and thallium in subsurface soil, and one pesticide (dieldrin) in groundwater. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, construction workers, recreational receptors, and residential adult receptors. There is some slightly elevated health hazard associated with ingestion of groundwater by an industrial worker from iron. For a residential child, the HI exceeds the target value, primarily from iron in surface soils and groundwater. However, iron is commonly detected at similar

concentrations across the former NASD at most sites, and thus represents the site soil mineralogy and groundwater suspended particles. A well upgradient of this site has higher metals concentrations than the site well. This site does not present an excessive risk or hazard to human health from site-specific conditions.

12.4 SWMU 15 – Former Waste Transportation Vehicle Parking Area

SWMU 15 was a Navy truck parking area in the vicinity of the Transportation Shop in the Public Works Area. The truck contained drums of a waste labeled as caustic D002 (EPA code for corrosive waste). The drums allegedly contained napalm from NSRR. The truck contained 55-gallon metal drums and overpack drums. The waste drums and transport vehicle were removed from SWMU 15. A chain-link fence and signs were installed around SWMU 15 and will remain until the CERCLA process is completed for the surrounding area.

Seven metals (aluminum, arsenic, chromium, iron, manganese, thallium, and vanadium) and one SVOC (benzo[a]pyrene) were selected as COPCs for surface soil; five metals (aluminum, antimony, iron, manganese, and vanadium) were selected as COPCs for groundwater. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential adult receptors. For a residential child, the HI exceeds the acceptable limit, primarily from iron in surface soils and groundwater. There is no historical evidence to suggest any activities at this site would have resulted in the release of iron to surface soils or groundwater. Similar iron levels were detected in several other sites located within this area. The background samples also had the same metals at similar concentrations. The cancer risks and HI estimates are within acceptable limits for maintenance workers, industrial workers, and recreational receptors, the hazard to future residents were above a value of 1.0 from metals in soil and groundwater. Iron concentrations in surface soils and groundwater are within the range of background concentrations found at the former NASD. Groundwater samples had high turbidity, resulting in particulate-bound metals being measured as water concentrations. The dissolved metals levels are similar in background levels and site well concentrations. Therefore, this site is recommended for NFA due to the absence of unacceptable risks to human health, and the observed metals concentrations that are similar to background levels.

12.5 AOC B – Former Wastewater Treatment Plant

AOC B is the former WWTP in the former Main Operations Area. The WWTP served as the primary treatment system for the former NASD. The WWTP consisted of one aeration tank and one separation tank with two blowers to supply air for biological treatment. Effluent from the former WWTP drained into a series of four lagoons, which has no discharge point.

Six metals (aluminum, arsenic, iron, manganese, thallium, and vanadium) were identified as COPCs surface soil. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, construction workers, recreational receptors, and residential adult receptors. For a residential child, the HI slightly exceeds the target value, primarily from the iron in surface soils. However, iron levels are similar to the

background soil iron levels. Therefore, any health hazard that may be present in AOC B soils is not site-specific. Due to the absence of site-related risks, AOC B is recommended for NFA status.

12.6 AOC C – Drainage Ditch at Former Transportation Shop

AOC C is located in the Public Works Area near the former Transportation Shop. Two drainage ditches near the shop routinely handled stormwater runoff during rain events. An oily sheen was observed in one of the ditches during a visual site inspection in 1988. Also located in this area is a septic tank that collects wastewater from one sink inside the Transportation Shop.

Only metals were selected as COPCs in surface soil (aluminum, arsenic, iron, manganese, thallium, and vanadium), subsurface soil (aluminum, iron, and thallium), and groundwater (aluminum, chromium, iron, manganese, and vanadium). The cancer risks and health hazard effects of these metals are within acceptable limits for maintenance workers, industrial workers, construction workers, recreational receptors, and residential adult receptors. For a residential child, the HI exceeds the acceptable limit, primarily from iron in surface soils and groundwater. Therefore, due to the absence of unacceptable human health risks that are specific to the site, AOC C is recommended for NFA status.

12.7 AOC F– Former UIC Septic Tank

AOC F is near the Enlisted Men's Club in the Public Works Area. The septic tank has a capacity of 1,500 gallons. A preliminary investigation in July 1997 identified several metals present at concentrations that exceeded the applicable screening criteria. This site was further investigated in the Expanded PA/SI investigation.

Metals selected as COPCs included aluminum, arsenic and iron in subsurface soils and five (aluminum, antimony, chromium, iron, manganese, and vanadium) in groundwater. The health HIs were greater than target value of 1.0 for an industrial worker, residential adults, and residential children due to iron in groundwater. Metals concentrations (particularly dissolved metals) are similar to background groundwater concentrations. Due to the absence of contamination above the background levels, and the absence of human health cancer or non-cancer hazards, the site is recommended for NFA.

12.8 AOC K – Former Water Well

AOC K consists of one 8-inch-diameter well completed to 69 ft bls northeast of the barracks in the Public Works Area. The well was utilized for potable water supply between 1941 and 1979, but has since been abandoned. The AOC K well was rehabilitated in 1997 as part of an water well investigation conducted by the USGS at the former NASD. The well was resampled in 2000 for benzene, ethylbenzene, toluene, and xylene, and none was detected.

Six metals (aluminum, barium, iron, manganese, thallium, and vanadium) were selected as COPCs for groundwater. The health hazard effects are within acceptable limits for an industrial worker. There is some slightly elevated HI associated with residential adult

exposure to thallium in groundwater but it is within the range of acceptable health effects. For a residential child, the HI exceeds the acceptable limit, primarily from thallium and iron in groundwater. However, thallium was detected only in upgradient wells, and is associated with the high turbidity in groundwater samples. Thus, it represents site-specific background levels or turbidity in the groundwater samples. Iron concentrations in groundwater are within the range of concentrations found across areas upgradient of sites with no known hazardous waste activities (i.e., uncontaminated areas) of the former NASD; these may be the result of a widespread presence of this and other inorganic metals in Vieques Island soils, which may be suspended in water samples. Therefore, any health hazard that may be present in AOC K groundwater from iron or thallium is not related to the former water supply well. No benzene was detected. Therefore, the site is recommended for NFA.

12.9 AOC L – Abandoned Septic Tank

AOC L consists of a 25-ft by 40-ft concrete septic vault with separate compartments near the beach north of the Public Works Area. It is suspected that the vault was used in 1941 for treatment and disposal of installation sewage. The vault has been out of service since 1942. There are no indications that the vault was used for industrial purposes.

Four metals (aluminum, arsenic, iron, manganese) were selected as COPCs for surface soil and subsurface soil. The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential adult receptors. For a residential child, the HI is equal to the target value of 1.0, primarily from iron in surface soils. However, iron concentrations are within the range of background concentrations, and there is no reason to suggest that iron is a site-related COPC. This site does not present an unacceptable risk to human health, therefore was recommended for an NFA.

12.10 Areawide Groundwater Evaluation – Former Public Works Area

Groundwater samples were collected from several sites within former Public Works Area that include wells installed to investigate groundwater at six of the nine sites identified within the Main Operations/Public Works Area of the former NASD, and these sites include SWMUs 14, 15, AOC C, AOC F and AOC K. The wells from the five NFA sites included in this NFA are evaluated in this section to determine area-wide groundwater quality within the PWA area and also to determine the potential exposure related risks from potable use of the area groundwater. The shallow water table in this area is not of adequate producing capacity to serve as a potable source, as observed during well monitoring at different sites during the two phases of PA/SI. Thus this evaluation is primarily for a comparison purpose, at the request of the reviewing agencies, EPA and EQB on the draft NFA report review.

The cancer risks from groundwater in shallow water table are within acceptable limits for industrial workers, and future residential receptors. Metal concentrations detected in shallow groundwater resulted in hazard indices above acceptable limits. The primary

contributor, thallium, is from the upgradient wells to AOC K. Thus it is upgradient of all the sites within the Public Works Area, and is not specific to any of the sites. Secondary contributor is the iron, which is similar in concentration to the background levels, and found across the area in many wells. Additionally detected metals were elevated in background and site wells due to turbidity in the samples which could not be avoided due to the nature of low yield aquifer occurring in this area. Observed metals are from suspended soil particles in water samples, though sampling following the EPA protocol. Dissolved levels of all the metals are within the acceptable limits. None of the chemicals from site wells are above MCLs.

TABLE 12-1
Recommendations for Nine Sites
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Site ID	Description	COPCs	Unacceptable Human Health Risk?	Are COPCs Site Related?
SWMU 05	Former IRFNA/MAF-4 Disposal Site	Benzo(a)pyrene	No	NA
SWMU 10	Former Waste Paint and Solvents Disposal Ground	Aluminum, arsenic, Chromium, iron, manganese, and thallium	No	No
SWMU 14	Former Wash Rack	Aluminum, arsenic, chromium, iron, manganese, thallium, vanadium, and dieldrin	No	No
SWMU 15	Former Waste Transportation Vehicle Storage Area	Aluminum, arsenic, chromium, iron, manganese, thallium, vanadium, and benzo(a)pyrene	Yes	No
AOC B	Former Wastewater Treatment Plant	Aluminum, arsenic, iron, manganese, thallium, and vanadium	No	No
AOC C	Drainage Ditch at Former Transportation Shop	Aluminum, arsenic, iron, manganese, thallium, and vanadium	Yes	No
AOC F	Former UIC Septic Tank	Aluminum, antimony, arsenic, chromium, iron, manganese, thallium, and vanadium	Yes	No
AOC K	Former Water Well	Aluminum, barium, chromium, iron, manganese, thallium, and vanadium	Yes	No
AOC L	Abandoned Septic Tank	Aluminum, arsenic, iron, and manganese	No	No
Areawide Groundwater	Groundwater as Single Unit under Public Works Area	Aluminum, antimony, barium, chromium, iron, manganese, thallium, vanadium	Yes	No

TABLE 12-2
Risk Summary
NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

Receptor	Site Risk	SWMU 05	SWMU 10	SWMU 14	SWMU 15	AOC B	AOC C	AOC F	AOC K	AOC L	Combined Groundwater
Maintenance Worker	ELCR	8.7E-08	5.2E-07	2.2E-07	3.1E-07	6.0E-08	1.4E-07	NA	NA	1.3E-07	NA
	HI	0	0.021	0.027	0.025	0.020	0.020	NA	NA	0.017	NA
Industrial Worker	ELCR	4.2E-07	2.5E-06	1.6E-06	1.5E-06	2.9E-07	6.7E-07	NC	NC	6.3E-07	5.6E-07
	HI	0	0.10	0.13	0.77	0.088	0.43	1.3	1.5	0.08	1.8
Recreational Adult	ELCR	2.2E-07	1.1E-06	4.8E-07	6.9E-07	1.3E-07	3.0E-07	NA	NA	2.8E-07	NA
	HI	0	0.044	0.057	0.052	0.041	0.041	NA	NA	0.035	NA
Recreational Child	ELCR	2.9E-07	2.1E-06	9.0E-07	1.2E-06	2.4E-07	5.6E-07	NA	NA	5.3E-07	NA
	HI	0	0.36	0.47	0.42	0.35	0.35	NA	NA	0.30	NA
Construction Worker	ELCR	NA	NC	NC	NA	NC	NC	NC	NA	4.8E-08	NA
	HI	NA	0.14	0.24	NA	0.25	0.23	0.26	NA	0.17	NA
Residential Adult	ELCR	4.6E-07	3.1E-06	2.8E-06	1.8E-06	3.6E-07	8.4E-07	NC	NC	7.9E-07	1.5E-06
	HI	0	0.14	0.20	2.1	0.13	1.1	3.7	4.3	0.11	5.0
Residential Child	ELCR	9.6E-07	7.1E-06	3.9E-06	4.0E-06	8.2E-07	1.9E-06	NC	NC	1.8E-06	8.8E-07
	HI	0	1.2	1.6	6.0	1.2	3.6	8.7	10.1	1.0	11.9

ELCR = Excess Lifetime Cancer Risk

HI = Hazard Index

NA = Not Applicable NC = No carcinogenic COPCs identified

SECTION 13

References

A.T. Kearney, Inc. and K.W. Brown & Associates, Inc. *Phase II RCRA Facility Assessment of the Naval Ammunition Facility, Vieques Island, Puerto Rico*. October 1988.

Acevedo-Rodriguez, P. *Flora of St. John; U.S. Virgin Islands*. The New York Botanical Garden. Bronx, New York. 1996.

Baker Environmental, Inc. *Final Preliminary Assessment Narrative Report Site Inspection Forms and PA Score, Sites 1, 2 and 3, US Naval Station, Roosevelt Roads, Puerto Rico.* October 1992.

Baker Environmental, Inc. *Positive Detection Summary in Groundwater, Vieques Site, Puerto Rico.* November 15, 1999.

Baker Environmental, Inc. *Results of the Hydrogeologic Investigation, Vieques, Puerto Rico.* November 4, 1999.

CH2M HILL. *Investigation-Derived Waste Management Plan for the U.S. Naval Ammunition Storage Detachment*. Vieques, Puerto Rico. May 2000.

CH2M HILL. *Master Work Plan for the U.S. Naval Ammunition Storage Detachment, Vieques, Puerto Rico*. May 2000.

CH2M HILL. *Site-Specific Work Plan for the U.S. Naval Ammunition Storage Detachment, Vieques, Puerto Rico*. April 2000.

CH2M HILL. *Phase I Expanded Preliminary Assessment/Site Investigation, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico*. October 2000.

CH2M HILL. *Final Expanded Preliminary Assessment/Site Investigation Phase II, Seven Sites, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico*. November 2002.

CH2M HILL. *Draft NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico*. November 20, 2002.

CH2M HILL. *AOC E Site Characterization Study*. 1999.

Environmental Science and Engineering, Inc. *Confirmation Study to Determine Possible Dispersion and Migration of Specific Chemicals – U.S. Naval Station, Roosevelt Roads, Puerto Rico and U.S. Naval Ammunition Facility, Vieques: Evaluation of Data from First and Second Rounds of Verification Sample Collection and Analysis*. May 1986.

Greenleaf/Telesca Planners, Engineers, Architects, Inc. and Ecology and Environment, Inc. *Initial Assessment Study, Naval Station Roosevelt Roads, Puerto Rico.* September 1984.

Liogier, H.A. and L.F. Wadsworth. *Flora of Puerto Rico and Adjacent Islands: A Systematic Synopsis.* Editorial de la Universidad de Puerto Rico, Rio Piedras, Puerto Rico. 1982.

Liogier, H.A. *Descriptive Flora of Puerto Rico and Adjacent Islands; Spermatophyta*. Vol. 2 Leguminosae to Anacardiaceae. Editorial de la Universidad de Puerto Rico, Rio Piedras, Puerto Rico. 1988.

Liogier, H.A. *Descriptive Flora of Puerto Rico and Adjacent Islands; Spermatophyta*. Vol. 3 Leguminosae to Anacardiaceae. Editorial de la Universidad de Puerto Rico, Rio Piedras, Puerto Rico. 1994.

Liogier, H.A. *Descriptive Flora of Puerto Rico and Adjacent Islands; Spermatophyta*. Vol. 4 Leguminosae to Anacardiaceae. Editorial de la Universidad de Puerto Rico, Rio Piedras, Puerto Rico. 1995.

Liogier, H.A. *Descriptive Flora of Puerto Rico and Adjacent Islands; Spermatophyta*. Vol. 5 Leguminosae to Anacardiaceae. Editorial de la Universidad de Puerto Rico, Rio Piedras, Puerto Rico. 1997.

Little, E.L., and F.H. Wadsworth. *Common Trees of Puerto Rico and the Virgin Islands*. Agriculture Handbook No. 249. U.S. Department of Agriculture, Forest Service, Washington, D.C. 1964.

Little, E.L., R. Woodbury, and F.H. Wadsworth. *Trees of Puerto Rico and the Virgin Islands*. Vol. 2. Agriculture Handbook No. 449. U.S. Department of Agriculture, Forest Service, Washington, D.C. 1964.

Program Management Company. *Environmental Baseline Survey*. October 2000.

Raffaele, H., J. Wiley, O. Garrido, A. Keith, and J. Raffaele. *A Guide to Birds of the West Indies.* Princeton University Press, Princeton, N.J. 1998.

Raffaele, H.A. *A Guide to the Birds of Puerto Rico and the Virgin Islands*. Princeton University Press, Princeton, N.J. 1989.

U.S. Navy. *Final Report, Survey of Potential Habitat for Yellow-Shouldered Blackbird on U.S. Naval Station Roosevelt Roads, Puerto Rico*. Legacy Resource Management Program, Atlantic Division, Naval Facilities Engineering Command, Norfolk Va. And U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico, 15 p. 1996.

United States Geological Survey. Water Resources Investigations. *Reconnaissance of the Groundwater Resources of Vieques Island, Puerto Rico.* Report 86-4100 (by Sigfredo Torres-Gonzalez). 1989.

U.S. Environmental Protection Agency (EPA). *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses.* USEPA, January 1993.

U.S. Environmental Protection Agency (EPA). *Contract Laboratory Program National Functional Guidelines for Organic Data Review.* USEPA, February 1994.

U.S. Environmental Protection Agency (EPA). *Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites*. EPA/540/S-96/500. December 1995.

U.S. Environmental Protection Agency (EPA). Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. October 1998.

U.S. Environmental Protection Agency (EPA). Risk Assessment Guidance for Superfund (RAGs), Volume 1, Human Health Evaluation Manual (Part A). EPA/540/1-89/002. 1989.

U.S. Environmental Protection Agency (EPA). Guidance for Data Usability in Risk Assessment. EPA/540/G-90/008. 1990.

U.S. Environmental Protection Agency (EPA). Exposure Factors Handbook. EPA/600/P-95/022Fa. 1997.

U.S. Environmental Protection Agency (EPA). Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manul Supplemental Guidance: "Standard Default Exposure Factors." 1991.

Appendix A
Responses to Comments from USEPA and PREQB

COMMONWEALTH OF PUERTO RICO
OFFICE OF THE GOVERNOR
ENVIRONMENTAL QUALITY BOARD

Evaluation of "Draft No Further Action Report for Nine Sites, Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico, Volumes 1 and 2, dated November 2002.

I. Overview

The Navy has submitted for review a No Further Action report for nine (9) sites previously considered within Preliminary Assessments/Site Investigations (PA/SI) at the Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico. TRC reviewed the above-referenced document to evaluate the appropriateness of the risk assessment and NFA recommendations. TRC considered the following documents during this review:

- Risk Assessment Guidance for Superfund (RAGS), Parts A – EPA/540/1-89-002, Part B – PB92-963333, Part C – PB92-963334, Part D – Publication 9285.7-01D, and Part E – EPA/54-/R/99/005.
- Draft Expanded Preliminary Assessment/Site Investigation, Phase II Seven Sites, CH2MHill, Tampa, Florida, July 2001.
- Final Expanded Preliminary Assessment/Site Investigation, Phase II Seven Sites, CH2MHill, Tampa, Florida, November 2002.
- Phase I Expanded Preliminary Assessment/Site Investigation, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico, October 2000.

TRC comments are organized below into the following sections: Section 1 – Major Comments, Section 2 – General Comments, Section 3 – Comments Previously Provided to the Navy, and Section 4 – Page-Specific Comments.

1. Major Comments

1. The finding of NFA is premature since site characterization has not been adequately conducted and the risk assessment can only be performed after the nature and extent have been completely delineated as detailed in Section 3 for all SWMUs/AOCs.

   Response: We disagree with this comment. During the initial survey, the EPA, Navy, and Environmental Quality Board (EQB) identified a list of 17 sites across the Naval Ammunition Support Detachment (NASD), with the understanding that not all of them may qualify as sites requiring a full Remedial Investigation/Feasibility Study (RI/FS) or RCRA Facility Investigation (RFI)-type of investigation. A work

plan was submitted for the initial sampling effort for each of the agencies to review. Depending on the team agreements that were reached, investigations were conducted. Per the results of these investigations, those sites that did not have contamination were proposed for no further investigation. These nine sites are proposed for NFA and are grouped together in this report.

The general statement that the site characterization has not been adequately conducted is unacceptable, as it implies that none of the nine sites has been adequately characterized. If data gaps are identified on a site-specific basis, they may be discussed accordingly. In order to further clarify the site investigation history, additional text will be added to the Background section in the Introduction (Section 1.0).

2. The Navy must provide a reference and a summary of historical munitions assessments (including interviews), independent third-party confirmation of aerial photographic analyses, general magnetometer surveys of the Naval Ammunition Support Detachment (NASD), and site-specific surveys for munitions and unexploded ordnance (UXO). The report must discuss situations in which study results indicated the absence of munitions that were subsequently found to be erroneous (false-negative) and the corrective actions performed. The Navy must provide a clear association of all potential source areas with historical data, site operations, and the rationale for selection of sampling locations. This must be provided prior to finalizing site characterization and risk assessments.

   Response: The comment above is not pertinent to the subject report. As noted in the Environmental Baseline Survey (EBS), none of the nine sites has any UXO-related issues or surprise findings, as may be inferred by the comment. An archive records search revealed that no munitions were stored, used, or disposed of in the vicinity of any of the nine NFA sites. The rationale for sampling locations were adequately presented and discussed during work planning and the subsequent Preliminary Assessment/Site Investigation (PA/SI) report preparation. A risk assessment was added to this report in order to address comments regarding the PA/SI. Additional text will be incorporated into the Introduction (Section 1.0) in order to further describe activities performed during the UXO investigations at the nine sites that are proposed for NFA. **(MARTY TO PROVIDE)**

3. Prior to finalizing a risk assessment, the Navy must demonstrate that no munitions or related items (pyrotechnics, propellants, smokes, etc.) were stored, handled, used, managed, or disposed of at the subject AOCs/SWMUs. At any site where the potential for munitions use exists, results of analyses for explosives, perchlorate, firing by-products, and breakdown product compounds must be provided for all environmental samples. Analytical results must be provided with detection limits below health-based criteria (MCLs, Region 9 PRGs). Any assessment of perchlorate must consider that ongoing risk evaluations at other military installations are likely to adopt a 1.5 μg/L standard.

Response: Comment is noted. The sites were investigated according to the agreement reached with the reviewing team. Also, an archived records search did not detect any munitions usage or disposal in the vicinity of any of the nine sites. A full Target Compound List/Target Analyte List (TCL/TAL) list was analyzed for each medium at these sites proposed for NFA. As indicated during site historical surveys and the EBS, no munitions-related operations occurred in any of the nine sites. Any site having an historical association with munitions was not grouped into this set of sites proposed for NFA. Thus, no munitions-related operations occurred within any of the sites identified in this report. Solid Waste Management Unit (SWMU) 15 was investigated for any hazardous waste list in the Napalm, as discussed in the report.???

If a site is designated for further investigation, the most current sampling and analysis protocols will be followed, as presented in the respective site work plans. This includes analysis for munitions and perchlorates. Additional text will be added to the Introduction (Section 1.0), which details information regarding historical investigations at the sites that did not indicate the presence of munitions-related operations in this area of the former NASD.

4. The NFA recommendations do not include an ecological assessment. The NFA report should describe in detail the data, results, and findings from the ecological risk assessment.

   Response: The PA/SI report concluded that no such release was evident at the nine sites proposed for NFA, according to the results of an investigation to determine whether a contaminant release had occurred. Thus, there was no need to conduct a detailed Ecological Risk Assessment (ERA).

   Eight of the nine sites in this report are located in the administration area of the former NASD. This area is devoid of natural habitat, and due to its historic use, does not contain any potentially endangered habitat. In addition, as stated in the PA/SI report, an ecological survey conducted in the area identified no impacts to the ecology in the area. Therefore, there was no need to conduct an ERA for these nine sites. This was also proposed in the work plan and discussed with the team, with the rationale that an ERA would not provide any additional benefit to site management decisions performed for these developed areas. Additional text will be included in the site-specific sections of the revised report to present the results and conclusions of the ecological survey, that were originally presented in the PA/SI report.

5. Analytical data from groundwater samples must be obtained to demonstrate an absence of hazardous and munitions-related constituents at the following AOCs/SWMUs: SWMU 5, SWMU 10, AOC B, and AOC L. The Navy has not conducted groundwater sampling based on the assertion that the absence of contamination in surface and subsurface soil supports an anticipated absence of contamination in groundwater. However, migration via soil leaching may have depleted contaminants from the soil possibly to levels below screening criteria and

resulted in contamination of groundwater. The Navy must conduct a quantitative risk assessment for ground water.

Response: This response will address each site separately, and some of the following text will be incorporated into the appropriate site-specific sections of the revised report.

At SWMU 5, the alleged release was a surface release into a drainage ditch. As a result, surface soil samples were collected. In addition, subsurface soil samples were collected to assess if there were any impacts at depth. The surface and subsurface samples did not detect any site contaminants. The subsurface soils were evaluated using (OVM) readings, as reported in Appendix B of the PA/SI report. During the soil sampling, no groundwater was encountered when borings were extended up to the rock underneath the site. Thus, there is no shallow groundwater at this site, above the thick grandiorite rock that underlines this area. Accordingly, groundwater could not be sampled at this site.

At SWMU 10, most of the expected contaminants were inorganic toxic metals that are typically present in paints. These metals tend to remain bound to soils upon release, and do not migrate through the soil column. As described in the section which details the site historical operations, the site was a small storage shed that stored paint tins in pint and quart sizes. They did not present a large enough volume to be a mobility to groundwater concern. Additionally, none of the surface or subsurface soil samples contained any of the site-related contaminants. As a result, groundwater sampling was not deemed necessary for this site. Comment No. 2, by the EPA geologist, also addresses this issue. The information provided in this response will be incorporated into the revised report.

AOC B is wastewater lagoon that once received domestic sewage water. Sampling was conducted on the wastewater, the lagoon sediments, and the underlying soils. None of the lagoon sediments or underlying subsurface soils contained any hazardous material, except for metals which are naturally occurring. There is no evidence that a release occurred and monitoring wells were not warranted at this site.

AOC L is a partially aboveground concrete vault, which is likely associated with the past use of the area prior to the Navy's ownership. The vault had an overflow outlet located above land surface. The structure was not a subsurface septic vault. Surface soils and subsurface soils were collected at the surface outfall and around the perimeter of the vault. No hazardous waste-related chemicals were detected in site surface or subsurface soils. Therefore, there were no indications of any contaminant releases at this site, and as a result no monitoring wells were installed at the site.

In conclusion, the soil contaminant conditions at these sites do not indicate a need for further characterization. Due to absence of contamination at these sites, site closures are requested without further investigation.

2. General Comments:

1. The U.S. Environmental Protection Agency's Risk Assessment Guidance for Superfund (RAGS) Part D Format should be used for presenting data tables in the risk assessment. The current tables do not present the data in a manner that facilitates independent review. This common industry standard improves transparency, clarity, and consistency.

   Response: A similar comment was made by the EPA. While we feel that the existing format provides the information and analysis of the data required to complete the risk assessment, application of RAGS Part D formatting for these NFA sites will be implemented as requested by EPA and the EQB. This format will also be consistent with future RI/FS site risk assessments.

2. The procedures used to screen subsurface soils may not be protective of human health because the risk assessment does not address exposure from direct contact to subsurface soil (e.g., utility/construction worker). The Region 9 Preliminary Remediation Goals (PRGs) do not address short-term exposures. However, the PRG guidance document states that for pathways not covered by PRGs, a risk assessment specific to these additional pathways may be required. Note: Region 9 PRGs can be used as a conservative measure to screen for chemicals of potential concern (COPCs) for the subsurface soil. In addition, risk associated with the potential exposure to groundwater for the utility/construction worker should be evaluated. Finally, the Conceptual Site Models for each solid waste management unit and area of concern (SWMU/AOC) should include the utility/construction worker for exposure to surface soil, subsurface soil, and groundwater.

   Response: The subsurface soil samples of up to 10-ft depths will be evaluated for direct exposure to a future utility/construction worker exposure scenario. EPA has also requested that this analysis be conducted. In the original draft NFA report this pathway was not evaluated because none of the nine sites had buried wastes (e.g., landfill sites). Most of the subsurface chemicals are naturally occurring metals, as is described in each site-specific section, making this a very conservative risk assessment. The utility/construction worker scenario will be added to the revised report.

   Groundwater in this area is deeper than 20 ft, which is much deeper than typical construction excavation depths, and as a result will not be added to the utility/construction worker scenario. The Conceptual Site Models (CSMs) will be modified to include a construction/utility worker exposure scenario for subsurface soils, and will be included in the revised report.

3. Details pertaining to media-specific sampling procedures, including sampling depths should be provided in the report. This information is necessary in order determine if appropriate sampling procedures were used during data collection and to determine if depths and locations are appropriate relative to potential receptors.

Response: The comment is unclear. Sampling and analysis procedures were provided in the work plans, which were reviewed and approved by EPA. Sample depths were detailed in the PA/SI reports (see corresponding data tables), and appendices were included which presented the sample boring logs. Appendix B of this NFA report lists the results by sample, and includes the upper and lower depth information for each soil sample. For further clarification, a paragraph will be added to Section 1.0 in the revised report which describes the sampling approach and the sample depths for the across the nine sites proposed for NFA sites.

4. The complete data set, including quantitation limits must be provided in the report. This information is essential for conducting a through review of the data and is needed to verify that COPCs were calculated correctly.

   Response: All analytical data and associated Data Quality Evaluation (DQE) was presented in Appendix J of the Expanded PA/SI Report, Volume II (October 2000), and in Appendix H of the Phase II Expanded PA/SI Report, Volume II (July 2001). These appendices include all analytical data, including sample specific analytical quantitation limits. A reference to these appendices will be added to the revised report in Section 1.0, along with clarification that the DQE was conducted during the PA/SI. Any pertinent findings will also be included in the text of the revised report.

5. A summary of quality assurance and quality control (QA/QC) of the data needs to be provided in the report. This information is essential in determining if the data are usable for risk assessment.

   Response: Appendix K of the Expanded PA/SI Report, Volume II, and Appendix I of Phase II Expanded PA/SI Report, Volume II include the DQE reports for all analytical data. Only validated data were used in the risk assessments conducted for these nine sites. A clarification to this effect will be added to Section 1.0 of the revised report.

6. Units need to be provided for all factors shown in tables provided in the appendices of this report. This is especially important for the risk calculation spreadsheets. Please provide units for all data and other factors used in the risk calculations.

   Response: The units for all factors shown in the tables of the report are currently included as footnotes. However, in the revised report the units will be presented within the tables for clearer identification, and any missing units will be provided.

7. Details pertaining to the evaluation of background samples should be summarized in the report. The determination of background should be based on the U.S. Environmental Protection Agency (EPA) Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, (September 2002). Documentation needs to be provided that demonstrates that a reliable representation of background has been established and to show that the appropriate statistical methods were used to characterize background concentrations of chemicals in soil.

   Response: A separate background report has been finalized by the NASD (CTC). This report has been extensively referenced in this NFA report. A set of soil and

groundwater tables will be copied from this background report and will be included in this NFA report in the next revision as a new appendix. The text will be further clarified in Section 1.0 to reflect this addition, as well as the response to this comment.

8. Given the close proximity of the SWMUs/AOCs, it would be more appropriate to evaluate risks associated with exposure to groundwater by combining the data across each Site.

   Response: This issue was discussed by EPA during the last CTC meeting in Puerto Rico (January 2003). It was decided that the groundwater discussion will be kept separately for each site in the revised NFA report, as the report also evaluates the potential for site soil to leach and contribute to the groundwater contamination source, and determines whether each site's groundwater contains related chemicals of potential concern (COPCs). However, a new section will be added to the revised report that will include a main operations area-wide groundwater risk assessment.

9. The figures providing sampling locations and sampling results do not provide sufficient detail regarding reference points and landmarks. The figures do not facilitate independent determination of the appropriateness of sampling locations. The figures should also identify the boundaries of the SWMU/AOC, where the release occurred, and where the samples were collected in relation to the release.

   Response: The sampling was conducted from biased locations where potential releases may have occurred, based on each site's history, as detailed in the EBS. However, a SWMU/AOC boundary was not defined by EPA. A buffer land use/access restriction area was previously identified, and is identified as a "box" around an area in the figures. The entire Main Operations Area has one combined boundary (or "box"). Generally, sample locations indicate the area of a site. However, the figures that will be provided in the revised report will identify these boundaries as buffer areas for access restriction around a site, and the figures will identify the individual site within the entire NASD area more clearly.

3. Comments Previously Provided to the Navy

1. **General Response:** Responses to the following comments are not provided in this document, as these comments address a report that was previously reviewed by EQB/TRC and have been responded to. This report has already been issued in its final version.

PA/SIs for eight of the nine sites in this NFA report had been previously reviewed and comments provide to the Navy. The sites previously reviewed include: AOC B, AOC C, AOC F, AOC K, AOC L, SWMU-10, SWMU-14, and SWMU-15. These reports were presented in the following reports:

- Phase I Expanded Preliminary Assessment/Site Investigation, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico, October 2000
- Draft Expanded Preliminary Assessment/Site Investigation, Phase II Seven Sites, CH2MHill, Tampa, Florida, July 2001
- Final Expanded Preliminary Assessment/Site Investigation, Phase II Seven Sites, CH2MHill, Tampa, Florida, November 2002

The PA/SI for the ninth SWMU, SWMU-5, had not been considered in these previous document reviews. Comments to SWMU-5 are presented herein for the first time.

Comments to the eight AOC/SWMUs were provided to the Navy on April 15, 2002. Prior to the November 2002 NFA report, responses from the Navy were not provided to EQB. Appendix A of the current NFA report provides responses to three of the AOCs/SWMUs: AOC B, AOC K, and AOC L. Text in the current NFA report discusses a limited number of issues identified in the EQB PA/SI evaluations.
Listed below are comments from the previous evaluation which have not been adequately addressed.

Major Comments

1. The NFA recommendations made by the Navy at the eight locations can not be fully evaluated without detailed information regarding past activities at these sites. The Navy has used Vieques Island since the early 1940s, yet the site descriptions provided in the PA/SIs summarize current conditions with only a brief reference to former use. The PA/SIs did not present or reference any studies of archives, records, reference sources or interviews conducted to document past site activities. This information is essential to evaluate whether the site surveying and testing performed by the Navy is adequate, especially with regard to munitions handling and storage. Since munitions were stored and disposed on the western portion of the island, it is vital to provide additional discussion of past site use.

2. Additional geophysical survey data is necessary at each site prior to concluding that NFA is appropriate. Because of the long history of military use of Vieques Island, it is likely that unknown trenched waste disposal areas as well as surface and subsurface munitions storage and disposal areas are present that might not be identified by an archive search.

3. The NFA recommendations planned by the Navy are not acceptable without additional information/investigation at AOC B, AOC C, AOC F, AOC K, AOC L, SWMU 10, SWMU 14, and SWMU 15. The additional information/investigation necessary is identified in comments regarding each AOC or SWMU in the next section of this report.

4. Munitions utilization records for the Island need to be evaluated to identify the chemical composition of munitions historically stored at the Naval Ammunition Support Detachment. The chemical composition data must then be evaluated to determine appropriate chemical analytes for investigation of possible munition disposal sites.

5. ...The PREs need to consider ecological benchmarks in addition to human health.

8. The Navy should provide results of closure surveys of all drainage structures at SWMU 14, AOC C, AOC F and AOC B in which the integrity of the structures is surveyed for cracks or breaks. Based on the findings of this survey, additional soil and ground water samples may be required at areas of questionable integrity to verify that there have been no impacts to the environment.

Comments on Final Expanded Preliminary Assessment/Site Investigation, Volume I - Report, October 2000

SWMU 10 - Waste Paint and Solvents Disposal Site

General Comment

- The Navy did not obtain any ground water samples at this site. Due to the nature of possible waste disposal at this site, ground water sampling is mandatory.

SWMU 14 - Wash Rack

Page Specific Comments

Page 8-1, ¶4: An investigation of the swale that received runoff water from the driveway needs to be conducted.

SWMU 15- Waste Transportation Vehicle

General Comments

- The location of the truck must be presented to evaluate the appropriateness of the soil and ground water sample locations.

AOC C- Drainage Ditch in the Vicinity of Transportation Shop Area

Page Specific Comments

Page 10-3, ¶1: The Navy indicates that they installed one monitoring well down-gradient of the septic tank. However, with only one monitoring well, it is not possible to know which way ground water flows, and whether the well is indeed down-gradient. Furthermore, it is not known where the leach field is, and whether the well was placed down-gradient of this potential release area. Additional information is needed to verify that this well is down-gradient of the source/release area prior to recommending NFA for this site.

Page 10-5, ¶1: The Navy did not screen the sediment results against any soil or sediment criteria because these samples "are not considered media samples." While it is not clear what this statement means, the Navy needs to present these data (they are not included in the report) and properly screen these samples prior to making an NFA recommendation.

AOC F - UIC Septic System

Page Specific Comments

Page 12-2, ¶6: It is not clear whether there is a leaching field associated with this septic tank and whether the wells were placed to examine releases from an associated leaching field. If a leaching field is present, the Navy needs to indicate whether the sampling points are adequate, or if additional sampling points are needed.

Figure 12-1: Soil sampling needs to be performed to evaluate whether there were releases from the concrete pad.

Comments on Draft Expanded Preliminary Assessment/Site Investigation, Phase II, Seven Sites, CH2MHill, Tampa, Florida, July 2001

AOC B - Wastewater Treatment Plant

Page Specific Comments

Page 3-6: No ground water data are available to assess ground water quality impacts. Samples need to be collected from a minimum of two water table ground water monitoring wells and analyzed for the full suite of parameters.

AOC L - Septic Vault

General Comment

- Samples from a minimum of two ground water monitoring wells need to be collected and analyzed for the full suite of analytes. These results are necessary to evaluate the ground water quality impacts from the site.

Page Specific Comment

Page 8-2, ¶5: It is not clear whether the subsurface soil samples at this site were obtained below the discharge depth of the vault. Data should be provided to indicate the depth of the subsurface samples. If they were not collected below the discharge depth of the vault, deeper samples should be obtained prior to recommending NFA for this site.

4. Page-Specific Comments:

SWMU 5

1. **Page 2-1, Section 2.1.3.** The Navy must collect a minimum of one (1) sample from a downgradient water table monitoring well and analyze for the full suite of parameters. The admitted disposal of approximately 7,000 pounds of fuel, inhibited red fuming nitric acid, and amine fuel (Page 2-1, Section 2.1, Paragraph 2) may have resulted in impacts to soil and groundwater. Under this conceptual model, transport may have included longer-term migration via soil leaching depleting contaminants from the soil possibly to levels below screening criteria. This model is a reasonable and plausible hypothesis and contradicts the Navy's assertion (page 2-7, Section 2.2.1.1 Paragraph 3) that the absence of contamination in surface and subsurface soil supports an anticipated absence of contamination in groundwater.

   Response: During soil sampling at SWMU 5, no groundwater was encountered in the borings, which extended all the way to the grandiorite rock. No shallow groundwater was encountered at this site, as rock was present within 6 to 19 ft below land surface. The bedrock at this site is estimated to be more than 200 ft thick, thus it is not feasible to assume the solvents could reach the deeper aquifer. As a result, no deeper wells were deemed necessary at this site. Groundwater contamination is thus not likely to occur at this site due to the presence of the impervious rock which separates the soils and groundwater, and no new wells will be installed at this site. Clarification of this issue will be incorporated into the text of the revised report.

2. **Page 2-3 ¶ Table 2-1.** Please provide additional documentation showing the calculation of the benzo(a)pyrene equivalents (BEQs). The results provided in Table 2-1 could not be verified. An alternative approach for calculating risk associated with carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs) is to retain each individual carcinogenic PAH as a COPC and adjust the slope factor available for benzo(a)pyrene by the relative potency factors provided in Table 8 from the EPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. This approach is beneficial in that it allows for evaluation of each PAH and its contribution to the combined Site risks.

   Response: The COPCs were selected by comparing each of the detected PAH constituents against a criterion, whereas the risk calculations were conducted by converting all PAH constituents into a benzo[a]pyrene equivalent (BEQ) concentration. The method followed for BEQ calculation in the risk assessment is to take individual PAH constituent concentrations and multiply them with its corresponding Toxicity Equivalency Factor (TEF) value. When a PAH constituent was not detected, half the detection limit value was used to multiply with the TEF value, thus providing a conservative estimate of the potential PAHs' exposure concentrations. This approach of estimating BEQ values is recommended by EPA, so that no individual PAH constituents will be eliminated from COPC selection based on individual comparisons with Preliminary Remediation Goal/Risk-Based Concentration (PRG/RBC) values. The approach will be retained to ensure this

conservatism in the risk assessment, and the revised report will include the approach used to calculating the BEQs, as described above. The toxicity assessment portion of Section 1.0 in the revised report will include this information.

3. **Page 2-2 ¶ 5, Figure 2-5 and page E-1-4:** Refer to General Comment # 2 above pertaining to the evaluation of the Utility/Excavation Worker.

   Response: Please refer to the response to General Comment #2, provided above.

4. **Page 2-8 ¶ 5:** This paragraph is supposed to discuss the Conceptual Site Model. It appears to be a brief discussion of the fate and transport of potential Site contaminants. Please provide a discussion of the information provided in Figure 2-6 as was done for other SWMUs/AOCs.

   Response: Additional discussion on the pathways and receptors will be included in the revised report.

SWMU 10

5. **Page 3-1 ¶ 1.** Identify the source of the information that indicates that the total volume of materials disposed onto the ground at SWMU-10 was less than one (1) gallon.

   Response: No disposal was ever reported. The disposal is conservatively assumed since the paint cans stored on the site were in small containers. The source for this information is from the reports of the staff who visited the site during initial site reconnaissance. The text will be edited to clarify the site conditions in the revised report.

6. **Pages 3-1 through 3-6, Section 3.2.1.** The Navy must collect a minimum of one (1) sample from a downgradient water table monitoring well and analyze for the full suite of parameters. The admitted disposal of small quantities of paints, solvents, and thinners on the ground outside Building 4001 (Page 3-1, Section 3.1, Paragraph 1) may have resulted in the transport of contaminants from soil to ground water. Under this conceptual model, transport may have included longer-term migration via soil leaching depleting contaminants from the soil possibly to levels below screening criteria. This model is a reasonable and plausible hypothesis and contradicts the Navy's assertion (page 3-1, Section 3.2.1, Paragraph 2) that the absence of contamination in surface and subsurface soil supports an anticipated absence of contamination in ground water.

   Response: Due to the very small volumes of the paints stored at this site, the relatively low mobility of paint constituents such as lead, chromium, and zinc, and absence of any organic solvents in surface and subsurface soil samples, no subsurface leaching is anticipated at this site. This is further supported by the presence of clay-rich soils and low solubility for the metals at the site. Therefore, the installation of wells was not deemed necessary during the PA/SI, and because no existing information indicated a need for such action, no wells were installed

downgradient of the site. The text will be edited in the revised report to the explanation as recommended by the EPA Geologist in his Comment #2.

7. **Page 3-4 ¶ 3, Figure 3-5 and page E-3-2.** Refer to General Comment # 2 above pertaining to the evaluation of the screening criteria for subsurface soils.

   Response: Please refer to the response to General Comment #2 provided above.

8. **Page 3-7 ¶ 3.** The argument provided in the paragraph for not evaluating groundwater is not acceptable, given that the Site was in use from as far back as 1930. Solvents and waste may have impacted groundwater. Contamination in soil may have leached to concentrations below screening criteria.

   Response: SWMU 10 is a small metal shed built on a cement blocks and elevated aboveground with no sump. Paint cans are stored on racks. Several of the project team members visited the building and found it to be clean and well kept, with the paint cans stacked on shelves. There were no large-volume paint cans, and it was agreed that if site soil samples do not indicate paint-related contamination, no groundwater sampling will necessary for this site. Thus, no groundwater was collected. Additionally, Appendix B of the PA/SI includes the OVM readings measured at every sample location and depth (extended up to 6 ft below land surface) around this site, and none of the readings indicated the presence of subsurface volatile organic compounds (VOCs). As a result, no wells will be installed at the site because of the absence of site-related (i.e., paint storage operations-related) contamination. The text will be edited to include this information in the revised report.

9. **Page 3-7 ¶ 6.** The statement pertaining to the estimated combined Excess Lifetime Cancer Risk (ELCR) for the industrial worker incorrectly includes exposure to groundwater. Exposure to groundwater is not presently evaluated for the Site, but must be added.

   Response: The well from AOC C was included as representative of regional groundwater, however, it will be removed in the revised report from inclusion under this site.

10. **Figure 3-5.** See General Comment # 2 above pertaining to the evaluation of the Utility/Excavation Worker.

    Response: Please refer to the response to General Comment #2 provided above.

SWMU 14

11. **Page 4-1 through 4-12.** The discussion of SWMU-14 must be expanded to include sediment samples SD-1, SD-2, SD-3. Results for these samples are presented in Appendix B and exceed ecological risk criteria for copper, mercury, 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, naphthalene, nickel, p,p'-DDE, p,p'-DDT, phenanthrene, pyrene, and zinc. The location and sampling technique must be

detailed so that it can be determined if the appropriate sampling locations were sampled and to evaluate if appropriate sampling techniques were used. The results must be evaluated using appropriate human health criteria.

Response: There are no wet sediments at the site that are associated with a standing water body or a perennial stream. The sediment samples are essentially surface soil samples from a drainage ditch, which is a slight depression in the ground that eventually drains to the drainage system that is part of AOC C, as explained on Page 4-1. As stated in the last two sentences of Page 4-1, the sediments previously sampled and reported in Appendix B were removed as part of the Oil-Water Separator (OWS) removal action, and thus are no longer present at the site. The text will be edited in the revised report to further clarify this information.

12. **Page 4-6 ¶ 1 and page E-4-2.** Refer to General Comment # 2 above pertaining to evaluation of risk associated with subsurface soil.

    Response: Please refer to response to General Comment #2 provided above.

13. **Page 4-6 Table 4-2.** Mercury should have been selected as a COPC as demonstrated in Appendix B-1 page 15 of 72 for exceeding SSLs.

    Response: Consistent with the approach stated previously for all sites, the maximum concentrations that exceeded PRG values were selected as COPCs. The maximum detected mercury concentration was equal to the RBC, therefore it was not selected as a COPC. Mercury was discussed as a COPC for leachability on Page 4-7. As such, the text will be edited for clarity in the revised report.

14. **Page 4-6 ¶ 2.** Describe the sampling procedures used for sampling unfiltered groundwater samples. Specifically, were samples collected using low-flow sampling techniques).

    Response: The low-flow sampling method was used to collect water samples. If the depth to water was less than 25 feet, a peristaltic pump was used at a flow rate of approximately 0.2 gallons per minute (gpm). If the depth to water was greater than 25 feet, a submersible pump was used with the lowest flow rate possible, at approximately 0.2 to 0.4 gpm. The wells were purged a minimum of three well volumes using the same pump as that used for sampling. The wells were purged until measured parameters of temperature, conductivity, and pH were within a range of 10 percent before sampling. An in-line filter was used attached to the tubing to collect the filtered groundwater samples. These sampling methods were included as part of the work plan which was reviewed and agreed upon by the agencies. This information will be included in the revised report for further clarification.

15. **Page 4-6, ¶ 2.** The turbidity of the groundwater samples and method of collection (i.e., low-flow) should be presented. Without this information, it is unclear if the metal compounds are associated with suspended particles, improper well construction, and/or sampling error or naturally occurring condition (e.g., colloidal materials with dissolved concentrations).

Response: In general, the turbidity of groundwater in the public works area is relatively high. The soils are derived from weathered granodiorite and have a very high clay content. The wells typically produce very little water and often pump dry. The EPA sampling protocol for wells that pump dry is to purge the well dry, wait for recovery (which could be up to 24 hours in the public works area) and then sample the well. Unfiltered groundwater samples are preserved with acid, which may increase the metals concentration by bringing metals bound in clay particles into solution. Filtered groundwater samples from the public works area in general have much lower metal concentrations, indicating that metals may be leaching from the clayey matrix in turbid samples. The PA/SI reports include the sampling and analytical methods details, which were not included again in this NFA report. However, in the NFA report the PA/SI reports were extensively referenced for the reviewers to look up such information. This information will be added to the revised text of the NFA report.

16. **Page 4-6, ¶ 1 and Page 4-7, Section 4.2.2.** Field notes, observations, measurements, and sample results obtained during the oil water separator (OWS) removal should be incorporated into the subsurface soil discussion and fate and transport assessment to provide a comprehensive discussion of all site-related data.

    Response: No sampling and analysis data are available from the OWS removal activities. The site subsurface soil was extensively characterized during the PA/SI, considering the small size of the site. The data were discussed in the risk assessment and fate and transport sections of the NFA report. In the revised report, the text will also include this information.

17. **Page 4-7, ¶ 3.** Resampling of SWMU-14 MW-01 should be performed to verify the cause of the dieldrin detection (e.g., sampling or analytical artifact). If dieldrin is detected in the second sample, then additional investigation must be conducted to identify the source and extent of contamination. The concentration of dieldrin detected in SWMU MW-01 (0.01 μg/L) exceeds the tap water PRG (0.0042 μg/L).

    Response: Dieldrin was selected as a COPC because it was exceeded the PRG; however, overall risks and the Hazard Index (HI) from its presence are negligible (well below acceptable criteria). Therefore, due to the absence of excessive human health risks from its detection, this site was recommended for NFA without further monitoring.

18. **Figure 4-5, Figure 4-5 and page E-4-2.** See General Comment # 2 above pertaining to the evaluation of the Utiltiy/Excavation Worker.

    Response: Please refer to response to General Comment #2 provided above.

19. **Page 4-11 ¶ 1.** The text incorrectly refers to Table 4-5 as presenting the risk characterization summary for the quantitatively evaluated receptors for SWMU 14. Table 4-5 presents the Exposure Point Concentrations for Surface Soils at SWMU 14.

The referenced table is missing from the report. Please provide the appropriate table.

Response: The appropriate risk summary table will be included in the revised report.

SWMU 15

20. **Page 5-1 ¶1.** Please provide the timeframe when the release at SWMU 15 may have occurred. This information is useful in determining the potential fate and transport of potential contamination at SWMU 15.

    Response: The EBS report states that the drums contained one of the components of Napalm. These drums were disposed of properly at Naval Station Roosevelt Roads (NSRR) in the early 1990s. The timeframe for the truck is unknown. The information presented in this response will be incorporated into the revised report for further clarification.

21. **Page 5-1 ¶ 2.** Explain why subsurface soil samples were not collected. Section 5.2.1.1 indicates that several inorganic chemicals and two PAHs were detected at concentrations exceeding either the residential PRG and /or leachability screening criteria (SSLs). These exceedances trigger the criteria that were used to determine whether the collection of subsurface soil samples is warranted.

    Response: If the surface soils had Napalm components, subsurface soil sampling would have been collected. None of the hydrocarbons typical of fuel oils were reported at the site. While PAHs may have been part of the past site operations, they are also likely to be derived from oils and asphalt material that are present in this parking area. Groundwater samples that were collected at the site contained no organic chemicals.

22. **Page 5-3 ¶ 1.** The location of the former storage truck should be indicated in Figures 5-3 and 5-4 to facilitate an independent assessment of the appropriateness of the soil and groundwater sample locations.

    Response: The exact location of the truck was never identified in the EBS report. Only the general parking area was identified to be within the triangular area included for the sampling. Samples were evenly spaced all across the area, because of the uncertainty associated with exact location for the parked vehicle, which may have been different locations within this area. No further action in regard to this comment is required.

23. **Page 5-3 ¶ 3.** This paragraph indicates that there were two PAHs detected at concentrations above the screening criteria. Table 5-1 only shows Benzo(a)pyrene as a selected COPC. Please clarify the apparent contradiction between the text and table.

Response: Appendix B-1, Pages 18 of 72 and 19 of 72 of this NFA report include all the reported detections of PAHs. The referenced text indicates that PAHs were detected in two samples, which have station identifications of W15-SB03 and W15-SB08. Of these only one detection of benzo[a]pyrene exceeded criteria, and therefore was included as COPC. Table 5-1 includes the two detections of benzo[a]pyrene. The text in the revised report will be edited to reflect this clarification.

24. **Figure 5-5, Figure 5-5 and page E-5-2 ¶1.** See General Comment # 2 above pertaining to the evaluation of the Utility/Excavation Worker.

    Response: Please refer to response to General Comment #2 provided above.

25. **Page 5-9 ¶ 5.** The text incorrectly refers to Table 5-4 as presenting the risk characterization summary for the quantitatively evaluated receptors for SWMU 15. Table 5-4 presents the Exposure Point Concentrations for Surface Soils at SWMU 15. The referenced table is missing from the report. Please provide the referenced table.

    Response: The appropriate table with risk calculation results will be added to the revised report.

26. **Page 5-10 ¶ 4.** This paragraph states that the cancer and health hazard effects for SWMU 15 are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential receptors. The residential receptors should not be included in this statement, as the hazard index (HI) for the child and adult receptors exceeds the acceptable non-cancer risk limit of 1.0.

    Response: The text in the revised report will be edited to remove residential receptors from the first sentence.

27. **Page 5-11 ¶ 4.** This paragraph correctly identifies the child residential HI as exceeding the acceptable non-cancer risk criteria of 1.0. However, the HI (1.68) for the adult residential should also be identified as exceeding the acceptable non-cancer risk criteria and that the risk driver is iron in surface soil.

    Response: This is a summary paragraph, which already identified that the HI was exceeded for an adult and child. However, the paragraph above that lists the HI for an adult resident will be corrected to indicate that the HI is from surface soil (not groundwater) iron.

AOC B

28. **Pages 6-1 through 6-5.** Samples need to be collected from a minimum of two (2) water table groundwater monitoring wells and analyzed for the full suite of parameters. The admitted disposal of hazardous constituents at the waste water treatment plant (WWTP) (Response to EQB Comment 1, page J-1, Appendix J of the Final Expanded Preliminary Assessment/Site Investigation, dated November 18, 2002) using unlined lagoons would have resulted in the release and subsequent transport of contaminants from soil to ground water. This transport would have

included longer-term migration via soil leaching depleting contaminants from the soil possibly to levels below screening criteria. This would invalidate the Navy's Response to EQB Comment 3 (page J-2, Appendix J) that correlates an absence of contamination above screening criteria in surface soil and subsurface soil with an anticipated absence of contamination in ground water.

Response: We disagree with the comment. Appendix A of this NFA report includes a copy of the same comments and responses to the PA/SI reports. The reviewers are urged to look at Page 6-11 of EBS report. There is no "admitted" release of hazardous waste. The EBS report recommended that AOC B should be investigated because the disposal of hazardous waste may have occurred at the wastewater treatment plant (WWTP) during past operations. This area is approximately 30 to 150 feet that includes the buffer zone around the lagoons. A total of 32 samples, 16 samples from surface soil and 16 samples from subsurface soil were collected and analyzed for the full TCL/TAL list. If any semivolatile organic compounds (SVOCs), metals, or pesticides were part of the suspected hazardous wastes, none were in the 16 surface or 16 subsurface soil samples. There were no VOC residuals, other than trace levels of toluene (0.00035 mg/kg for maximum), and 1,1-dichloroethene (0.0011 mg/kg for maximum).

29. **Table 6-1:** There appears to be an error in this table pertaining to the Best Estimate of the Mean (0.84) and the Maximum Detected (0.68) concentration of thallium. The maximum concentration should be greater than the mean concentration.

    Response: The best estimate of the mean includes non-detects at half the detection limit value. When detection limits are greater than detect values, this mean value exceeds the maximum. It also indicates that maximum detected concentration is within instrument detection limit range (i.e., noise range). This informaiton is useful in keeping a perspective on some of the reported detect values.

30. **Page 6-5 ¶ 1:** See General Comment # 2 above pertaining to the evaluation of the Utility/Excavation Worker.

    Response: Please refer to response to General Comment #2 provided above.

31. **Page 6-5 ¶ 2:** See General Comment # 2 above pertaining to the screening criteria used to evaluate subsurface soil. In addition, the sentence " All chemicals analyzed in the subsurface soil were either not detected or were detected below the screening criteria for leachability (SSLs), and other compounds." Is confusing. Please clarify what "other compounds" means in this sentence.

    Response: The text in the revised report will be edited to delete the phrase "other compounds" in order to avoid confusion.

32. **Page 6-6 ¶ 7, Figure 6-5, and page E-6-2:** See General Comment # 2 above pertaining to the including the Utility/Construction Worker in the Conceptual Site Model.

    Response: Please refer to response to General Comment #2 provided above.

33. **Page 6-8 ¶ 5:** This paragraph incorrectly refers to Table 6-3 as a summary of the risk characterization for the quantitatively evaluated receptors. Table 6-3 presents the Exposure Factors for Receptors Exposed to Surface Soils at AOC B. The referenced table is missing from the report. Please provide the referenced table.

    Response: The appropriate table will be included in the revised report.

AOC C

34. **Page 7-1 ¶ 1:** Please provide a time frame for when the disposal activity occurred at this site. This information is useful in determining the potential nature and extent and fate and transport of contamination at the site and the applicability of the conceptual site model.

    Response: As stated in the third paragraph of Page 7-1 of the NFA report, the site was identified because of the sheen observed during the site inspection visit. No disposal was ever reported to have occurred at this site. It is suspected that the sheen is likely from the adjacent road where vehicles travel on this access road to the administration area. From the sampling results it appears that there are no other releases to this ditch. No further action regarding this comment is required.

35. **Page 7-1 ¶ 4:** Please provide an explanation why subsurface soil samples were not collected in the two ditches along with surface soil samples.

    Response: No subsurface soil samples were collected because there were no buried or subsurface releases expected in the ditches. The suspected contamination is likely from a surface release (sheen), and the results from the surface soil collection did not indicate a need for subsurface soil to be collected. As there were no concentrations above screening level criteria, no subsurface soil samples were collected from these two ditches. There were subsurface soil samples collected from four locations around the old septic drain at multiple depths extending to 26 feet below land surface (see Appendix B2 for details on individual sample results). The above information will be incorporated into the revised text of the NFA report.

36. **Page 7-3 ¶ 1:** The rationale for COPC section needs to be clarified in this paragraph. This paragraph suggests that all soil samples (surface and subsurface) were screened against Region 9 PRGs. Table 7-2, AOC C COPC Selection for Subsurface Soil suggests that subsurface soils were only screened against SSLs. In addition, groundwater samples were also screened against MCLs.

    Response: The text in this section of the revised report will be edited for clarity, and a direct exposure scenario will be added with the evaluation of construction worker exposure to the subsurface soil. Sections 1.6.2.1 and 1.6.2.2 present the COPC screening process, which was applied consistently across all sites proposed for NFA. For COPC selection during the risk assessment MCLs were not used for screening. Additionally, a new appendix will be added to the revised report that includes the

PRG tables for years 2000 and 2002, EPA's SSL values, the most current MCL values (February 2002), and a set of background values tables from the background investigation report.

37. **Page 7-3 ¶ 2:** This paragraph suggests that volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs) may have been detected in site surface soil samples at concentrations below the screening criteria. Compounds detected below screening criteria are relevant to the nature and extent of contamination determination. Therefore this information should be presented in the report.

    Response: The PA/SI reports presented most of the nature and extent and screening results. This NFA report includes the summaries from the appropriate PA/SI report, and the needed information was included in this report. Appendices B and C of the NFA report present the details of all constituents detected from the PA/SI investigations. No further action in regard to this comment is required.

38. **Page 7-8 ¶ 7, Figure 7-5, and page E-7-2:** See General Comment # 2 above pertaining to the evaluation of the Utility/Excavation Worker.

    Response: Please refer to response to General Comment #2 provided above.

AOC F

39. **Page 8-1, Section 8.1, Paragraph 1.** The text should indicate the presence or absence of a leaching field associated with the septic tank. If a leaching field is present, then the boundaries must be indicated in Figures 8-3 and 8-4 and the appropriateness of the sample locations evaluated. Additional ground water or soil samples must be recommended if the current sample locations do not appropriately address/identify potential impacts downgradient from the leachfield.

    Response: As stated in the report, the septic tank at the site was a subsurface structure and the EBS report did not identify any leach field. Soil borings were completed around the perimeter of the tank, and therefore, any releases from the tank would have been detected within the soil borings. In addition, the downgradient location was investigated for any subsurface releases by installing groundwater monitoring wells. This information will be added to the revised report for further clarification.

40. **Figure 8-3:** Please include the location of the former Underground Septic Tank on this figure for reference.

    Response: The faded gray lines in the middle of the soil borings depict the location of the tank. These lines will be made darker in the revised report for better demarcation.

41. **Figure 8-4:** Please include the location of the former Underground Septic Tank on Figure for reference. In addition, paragraphs 1 and 2 on page 8-4 indicate that

chromium and thallium are the only two inorganics that were detected in Site subsurface soil samples at concentrations above screening criteria. This figure suggests that aluminum, cobalt, copper, iron and manganese were also selected as COPCs. Please clarify this discrepancy between the text and Figure 8-4.

Response: Please refer to the response to the Comment #40 regarding the location of the underground tank. The text identified that chromium and thallium were the only chemicals detected above background levels. Although the other chemicals were identified in the figure because they were above screening criteria, they were not detected above background levels. The text will be edited for clarity.

42. **Page 8-4 ¶s 1 and 2:** These two paragraphs indicate that chromium and thallium are the only two inorganics that were detected in Site subsurface soil samples at concentrations above screening criteria. However, Table 8-1 shows that aluminum, cobalt, copper, iron and manganese were also selected as COPCs. Please clarify this discrepancy between the text and Table 8-1.

    Response: Please see the response to Comment #41. The COPCs include all chemicals detected above PRGs and SSLs. Table 8-1 lists all of the chemicals that were above criteria, and chemicals without SSL values. The table will be revised to include only the chemicals that were detected above criteria. The text will be corrected to reflect the information included in the revised table.

43. **Page 8-6 ¶ 3:** The first sentence of this paragraph must be deleted. The sentence is based on the flawed logic that since chromium was not detected in groundwater at concentrations that exceeded applicable screening criteria, that the chromium detected in subsurface soil at concentrations that exceed the SSL leachability criteria are not leaching to groundwater. This ignores the possibility of future increases in contaminant levels in groundwater with continued soil leaching.

    Response: We disagree with the comment. Please also refer to the response to General Comment #14 and Specific Comment #63 of the EPA risk assessor's comments). The reviewer is urged to refer to Section 1.0 of EPA's SSL Guidance (EPA, 1996) to gain a perspective on SSL values. In the site's five wells, chromium was detected at concentrations ranging from 1.8 $\mu g/L$ to 28 $\mu g/L$, whereas dissolved chromium was detected between 0.9 $\mu g/L$ to 2.3 $\mu g/L$. Chromium in other wells at other sites located within this area (see Appendix C-4 of the NFA report) was similar in concentration ranging between 3.3 $\mu g/L$ to 68 $\mu ug/L$, and dissolved chromium ranging between 0.9 $\mu g/L$ to 2.0 $\mu g/L$. The observed maximum chromium concentration at well MW05 is not spatially related to the soil boring where the maximum detection is reported. Thus, any leaching to groundwater is not readily obvious at the site. The SSLs were applied according to the EPA guidance, and there is no reason to believe that chromium is leaching to the groundwater, particularly when the dissolved chromium measurements are low. The text will be edited with the above information as well as other relevant comment responses information for clarity.

Source: EPA 1996 – Soil Screening Guidance: Technical Background Document . 9355.4-17A EPA/540/R-95/128, May 1996.

44. **Page 8-7 ¶ 4 and Figure 8-5 and page E-8-1:** See General Comment # 2 above pertaining to the evaluation of the Utiltiy/Excavation Worker. In addition, Figure 8-5 incorrectly lists particulate inhalation as a potential exposure route. The correct potential exposure route is volatile inhalation from groundwater.

    Response: Please refer to the response to General Comment #2 above. Though a complete pathway was not identified for the particulate emission, it will be revised for applicability to groundwater pathways.

AOC K

45. **Page 9-1 ¶ 4:** Information pertaining to laboratory and field quality control samples (i.e., laboratory and field blank samples results) should be presented in an assessment prior to the determination that bis(2-ethyl)phthalate is considered to be a laboratory or sampling contaminant. Pthalates are also used in munitions and should not be dismissed prematurely.

    Response: Appendix K of Expanded PA/SI report presented the DQE report. There is no pattern to the detection of bis(2-ethyl)phthalate (BEHP), and the site is an old water supply well identified because of presence of low-level benzene. Of the five wells, one well, which is away from the original water supply well has this BEHP detection. Di-n-octyl phthalates were detected in blank samples. An area-wide groundwater evaluation will be included in the revised report that will include all the detected chemicals in groundwater.

46. **Page 9-6, Figure 9-5, and page E-9-1:** See General Comment # 2 above pertaining to the evaluation of the Utility/Excavation Worker. In addition, Figure 9-5 incorrectly lists particulate inhalation as a potential exposure route. The correct potential exposure route is volatile inhalation from groundwater. In addition, this exposure route should not be selected as a complete pathway because VOCs were not detected in groundwater. Finally, the figure incorrectly shows that the maintenance worker, recreational adult and recreational child scenarios are complete pathways.

    Response: Please refer to the response to General Comment #2 above. The Conceptual Site Model (CSM) in Figure 9-5 will be corrected to include the appropriate exposure pathways, receptors, and routes in the revised report.

AOC L

47. **Pages 10-1 through 10-5, Section 10.2.1:** Samples need to be collected from a minimum of two (2) water table ground water monitoring wells and analyzed for the full suite of parameters, including explosives and perchlorate. There is no information to confirm that the tank did not leak or that contamination did not seep through the concrete walls or floor of the tank. The Response to EQB Comment 5 (page A-2, Appendix A) does not provide any data to confirm that the tank did not

leak (or seep). The Response suggests that surface and subsurface soil samples collected around the tank indicate the absence of release to ground water. This suggestion does not consider that given the potential for associated releases, contamination may have leached from soil to concentrations below screening criteria, while impacting ground water. Note that the depth of the samples is not provided as requested in EQB Comment 6. The response to EQB Comment 6 (page A-3, Appendix A) does not provide the depth but indicates that the samples were collected below "discharge depth." Additional documentation is required to allow independent assessment of the adequacy of characterization.

Response: The site is an old cement tank, whose integrity is no longer intact (fractures and opening are visually apparent). This structure was thought to be used as a container for molasses during sugar cane operations in this area. The tank predates Navy operations in this area. The non-Navy related operations ceased in 1940s. Pages 44 and 45 of 72 in Appendix B-2 list the individual sample depths of 5 to 6 ft below land surface, which is near the water table in this area. The response indicated that the soil sample was deeper than the tank depth. The bottom of the tank is visible and does not extend more than 2 to 4 ft below land surface, depending on the side of the tank. The outlet for the tank is a surface overflow, and samples were collected to address this issue. The groundwater in this area is likely to be very mobile, and possibly tidally influenced, thus any suspected historical release, if they occurred, are no longer anticipated to be present at the site. Site surface and subsurface soil samples did not indicate any hazardous waste release. Considering the site was not in use for about 60 years, any historical releases are not likely to be of importance at this time. No further action regarding this comment is required. Also, please refer to the response provided above.

48. **Page 10-6 ¶ 3, Figure 10-5, and page E-10-1:** See General Comment # 2 above pertaining to the evaluation of the Utility/Excavation Worker.

    Response: Please refer to response to General Comment #2.

49. **Page 10-6 ¶ 3:** Risks associated with exposure to groundwater must be evaluated for this AOC.

    Response: As discussed above, no release was detected. The site was not used by the Navy for storage of hazardous constituents, and therefore, groundwater sampling is not warranted. No changes to the text are warranted.

50. **Page 10-6 ¶ 5:** The text incorrectly refers to Table 10-2 as presenting the exposure pathways for the evaluated scenarios for AOC L. Table 10-2 presents the AOC L COPC Selection for Subsurface Soil. The correct table to reference is Table 10-3.

    Response: The reference to the table will be corrected in the revised report.

51. **Page 10-6 ¶ 5:** The text incorrectly refers to Table 10-3 as presenting the risk characterization summary for the quantitatively evaluated receptors for SWMU 14.

Table 10-3 presents the Exposure Point Concentrations for Surface Soils at SWMU 14. The referenced table is missing from the report. Please provide the referenced table.

Response: Please specify as to whether the comment addresses SWMU 14 or AOC L. In reference to AOC L, the risk characterization summary table will be included in the revised report, and the table number references will be corrected in the text.

5. Summary and Recommendations by Site

1. **Page 11-1 Table 11-1:** The status for the Unacceptable Human Health Risk column incorrectly reports a "No" status for SWMU 10, SWMU 14, SWMU 15, AOC B, AOC C, AOC F, and AOC K. Unacceptable risk were calculated for each of these SWMUs as was summarized in the individual write-ups and on the risk summary table provided in Table 11-2.

   Response: The table will be edited in the revised report.

2. **Page 11-3 ¶ 1:** This paragraph reports benzo(a)pyrene as a COPC for SWMU 5. It should state that BEQ is a COPC to be consistent with Table 2-1 in Section 2.2.2.

   Response: The suggested change will be made in the revised report.

3. **Page 11-4 ¶1:** This paragraph incorrectly identifies a slightly elevated health hazard associated with ingestion of groundwater by an industrial worker. The HI for this scenario was 0.13, which is below the acceptable risk criteria of 1.0.

   Response: The text will be edited in the revised report to indicate that there is no elevated HI to industrial workers.

4. **Page 11-4 ¶ 3:** This paragraph incorrectly states that the cancer and health hazard effects are within acceptable limits for the residential adult receptor. The HI for this scenario is 1.7, which is above the acceptable risk criterion of 1.0.

   Response: The text will be corrected in the revised report to reflect the above comment.

6. Appendix B

1. **General Comment:** The data provided in Appendix B includes detected results only. A complete data set should be provided in order to evaluate the accuracy of the statistical data analysis for this risk assessment. In addition, detection limits should be provided in order to determine if appropriate detection limits were achieved (i.e., if detection limits exceed screening criteria, contaminants may be present at concentrations that could result in an unacceptable risk). The detection limits are also required to generate the Exposure Point Concentrations (EPCs) for the selected COPS. Thus, the calculated exposure point concentrations could not be verified.

   Response: All analytical results were previously included in the PA/SI reports, and no new data were collected as part of this NFA report preparation. The non-detect

concentrations were included at half the detection limit value for 95-percent Upper Confidence Limit (UCL_{95}) estimations in accordance with the EPA recommended methods for Exposure Point Concentration (EPC) calculations. For future reports, electronic data can be provided to the reviewers upon request, for the verification of EPC calculations discussed in this comment. No changes to the appendix are warranted.

7. Appendix C

1. **General Comment:** Units should be provided for the sample results and for the screening criteria.

   Response: The units will be clearly added to Appendix C. However, as can be noted from Appendix B, all solid media (surface and subsurface soil and sediments) were listed in units of milligrams per kilogram (mg/kg) or parts per million (ppm). All groundwater data were in micrograms per liter (μg/L or parts per billion (ppb).

2. **Page 61 through 64:** The data provided on these pages appears to be from sediment samples. The text does not discuss the collection of sediment samples. If sediment samples were collected, the potential risks associated with exposure to Site sediments should be evaluated. In addition, it appears that the sediment data was screened against ecological screening criteria. Although this type of screening may be appropriate for an ecological risk assessment, it is not an acceptable procedure for human health risk assessments.

   Response: None of the sites included in this NFA report have surface water bodies or ditches with standing water. Samples included originally in PA/SI reports were designated as sediments if they were collected from drainage ditches (mostly dry or wet during rain events) or from the sump bottom. The sump data collected prior to its removal is no longer representative of the site. AOC C sediments are included as surface soils. All the dry ditch samples were included as surface soils for evaluation. No further action regarding this comment is required.

3. **Page 72**: The data provided on this page appear to be samples (SD and SL) that were collected from AOC B. It is unclear what these samples are. Please clarify the type and locations of these samples, and, if necessary, include information pertaining to these samples in the risk assessment.

   Response: Please refer to the response to the comment on this same issue under AOC B. The sump and the grit (sediments) were removed by a previous contractor, as discussed on the text of the NFA report. No further action in regard to this comment is required.

8. Appendix D

1. **General Comment:** Please provide units on all factors provided in the spreadsheets in Appendix D.

Response: All risk estimation tables will be formatted according to the RAGS Part D, and this comment will be addressed in the revised tables.

2. **General Comment:** Please provide references for all chemical specific absorption factors on the spreadsheets provided in Appendix D.

3. **Response:** All risk estimation tables will be formatted according to the RAGS Part D, and this comment will be addressed in the revised tables.**General Comment:** For many of the spreadsheets provided in Appendix D, there are values provided in the column next to the GI Absorption Factor (ABSgi) that are not identified. Please identify these values.

   Response: The missing factors, if available, will be provided in the revised tables.

4. **General Comment:** When evaluating dermal exposure to groundwater, the use of 10 minutes as the exposure duration for a bathing event under a reasonable maximum exposure (RME) exposure scenario is not consistent with EPA's dermal guidance, which recommends a value of 35 minutes for an adult and 1 hour for a child. These recommended values are based on data from the Exposure Factors Handbook (EPA 1997) and are more representative of a RME scenario and should be used in evaluating dermal exposure.

   Response: EPA has provided assumptions for exposure while showering/bathing that will be used. A preliminary list of exposure assumptions will be provided to TRC (EQB) and EPA for review prior to implementation in the risk estimations.

5. **Appendices D-1 and D-2:** The values provide in Table Appendix D-1, Soil Screening Criteria for Detected Chemicals should be reviewed. Several of the values provided in this table are slightly different from the values provided in the most recent online Region 9 PRG tables and EPA's March 2001 Supplemental Guidance for Developing Soil Screening Values. Note that the values provided for Aldrin are significantly different than those provided in the noted references.

   Response: The units are already included as footnotes to each of the two tables. A copy of the PRG table from which these values were obtained (November 2000 version, EPA Region 9 PRG table) will be included in the revised report. A check of values performed matched those in the PRG table. The PRG values for aldrin were missing for the residential and industrial scenarios, and SSL is incorrect. Though this chemical was never detected within the NASD, the PRG values will be corrected in the revised report for all chemicals.

6. **Appendix D-3:** This table should include the Utility/Excavation scenario as a potential receptor. If there is adequate justification for not evaluating this scenario, the rationale should be provided in the text portion of the report and this scenario should be discussed qualitatively in the risk assessment.

Response: The suggested scenario will be added in the revised report, and soil depths up to 10 ft below land surface will be used as potential exposure media. In addition, a construction worker scenario will be added to the revised report.

7. **Appendix D-4:** Information pertaining to the Exposure Time for each of the evaluated scenarios is missing from this table.

   Response: This information will be added to the table for the applicable scenario in the revised report.

8. **Appendix D-6:** Several COPCs are missing from this table. Please update this table to include the required information for all COPCs. Also, please provide the references for the provided Dermal Absorption Factors and Permeability Constants so that these values can be verified.

   Response: The suggested revision will be made to the revised report.

9. **Appendices D-11, D-28, D-45, D-70, D-95, D-112, D-153, D-170:** Please provide additional detail on the development of the equations used to calculate an age-adjusted chronic daily intake (CDI). The CDI equation for the dermal pathway is not consistent with the approach for developing an age-adjusted dermal factor as outlined in RAGS Part E. The age-adjusted dermal factor includes child and adult body weights (BWs) and adherence factors (AFs). These factors do not appear to be included in the age-adjusted skin surface area factor developed for this risk assessment. Age-adjusted dermal factors should be developed rather than age-adjusted skin surface area factors to ensure that large differences in body weight and activity-related adherence factors are taking into account in the risk assessment. For example, the Soil-Skin Adherence Factor for a Groundskeeper is inappropriate for a child. An activity-specific Soil-Skin Adherence Factor for a child should be incorporated into the age-adjusted dermal factor. All exposure parameter values and subordinate equations should be provided.

   Response: The revised report will follow the RAGS Part D format, and pertinent information will be included according to this format.

10. In addition, please provide the exposure parameters and equation used in calculating a SAadj of 2671 [(mg^2-yr)/(kg-day)]. The reference indicates it is based on adult body part skin surface areas, yet it is supposed to represent both child and adult skin surface areas. In addition, when the values and units presented for the age-adjusted dermal pathway are input to the CDI adj equation, the resulting units are mg/kg^2.

    Response: EPA Region 2 recommends not to use age-adjusted exposure factors. Therefore, this will no longer be an issue in the revised report.

11. In addition, please provide additional detail on the development of the equation used to calculate the age-adjusted CDI for the inhalation pathway. The Age-adjusted Inhalation Rate appears to include body weight, yet body weight is also included in the CDI equation. In addition, the CDI equation does not appear to include the Averaging Time

(AT). When the values and units presented for the age-adjusted inhalation pathway are input to the CDI adj equation, the resulting units are mg/kg-m^3.

Finally, please provide the exposure parameters and equation used in calculating an age-adjusted Inhalation Rate of 13 mg-yr/kg-day.

Response: EPA Region 2 recommends not to use age-adjusted exposure factors. Therefore, this will no longer be an issue in the revised report. When tables are formatted according to the RAGS Part D format, this comment will no longer be an issue.

12. **Appendices D-62a through D-69:** These risk summary tables indicate that the risk associated with exposure to groundwater at SWMU 14 was calculated twice. The first set of calculations (Tables D-62B through Appendix D-64b) appear to present the correct calculated risk to the selected groundwater COPCs. Tables D-66 through D-69 appear to include additional COPCs that were not selected as Groundwater COPCs for SWMU 14. Please clarify the purpose of the addition risk evaluations or eliminate the unnecessary risk spread sheets. Note that some renumbering of risk spreadsheets will be necessary if risk spreadsheets are eliminated in Appendix D.

    Response: The risk summary tables will be formatted according to the RAGS Part D guidelines in the revised report.

13. **Appendices D-62b, D-66, D-141, and D-149:** Footnote (a) on each of these spreadsheets indicates that the calculation for dermal risk due to direct contact with groundwater does not include exposure during showering. This is inconsistent with EPA's dermal guidance, which recommends a value of 1 hour dermal exposure during showering/bathing for a child. The equation and assumptions provided on Appendix D-62a suggest that the dermal pathway for the child resident includes exposure to the total body surface area, which is consistent with the showering pathway. Thus, it appears as though the footnote may be incorrect.

    Response: These tables will be formatted according to the RAGS Part D guidelines in the revised report.

14. **Appendices D-64a, D-137, and D-145:** The equation provided for CDI_{adj} must be corrected since it includes a conversion factor that is not necessary.

    Response: EPA Region 2 recommends not to use age-adjusted exposure factors. Therefore, this will no longer be an issue in the revised report. In addition, when the tables are formatted according to the RAGS Part D guidelines, this comment will no longer be an issue.

15. In addition, please note that the age-adjusted body weight used in developing a CDI for carcinogenic compounds is based on both a 15-kg child and 70-kg adult rather than just a 70-kg adult.

Response: We agree with this comment. Both child and adult body weights were used in the calculations. Please refer to the response to Comment #14.

16. Also, the approach used in developing a CDI for constituents in groundwater via dermal exposure is not consistent with current EPA guidance. Please refer to EPA's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment, Interim, dated September 2001 for guidance on evaluating this route of exposure. This guidance also provides dermal permeability constants (Kps), both experimental and calculated, for a multitude of chemicals. Selecting the appropriate value or calculating a value using the algorithms presented in the guidance is preferred to using a default value of 0.001. As stated above, the use of 10 minutes as the exposure duration for a bathing event under a RME exposure scenario is not consistent with EPA's dermal guidance, which recommends a value of 35 minutes for an adult and 1 hour for a child. These recommended values are based on data from the Exposure Factors Handbook and are more representative of a RME scenario and should be used in evaluating dermal exposure.

    Also, footnote (b) on these spreadsheets suggests that the inhalation intake (CDI) is equal to the ingestion intake for VOCs. This is not consistent with EPA Region IV guidance that suggests that the inhalation of groundwater volatiles while showering/bathing is accounted for by doubling the ingestion volume as stated in footnote (f) on spreadsheets Appendix D-64a, D-137, and D-145. This discrepancy must be corrected.

    Finally, an inhalation slope factor is provided for dieldrin on spreadsheet Appendix D-64b, but the ELCR was not calculated. The results of this calculation must be included.

    Response: Exposure assumptions will be verified and adjusted as needed using the EPA Exposure Factors Handbook, online EPA documents (dermal guidance) and tables will be formatted in the RAGS Part D format. There were no VOCs as COPCs in the nine sites evaluated, thus the doubling of the ingestion intake to account for inhalation is not relevant to these sites. Dieldrin inhalation exposure is not relevant, as it was detected in groundwater, and it is not volatile. No further action is required in regard to this comment.

17. **Appendix D-102:** The total presented for the total dermal hazard quotient (HQ) is incorrect. The value should be 0.0006.

    Response: Tables will be reformatted according to RAGS Part D, which will recalculate all risk and HQ values.

18. **Appendix D-151:** Please clarify what footnote (a) is in reference to.

    Response: As the tables will be reformatted according to RAGS Part D guidelines, this comment will be addressed within the appendix of the revised report.

19. **Appendices D-10 through D-186:** The information provided in these spreadsheets is for AOC R which has not been selected as an no further action (NFA) site and therefore should not be included in this report.

    Response: All references to AOC R will be eliminated from the revised report.

9. Appendix E

SWMU 5

1. **Page E-1-3¶ 1:** The most recent Primary Drinking Water Standards (Spring 2002) should be used for screening Site groundwater data.

    Response: The latest values at the time of the report preparation were used. These will be added to a new appendix in the revised report, as previously stated above.

2. **Page E-1-5 ¶ 7:** This paragraph provides information pertaining to estimating volatile emissions from soil to ambient air. The risk spreadsheets provided in Appendix D indicate that none of the selected COPCs were evaluated for this pathway. Please clarify this discrepancy.

    Response: There were no VOCs identified as COPCs. Any reference to VOCs will be removed, as we are now aware that there are no VOCs in site soils.

SWMU 10

3. **Page E-2-1 ¶ 5:** This paragraph incorrectly identifies the evaluated potentially exposed populations as "under current conditions". The statement should state "under potential future conditions".

    Response: The statement is correct. It refers to what is likely to occur at the present time. No change to the text is warranted.

4. **Table E-2-4:** The number of samples "N" should read "4" and the Frequency of Detection should read "50%" as is shown on Table 2-1 on page 2-3 of the NFA report.

    Response: Any errors will be corrected in the revised report.

SWMU 14

5. **Page E-4-3:¶s 2 and 3:** The HI values provided for the residential adult and residential child do not agree with the values provided in Table 4-8. This discrepancy must be corrected.

    Response: Any discrepancies will be corrected in the revised report.

6. **SWMU 15 ¶ 2:** The laboratory data should be provided to confirm that detected VOCs are in fact due to laboratory contamination.

Response: The DQE report was provided as an appendix to the final PA/SI report. No further action in regard to this comment is required.

7. **Table E5-7:** BEQ and arsenic should be identified as risk drivers for the industrial worker, exposure to surface soil and iron should be identified as a risk driver to residential adult, exposure to groundwater.

   Response: Consistent with EPA comments these chemicals will not be referred to as risk drivers in the revised report.

AOC B

8. **Table 6-6:** Iron should be identified as a risk driver for the residential child, exposure to surface soil.

   Response: As iron did not exceed an HI=1.0 (iron HQ=0.76), it was not identified. No further action in regard to this comment is required.

AOC K

9. **Table 9-5:** Thallium should be listed as the main risk driver for the industrial worker, exposure to groundwater.

   Response: The industrial worker HI for thallium was only 0.66. There was an error in this table in the NFA report. This error will be corrected in the revised report.

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION II
Emergency and Remedial Response Division
290 Broadway, 18th Floor
New York, New York 10007-1866

MEMORANDUM

TO: Helen Shannon, Remedial Project Manager
ERRD/SPB/FFS

FROM: Michael Sivak, Risk Assessor
ERRD/PSB/TST

DATE: February 14, 2003

RE: Draft No Further Action Report for Nine Sites
Former U.S. Naval Ammunition Support Detachment
Vieques Island, Puerto Rico
November 2002

I have reviewed the above referenced document. Basically, I cannot support the conclusions of the document because I cannot clearly follow the steps in the process. Following are my comments:

EPA, Region II
Michael Sivak, Risk Assessor
Review of Draft No Further Action Report for Nine Sites
Former U.S. Naval Ammunition Support Detachment
Vieques Island, Puerto Rico

General Comments

1. The document is not consistent with EPA guidance for preparing risk assessments under CERCLA. For example, *Risk Assessment Guidance for Superfund Part D* (OSWER 9285.17-01D-1) was not followed. This guidance, which provides a standardized format for reporting data in the risk assessment, is required for all risk assessments completed under CERCLA. Using the standardized reporting format results in a risk assessment that is clear and transparent - information can be easily referenced, and results are readily reproducible. The NFA document did not report data using this guidance, and the document is very confusingly organized and difficult to follow. This is especially true of Appendix D, which was not thoroughly reviewed.

   Response: It is typically not required to format risk assessment tables in RAGS Part D format, unless specifically requested by EPA, and such formatting is typically applied mostly at CERCLA sites that are undergoing full RI/FS process because of the more extensive effort involved in generating these tables. Such a request was not previously made for this facility during risk assessment approach discussions. However, as all the parties involved are in agreement with this request, the risk assessment tables will be reformatted to fit the RAGS Part D format, as suggested by this comment. These reformatted tables will be included in the revised NFA report.

2. The document is poorly referenced. For example, in Volume 1, Table 3-1, no references are provided for superscripts "1" and "2." Another example can be found in Volume 2, Appendix D-25, where superscripts "e" and "f" reference Appendix XX, and superscript "h" references "FDEP Brownfields Table 4, Chapter 62-777, F.A.C., December 1998." Where are these documents and appendices? Tables should be provided for all chemical-specific information.

   Response: Any cross reference errors will be corrected in the revised report. Most of these will be eliminated when tables are reformatted according to the RAGS Part D guidelines.

3. The presentation of data is confusing. In Volume 1, Sections 2 - 10, why are different tables used to present information for surface soils and subsurface soils? For example, shouldn't Tables 3-1 and 3-2 both contain the appropriate screening values? What is the reason for including the "best estimate of the mean"? Wasn't the maximum detected concentration used to screen the chemicals? Why are no SSLs for migration to groundwater provided for metals? EPA's *Soil Screening Guidance: Technical Background Document* (9355.4-17A) provides generic SSLs for metals, as well as a method to develop site specific SSLs. For the SSLs which are provided, why was a DAF of 20 used, rather than the more conservative DAF of 1? Since this is a screening exercise, conservative assumptions should be incorporated into the process.

Response: Typically surface soils are the only medium of direct exposure concern. As indicated in Section 1.0 of the report, the maximum detected concentration is used to compare against criteria in the COPC selection process. Therefore, surface soil maximum concentrations are compared against criteria that are protective of human health as well as criteria for protection against migration to groundwater. Subsurface soils are only compared against criteria that are protective of migration to groundwater. All detected maximum concentrations are compared against these criteria for the selection of COPCs, as described in Section 1.6.

The mean and best estimate of the mean are provided as additional data that assist in understanding the sitewide distributions of a detected chemical, and to determine if the sitewide average is significantly above criteria. However, such comparison was not used in the site COPC selection. The metals detected in soil did not have soil screening levels (SSLs) in EPA guidance. A dilution attenuation factor (DAF)=20 was determined to be appropriate for use at this facility during the PA/SI, as these sites are based on relatively deep groundwater depths, clayey soils, and lack of significant percolation from rain water leading to shallow aquifer around most of the sites. The screening process used is relatively conservative. The text will be edited for clarity in the revised report.

4. The document is confusing in its evaluation of subsurface soils in the risk assessment. Each site looks only at direct contact exposure to surface soils, while subsurface soil contamination is evaluated solely on the basis of potential for migration to groundwater. What about construction and utility workers? On pages 1-19 and 1-20, populations such as maintenance workers and industrial workers would potentially be exposed to contaminants in the subsurface by direct contact (this is also true of populations such as construction workers, which are not mentioned in the document but are included in Specific Comment 26). The tiering process used to evaluate soils should be more clearly explained.

   Response: A direct exposure to subsurface soil was not assumed for any receptors at any of the sites. Due to the lack of any buried wastes (e.g., landfills) within any of the nine sites proposed for NFA, such a pathway was not included for analysis. No contamination was identified in subsurface soils during the PA/SI at any of the sites to assume a potential future exposure risk. However, the revised report will include a construction worker exposure pathway to address EPA and EQB comments on this issue. At sites where future construction is planned, soils to the depth of 10 ft below land surface will be assumed to be excavated and mixed with surface soils during construction-related excavations for foundation. The exposure assumption for this scenario and the exposure point concentration (EPC) estimations will be discussed with EPA and EQB risk assessors prior to their inclusion in the revised report.

   All subsurface soil data will be screened against PRG values for the industrial land use scenario. Any COPCs identified for a site will be included in a construction worker exposure scenario. The EPC for a construction worker at such a site will be

evaluated using both surface and subsurface soils up to 10 ft depths combined. A construction worker scenario evaluated according to these assumptions will be included in the revised report.

5. The document does not clearly differentiate the risk assessment/risk management process. According to Figure 1-9, a "focused risk assessment" will be performed for those AOCs/SWMUs with contaminant concentrations above RBCs, while a baseline risk assessment/land use assessment will be conducted when background is exceeded. This process is somewhat confusing, and appears to be inconsistent with CERCLA. What is the difference between a "focused risk assessment" and a baseline risk assessment? These terms should be clearly defined. Why is a baseline risk assessment conducted only after an assessment against background? Consistent with Superfund's recent background guidance, any evaluation of risks/hazards associated with samples collected onsite with those samples collected as part of the background should be completed either as part of the risk characterization in the baseline risk assessment (in a clearly identified section reserved for management considerations), or as a risk management activity in a document such as an FS.

   Response: The term "focused risk assessment" was used to indicate that the site is not similar to a typical "RI Site or RCRA SWMU," which typically requires extensive investigation due to site-related releases. A "baseline risk assessment" is typically part of such an RI/RFI. These PA/SI sites were included for a risk assessment in order to support "risk-based decisions" prior to closure as suggested by EPA during comments on the PA/SI reports. While some of the sites within the Former U.S. Naval Ammunition Support Detachment (NASD) will have baseline risk assessments as part of the RFI/RI, these nine sites are proposed for NFA, due to the absence of unacceptable risks and/or due to the absence of any future contamination migration concern. If the term "focused risk assessment" is not an acceptable or preferred term for EPA, a more suitable term will be used to replace it. However, the process used in the Human Health Risk Assessment (HHRA) is conservative, and is similar to a baseline risk assessment. The risk assessment in the revised report will be referred to as a "risk assessment," in concurrence with the comment made by EPA.

6. The document contains several inconsistencies regarding the assessment of COPCs. For example, Section 4.2.1.1 identifies mercury as a COPC, but it is not listed in Table 4-1 (as an additional note, when data are not available regarding the type of mercury present, mercury should be screened against a risk-based concentration for methylmercury). Another example is in Section 8.2.1.2, where chromium is listed as COPC; again, this chemical is not included in Table 8-2 (as an additional note, when data are not available regarding the valence state of chromium, chromium should be screening against a risk-based concentration for hexavalent chromium).

   Response: The statement in the text is similar to the one included in the PA/SI report; however, subsequent data evaluation indicated that mercury was not

detected in the site soils. Similarly, chromium was no longer considered a COPC, as per the newer screening process. The text was taken from the previous PA/SI report. This error will be corrected. The EPA Region 9 PRG table provides a value for total chromium, which assumes a mixture of trivalent and hexavalent chromium at 1:6, which was used for screening. When no such value is available, a hexavalent chromium based value has historically been used for the soil PRG. Section 4.2.1.1 of the NFA report will be edited to correct the text.

7. Toxicity data have not been reviewed by EPA. Typically, toxicity data from sources other than IRIS are sent by Region to EPA-NCEA. The document continually refers to the Environmental Criteria and Assessment Office; the name of this office changed in the late 1990s to the National Center for Environmental Assessment (NCEA). Also, due to the fact that HEAST has not been updated since 1997, EPA Region 2 recommends that all toxicity data from HEAST should be sent to NCEA for review and possible update, and also to determine if the existing toxicity data developed by NCEA is still current. This exercise was not completed for this document.

   Response: A request for the supporting toxicity information for a list of chemicals not listed in IRIS were forwarded to Mr. Bob Wing at the start of this project. However, a response was not received from EPA. The toxicity values and most current profiles from NCEA, which will be obtained and provided by EPA, will be included in the revised report.

8. The development of the EPC is inconsistent with EPA Region 2, as presented on page 1-22 and Appendix D-7. First, when data are determined to be neither normal nor lognormal, Region 2 recommends using the software PRO UCL, developed by EPA-National Exposure Research Laboratory (NERL). This software provides several nonparametric tests, including Bootstrap, Jacknife, and Chebyshev, and recommends the most appropriate upperbound estimation of the mean. The text in the document limits the nonparametric tests solely to the Bootstrap, which often overestimates the upperbound value. Second, the document, on page 1-22, offers a method for developing an EPC for organics in groundwater, which appears to be different from the process used to develop an EPC for other constituents in other media. Region 2 does not use different methods to develop EPCs for different types of contaminants in various media.

   Response: The 95-percent Upper Confidence Limit (UCL_{95}) calculation conducted for the data are consistent with the latest EPA guidance, as well as published papers by EPA statisticians. The most suitable UCL_{95} was selected according to the guidance available at the time. The PRO UCL tool from EPA became available for use after the completion of the initial draft of this report. If the Bootstrap "overestimates the upper-bound value" as suggested by the comment, it ensures a higher conservatism in the risk assessment. The groundwater EPCs will be the UCL_{95} values, and the text will be edited to reflect this change in the revised report.

Since groundwater rarely contained organic COPCs, this will not have any effect on the findings in this NFA report. However, it will be useful for future evaluations where it provides a consistent approach for future risk assessment. A comparison of the PRO UCL-estimated UCL_{95} and the Bootstrap method-based tool that CH2M HILL developed will be included as an appendix to the revised NFA report.

9. Due to the fact that several AOCs and SWMUs are adjacent to each other in the area near the former main operational area, it may be more appropriate to evaluate risk from potential exposure to groundwater by looking at all monitoring well data, in addition to the way the data are evaluated in the current draft. There are two primary reasons for this. First, the exposure area for a potential receptor is the aquifer. If all wells in these AOCs/SWMUs (SWMUs 10, 14, and 15; AOCs B, C, F, K, and L) are screened in the same aquifer, then all data should be combined because exposure could occur anywhere throughout the aquifer. The second reason is that combining the data allows for a better statistical evaluation of the entire aquifer (the entire exposure area). Any wells associated with "hot spots" can be identified and evaluated separately. This approach would require the NFA designed for soils in each AOC/SWMU, and then for groundwater in the area of the AOCs/SWMUs.

   Response: Sites-specific wells were used to more conservatively estimate risks associated with exposure. If the site wells contained site soil-related chemicals, this would indicate whether the site was a source for groundwater contamination. None of the wells monitored at these sites had any organic contamination that is typical of solvent usage (e.g., SWMU 10, 14, or 15). However, to address EPA and EQB comments on this issue, a Main Operations Area–wide groundwater evaluation will be performed, and a new section will be added to include this information in the revised report.

10. The document uses the term "risk driver" inappropriately. Typically, the term "risk driver" is only used when risks/hazards exceed acceptable levels. Under these conditions, those chemicals which contribute most significantly to the cumulative risk/hazard are identified as "risk drivers". When the estimated risks/hazards are equal to or less than the acceptable risk ranges, the term "risk driver" is not used.

    Response: The footnote used in conjunction with this term does explain how it is defined in the context of this report. However, as suggested by the comment, the term "risk driver" will be removed from the report.

11. The document repeatedly represents the perspective that certain commonly occurring metals such as aluminum, iron, manganese, are not associated with site-related activities. Since these metals are often ubiquitous in industrial processes, washings, paints, etc., it is unclear how the statement can be made. If these commonly occurring metals are contributing to unacceptable systemic toxicity, then an appropriate comparison to background concentrations should be made, rather than stating that the metals are not associated with site-related activities.

Response: Metals concentrations are similar across all sites, although the sites differ in their past operational histories. While no chemicals were eliminated from further analysis, it was important to distinguish whether any of the metals observed were similar to background levels or were elevated specifically at the site. This was done so that when the document is being reviewed by the public, it is clear that the same chemicals are present in the background and at other sites. The range of site-specific background concentrations were compared with the general range of background concentrations at the end of the report. The document will be reviewed and corrected for any redundancy. A separate heading will be added to include these discussions of background comparisons in the revised report.

12. Residential and Industrial PRGs could not be verified. For example, the most recent version of the PRG Table indicates that the Industrial PRG for benzo (a)pyrene is 0.21 mg/kg, rather than 0.29 mg/kg which is shown in Table 2-1 on page 2-3. If a previous version of the PRG table was used please include it as an appendix.

    Response: A copy of the PRG table that was used in selecting the screening values will be included as an appendix in the revised report. The most current PRG tables will also be included, in addition to a comparison table between the two versions for chemicals detected these nine sites, in order to facilitate further clarity of this issue.

13. EPA Region 2 does not integrate the exposures to the adult and child resident when estimating cancer risks. The region typically looks at adult residents and child residents separately, then adds the cancer risks and presents this information in the text and as a footnote to the appropriate RAGS Part D tables.

    Response: When reformatting to the RAGS Part D tables in the revised report, the recommended exposure factors will be used as suggested in the comment.

14. Based on the information provided in the NFA report, the issue of chromium in the subsurface soil as a potential source of chromium in the groundwater at AOC F has not been adequately addressed. Chromium has been identified in the subsurface soils and in the groundwater. Although the detected concentration in the groundwater is below the MCL, the limited sampling data do not allow for a complete assessment of any future potential migration to the groundwater. This issue is discussed more thoroughly in Specific Comment 63.

    Response: The wells were turbid during monitoring, and the total chromium detected is likely from suspended particulates. Also, the detected total chromium in all the site wells are similar to the chromium found across all other sites in the Main Operations Area. Additionally, dissolved chromium in the wells is much lower, and is similar to background (see Appendices B-4 and C-4 of the NFA report). There is no spatial correlation between soil and groundwater chromium levels, where the maximum detected level of chromium is not located near the soil sample that indicated maximum chromium levels. Thus, leachability is not indicated at the site, based on the currently available data. Since the detected concentrations are much

lower than the most conservative hexavalent chromium-based Maximum Contaminant Level (MCL) of 100 micrograms per liter (μg/L), no further monitoring will be conducted at this site. The text in the revised report will be edited in Sections 1.0 and 8.0 to reflect this response. Also, please refer to the response to Comment #63 and EQB's specific comment regarding Page 8-6 for additional clarification of this issue.

15. The potential exists for exposure through plant/fruit/vegetable uptake of contaminants in the soil. Based on other sites in Region 2 at which this pathway has been both modeled and monitored, EPA does not believe that this pathway is significant at the Vieques site. First, because the levels of contaminants, primarily metals, are not considered to be of concern for this pathway, based on previous experience with this pathway. Second, because it is reasonable to assume that the exposure, even under a maximum exposure scenario, would not be significant and would likely not be greater than the exposure through direct contact with soils. However, it may be helpful to include a discussion of this potential pathway in the text. It may also be helpful to include the results of a literature search on the potential for uptake of these types of contaminants into plants (either native or surrogate).

    Response: We agree with the comment that potential exposure from plant and animal uptake of site-related metals is not likely to be significant. However, such discussion is likely to be appropriate at sites where a more extensive investigation is conducted due to presence of some levels of site-related contamination, such as those sites undergoing RI/FS. The range of shallow soil metals at all of the NFA sites in this report are not different from background soil metals concentrations. Thus metals uptake by plants at these sites are expected to be same as those growing elsewhere on this portion of the island. Comments made by TRC during the meetings about metals uptake might be an issue worth evaluating for the eastern portion of the island. Documentation based on a literature search will be researched for the four RI sites (SWMUs 6 and 7 and AOCs H and J) that are proposed for investigation.

Specific Comments

1. Page ES-1: In the "Purpose" section, the text states that the NFA includes risk assessments that were not part of the PA/SI report. The terminology should be consistent with the flow chart presented in Figure ES-2 and should be called "focused risk assessments." The use of the terms should be consistent throughout the document.

    Response: The term "focused risk assessment" will be revised to read "risk assessment" in the revised NFA report. This change will be made in concurrence with the above and other reviewer comments on the issue.

2. Page ES-2: In the "risk Assessment" section, the terms "focused risk assessment" and baseline risk assessment' should be clearly defined.

Response: The risk assessment conducted is designed to be conservative and equivalent of a baseline risk assessment (under :as is" conditions). However, it will be referred to as "risk assessment" in the revised report.

3. Figure ES-2:
Typically, the maximum detected concentration is used for screening for COPCs.

Response: The maximum detected concentration was used for screening for COPCs in the NFA report.

A. What is meant by "significant exceedance?" What decision criteria are used to decide when a site is eligible for a full RI or when a baseline risk assessment is performed?

Response: Figure ES-2 will be edited to remove the term "significant exceedance," and will be replaced with the word "yes." The risk assessment conducted is similar to a baseline risk assessment and use conservative assumptions.

4. Page ES-5: The descriptions of the "Exposure Assessment," "Toxicity Assessment" and "Risk Characterization" should be more complete. For example, the "Exposure assessment" section should clearly define exposure pathways, potentially exposure populations, and media of concern. Also, please note that the EPA Environmental Criteria and Assessment Office has been renamed the National Center for Environmental Assessment.

Response: The comment is noted. Additional text will be added to the Executive Summary in the revised report, as suggested by the comment.

5. Page ES-5: The "Risk Characterization" section should more clearly differentiate between risk assessment and risk management activities. It may be helpful to precede the discussion of background with a new heading. This would provide a visual way for reviewer to determine that the comparison to background is separate activity and is not part of the risk assessment process.

Response: Background comparisons will be discussed under a separate heading for each site-specific discussions in the revised report.

6. Table ES-1: It is recommended that the column "COPCs Site Related?" be revised to read, COPCs Present Above Background Concentrations?" Some metals listed in the tables are ubiquitous to many activities, and they may be present due to site related activities; however, the NFA report should be focused on whether they are present at concentrations consistent with background concentrations. Also it is more difficult to support the claim of non-site relatedness if certain metals are COPCs at some sites, but not at all sites (for example arsenic was not identified as a COPC at all sites).

Response: The suggested change will be made to Table ES-1. If a site has contamination (i.e., above criteria and background levels) it was not included among the sites included in this NFA report. Of the 17 sites, only nine were included, as the remainder will undergo an RI. If the number of samples at any given site is the same

as the background data set, it is likely to present the same chemical detection, a similar concentration range, and similar frequency of detection, etc. Chemicals that are typically detected with low frequency will have sporadic detections, if the data set is large enough for them to be detected. Arsenic is one of the less frequently detected chemicals in the background data set. The text will be edited to clarify such statements.

7. Page ES-7: In the discussion of SWMU-05, the text states that risks were within acceptable levels. The text should be revised to read, "the cancer risks and noncancer hazards" are within acceptable levels. This is consistent with how the two different types of health effects are evaluated, and may be easier for reviewers of the document to follow.

   Response: The suggested change will be made to the text in the revised report.

8. Page ES-7: In the discussion of SWMU 5, it may be helpful to say that no contaminants were identified above risk-based screening concentrations, rather than to say "{n}o COPCs were identified in subsurface soils."

   Response: The suggested change will be made to the text in the revised report.

9. Page ES-7: In the discussion of SWMU 14, please clarify what is meant by "[f]ield testing of soils during the removal activities occurring? Second, what is meant by the phrase "no evidence of contamination" – were the analytical results reported as non-detects?

   Response: Soil-gas monitoring was conducted on most, if not all, samples collected by CH2M HILL, and the results were reported in an appendix to the PA/SI report (see Appendix B of the Expanded PA/SI Report, Volume I [October 2000]). A similar investigation may have indicated very low to no positive organic vapor meter (OVM) detections during the oil/water separator (OWS) removal actions, which is an indication for lack of contamination releases related to vehicle maintenance operations to the subsurface soils at the site. The text will be edited for clarification in the revised report.

10. Table ES-2: As stated in "General Comment 10, the term "risk driver" is used inappropriately. The term should be used to identify those chemicals contributing most significantly to unacceptable levels of risk and/or hazard. When risks and/or hazards do not exceed EPA's acceptable levels, the tem should not be used. In Table ES-2, the hazard index for AOC K for residential adult and child is 3.5 and 8.1 respectively; however, no risk drivers are identified. Since the cumulative hazard indices for these two populations exceed EPA's acceptable level of 1, please identify any risk drivers.

    Response: The suggested changes will be made in the revised report.

11. Page ES-9: In the first paragraph of this section, the text states that "[n]one of these COPCs appear to be associated with the vehicle washing activities at SWMU 14." Since some of these COPCs are commonly found in a variety of washing products (aluminum and manganese are often found as cations in certain wash solutions), it is unclear how the document can state this. Please see General Comment 10 for further discussion.

    Response: The detected aluminum and manganese concentrations were also found in similar levels in background samples, indicating that they are not unique to this particular site. Also, the detected concentrations are similar to those detected at other sites within the Former NASD. Additional text will be added to the revised report in Section 1.0 and site-specific discussions to reflect this information.

12. Page ES-9: The last sentence of the first paragraph reads "[t]his site does not present an excessive risk or hazard top human health from site-related conditions." This implies that the site presents some level of risk that is less than excessive. EPA recommends that the language be revised.

    Response: The suggested change will be made to the text in the revised report.

13. Page ES-9, SWMU 15: The text should indicate how many drums of the waste were present on the site and the term "NSRR" should be defined. Also, the phrase "health hazard effects" in the second paragraph of this section should be revised to read "health hazard index" this should be revised in all text for all subsites.

    Response: All the historical information presented in the Environmental Baseline Survey report is included in the PA/SI reports and this NFA report. As defined in the acronym list included in the front part of the NFA report, NSRR refers to Naval Station Roosevelt Roads. The suggested text change will be made.

14. Page ES-10, AOC F: The second paragraph of this section discusses the health effects for the industrial worker and the residential adult. The text should include all receptors which were evaluated.

    Response: The text will be edited as suggested.

15. Page ES-11: In the first paragraph, the first complete sentence states "[t]here is some slightly elevated HI associated with residential adult exposure to thallium in groundwater but it is within the range of acceptable health effects." What does this mean? Typically, if the HI is identified as "slightly elevated," it is implied that the HI exceeds 1, which is above range of acceptable health effects." Please clarify the sentence.

    Response: The text will be edited for clarification in the revised report.

16. Pages ES-11,AOC L: The texts states that the HI for the residential child is equal to the minimum acceptable limit. However, when the HI or HQ value does not exceed the acceptable level of risk, there is no basis for stating the risk unacceptable. Please

revise text to more clearly state that the resultant hazards are within acceptable levels.

Response: The HI for a child is 1.0. The text will be edited as suggested.

17. Page ES-11, Conclusions: This section is particularly confusing. The text indicates that there are no risks above acceptable limits, but this is contradicted by Table ES-2 and by the text for several SWMUs/AOCs (SWMU15, AOC B etc.). There is a distinct difference between risks which are above acceptable limits, and concentrations of chemicals that are not likely to be associated with health effects or that are consistent with background concentrations., Please revise the text to more clearly indicate the conclusions of the NFA investigations.

    Response: The table will be edited to show exceedence of the HI at some sites from chemicals occurring in the background in the revised report.

18. Page 1-4: Please correct the fifth bullet: AOC C should be a separate bulleted item..

    Response: The text will be edited as suggested in the comment.

19. Page 1-4, Section 1.2: In the third paragraph, the text states the COPCs were selected "based on whether concentrations exceeded the screening criteria compared to each individual sample detection." This is confusing; typically, COPCs are identified by screening the maximum detected concentration against a risk-based concentration. Please clarify the text to clearly explain the process used to identify COPCs.

    Response: The text will be edited for clarification, as suggested by the comment.

20. Page 1-16, Section 1.6.1: Please clarify that the maximum detected concentration was used for screening for COPCs.

    Response: The text will be edited to clarify that the maximum concentration was used to screen for selection of COPCs.

21. Figure 1-9: Please see Specific Comment 3, which provides comments for Figure ES-2.

    Response: Please see the response to Specific Comment #3.

22. Page 1-18, Section 1.6.2.1:

    A. Please provide definitions for "surface soils" and "subsurface soils" These definitions should include the depth for each soil horizon.

    Response: Appendix B of the NFA report includes individual data points and the respective sample depths. Surface soil samples are typically 0 to 0.5 ft below land surface. Subsurface soil samples were typically less than 2 ft below land surface. The text in Section 1.0 will be edited to include a description of the sampling depths for soils.

B. Bullet 1 implies that no risk-based screening was performed for subsurface soils. Please clarify if the only screening that was applied to the subsurface soils was for the migration to groundwater scenario. If direct contact with subsurface soils is expected (i.e., construction workers), then some level or risk-based screening is necessary.

Response: The NFA report did not evaluate direct exposure to subsurface soils. The revised report will include construction worker exposure to the subsurface soil, as EQB has also suggested such a pathway evaluation. A future construction worker scenario will be included in the revised report, in accordance with EPA and EQB comments.

23. Page 1-18, Section 1.6.2.2: The second paragraph implies that no risk-based screening was performed for subsurface soils. Please clarify if the only screening that was applied to the subsurface soils was for the migration to groundwater scenario. See Specific Comment 22B for additional information.

Response: Please refer to response to Comment #22B above. A construction worker scenario will be included in the revised report.

24. Page 1-19: The third paragraph provides a brief discussion on how commonly encountered laboratory contaminants were evaluated in the COPC selection process. EPA Region 2 typically assesses laboratory contaminants consistent with the guidance provided on Pages 5-16 and 5-17 of RAGS Part A:

"...if the blank contains detectable levels of common laboratory contaminants, then the sample results should be considered as positive results only if the concentration in the sample exceeds ten times the maximum amount detected in any blank...if the blank contains detectable levels of one or more organic or inorganic chemicals that are not considered by EPA to be common laboratory contaminants...then consider site sample results as positive only if the concentration of the chemical in the site sample exceeds five times the maximum amount detected in any blank." Please verify if this guidance was followed.

Response: The data collected were evaluated by project chemists to determine the data quality. A data quality evaluation (DQE) report was included as Appendix K of PA/SI report (October 2000). The process followed is similar to the one described in RAGS Part A for blanks evaluations, and incorporates all other newer EPA requirements for data quality evaluation. Additional text will be added to Section 1.0 of the revised NFA report to include some of the description of past DQE evaluations.

25. Page 1-19, Section 1.6.3: Please clarify why maintenance workers are not expected to have exposure to site groundwater.

Response: There is no access to groundwater under current conditions; the depth to groundwater is generally greater than 30 feet. In addition, there are no plans to use it in the future. The text will be edited to describe that this pathway is incomplete.

26. Page 1-19, Section 1.6.3.1: Please clarify why construction workers are not included in the quantitative evaluation. Based on their typical activities, they would have exposure to subsurface contamination.

    Response: Such a scenario will be included in the revised report, as indicated in responses to previous comments regarding this issue.

27. Page 1-20, "Surface Soil Dermal Contact": EPA Region 2 recommends using the draft "Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim {EPA/540/R/99/005}, when identifying population specific parameters such as soil to skin adherence factors. This document is available at: http://www.epa.gov/superfund/programs/risk/ragse/index.htm

    Response: The approach used is based on draft dermal guidance from EPA. This update to the dermal guidance will be verified during report revision, and any needed changes will be incorporated.

28. Page 1-21, "Groundwater Dermal Contact": EPA Region 2 recommends the following times when evaluating dermal contact with water while showering:

	RME	CTE
Adult Resident Showering Time (hours)	0.25	0.10
Child Resident Showering Time (hours)	0.45	0.14

    Response: The suggested exposure factors will be used in the revised report, in accordance with EPA and EQB comments.

29. Page 1-21, "Surface Soil Inhalation": The parameters for the development of the default PEF should be discussed more thoroughly to ensure that these default assumptions are appropriately conservative for use in the NFA investigations.

    Response: The PEF is the default value from EPA SSL guidance, which also provides the methodology and assumptions used for calculating this value. However, it contributes to relatively negligible risk compared to the other exposure routes, such as ingestion and dermal contact pathways. Dust generation is likely to be low at most, if not all, sites included in this NFA report. A reference to the EPA SSL guidance for the PEF value selected will be included in the revised report in RAGS D format tables.

30. Page 1-21, "Chemical-Specific Factors": EPA Region 2 recommends using RAGS Part E as the primary reference for dermal absorption factors and permeability constants. Please provide a table with these values so that EPA can review these chemical-specific factors.

    Response: The revised tables will be revised to follow RAGS D format guidelines, and references will be provided as suggested by the comment. The dermal absorption factors will be verified against values from the latest EPA guidance, and values from Part E will be used (from online source).

31. Page 1-22, " Exposure Point Concentration": EPA Region 2 develops exposure point concentrations (EPCs) for groundwater in a manner consistent with EPCs for other media, such as soil. Please contact the EPA Region 2 risk assessor for further details.

    Response: A UCL_{95} estimate will be used for risk assessments for all COPCs in the revised report. However, because of the small sample size they will likely default to the maximum detected concentration as the EPC.

32. Page 1-22, Section 1.6.4: Please revise the name of the ECAO to the National Center for Environmental Assessment (NCEA).

    Response: Some of the supplemental toxicity information was taken from the EPA when the ECAO was still in existence. The text will include a clarification as appropriate. EPA Region 2 has been requested to provide the more current profiles for these chemicals, and they will be replaced in the revised report when received. The NCEA toxicity profiles provided by EPA Region 2 will be included in the revised report.

33. Page 1-22, Section 1.6.4: Please note that EPA Region 2 uses IRIS as the primary source of toxicity data. For chemicals for which toxicity data are not available from IRIS, EPA Region 2 consults with NCEA. This includes chemicals for which toxicity data are available in HEAST; due to the fact that HEAST has not been updated in several years, EPA Region 2 utilizes NCEA to review these data prior to use in a risk assessment.

    Response: The same process was used in selecting the toxicity factors in this report. A clarification to this effect will be included in the revised report.

34. Page 1-23, Section 1.6.4.1: EPA Region 2 uses the draft RAGS Part E as a source of oral absorption factors for converting administered toxicity data to absorbed toxicity data. Please see Exhibit 4-1 of this document for chemical-specific oral absorption factors. Also, consistent with the recommendations provided by this document, EPA Region 2 does not recommend adjusting toxicity data when the oral absorption factor is greater than 50%. Therefore, for chemicals with these high levels of absorption, oral absorption toxicity data and dermal absorption toxicity data should be consistent.

Response: The reference to the source of dermal toxicity factors extrapolation factors will be included in the revised report. A review of the absorption factors will be performed to check if any of the COPCs have greater than 50-percent absorption efficiency and same toxicity factors for dermal and oral pathways, as suggested by this comment, for chemicals with greater than 50-percent absorption rates through the oral route.

35. Page 1-23, Section 1.6.5: The first paragraph of this sentence states that a "'total HI range of 1.0 to 3.0 is typically considered evidence of the smallest potential for noncarcinogenic health effects." Please provide a reference for this statement. EPA Region 2 considers an HI of 1 as the benchmark. For HI values which exceed 1, further evaluation of the significant contributors to the HI is necessary, including an assessment of the uncertainty and modifying factors associated with each chemical.

    Response: the text will be edited to remove the reference to target HI as a range between 1 and 3, as it has no relevance to any of the nine sites proposed for NFA. Most of the calculated HI is from inorganic chemicals present at concentrations similar to background levels. The referenced text is from EPA Region 4 supplemental guidance to RAGS, which is available online.

36. Page 1-23, Section 1.6.5: EPA suggests that the second paragraph of this section be revised. For example, the text reads, "...toxicity factors supplied by the EPA uses several extrapolation methods that are ridden with inherent uncertainty.... " Noncancer RfDs may have an uncertainty factor which takes into account uncertainty in four particular areas. These factors are clearly defined on Page 7-19 of RAGS Part A. The text is unclear and very misleading in its assessment of toxicity data recommended by EPA.

    Response: The text will be edited in the revised report to clarify that there are four defined Uncertainty Factors (UFs) and Modifying Factors (MFs).

37. Page 2-3, Section 2.2.1: Was the site analyzed for metals? According to the text, only VOCs, semivolatiles, and explosives were analyzed. Please clarify why metals were not included in the analytical suite.

    Response: Based on the nature of the fuel oils released, no metals were expected to be present in the released chemicals. Therefore they were not part of the analysis. The text will be edited in the revised report to include this explanation of why metals were not analyzed.

38. Page 2-11: The text in the second paragraph of this page states that the excess lifetime cancer risk for a future residential receptor is 4.1E-06. Please clarify which residential receptor is discussed.

    Response: The risks were estimated for an age-adjusted scenario, where exposures as a child for the first 6 years of life and as an adult for the rest of 24 years. In response to these comments, this age-adjusted scenario was eliminated as suggested

by EPA, therefore, this is no longer an applicable issue to discuss in the revised report. The text will be clarified to this effect.

39. Table 3-1: The table includes two superscripts. Please include the superscripts in the key.

    Response: All the footnotes will be added to the tables in the revised report.

40. Figure 3-4: The thallium result for sample W10-SS06 is 0.84J, and is qualified "L". The thallium result for sample W10-SS04 is 0.62J and is qualified "R". How can the lower result exceed the residential PRG, but the higher result does not? Please verify the data and the results of the screening exercise.

    Response: The surface soil and subsurface soil samples were combined in this figure. Subsurface soil samples were compared only to the SSL, and not to the RBC. To avoid confusion, sample depths will be included in this figure in the revised report.

41. Table 4-1: Mercury is listed in the text of Section 4.2.1.1 as a COPCs, but it is not in the table. Please revise the table to include mercury.

    Response: The table in Appendix B-1, Page 15 of 72, includes the analytical results for mercury in surface soil samples. The maximum detected mercury at 2.3 mg/kg is the same as the screening PRG value of 2.3 mg/kg. Since the approach to selecting COPCs identified chemicals above PRG as COPCs, and the maximum mercury is not above the PRG, it was not selected as a COPC in this NFA report. The text will be edited to be consistent with the table in the revised report.

42. Figure 4-4: Please include the qualifier "R" in the key. Also, please redraw the blue boundary marker around the correct area.

    Response: The revised report will include the suggested editorial correction.

43. Page 4-7: The text in the first paragraph states that the dieldrin detection in groundwater is "likely an artifact because it is not very soluble and thus does not migrate sufficient depths to reach groundwater." If dieldrin was an artifact, was it also detected in the blanks?

    Response: Soil blanks did have detections of DDT, DDE, and a polychlorinated biphenyl (PCB), but not dieldrin. However, dieldrin was detected in the blanks collected as part of the Phase II PA/SI (see Appendix I of Phase II PA/SI report, Volume II [July 2001]). It is not imperative that dieldrin is detected in the blanks consistently, and there is no satisfactory scientific reasoning as to why low-level dieldrin positive results occur. The data validation as part of DQE for the Phase II PA/SI, following EPA functional guidelines, changes dieldrin detections below blank levels as non-detects. Thus, the detected dieldrin in groundwater at SWMU 14 is likely an artifact. Additionally, the overall risks and HI from dieldrin were within acceptable limits. Therefore it will not be further evaluated. There is no further action required in regard to this comment.

44. Page 4-7, Section 4.2.2: In the first paragraph, it may be helpful to state whether or not the detections of 1,2-dichloroethane were above or below the risk-based screening concentration.

    Response: The text will be edited as suggested to indicate that low-level 1,2-dichlorethane detected in subsurface soil were below the SSLs, and were not detected in the site well.

45. Page 4-7, Section 4.2.2: The text in the last paragraph of this page is questionable. Statements such as "[m]ost metals detected in soils as well as in groundwater are natural to soil mineralogical compositions. Therefore, most if not all of these metals are not contaminants associated with past use of wash rack..." It may be helpful to provide references for the information, or to revise the text so that it reads in a more factual way.

    Response: When site soil concentrations are similar to the soil inorganic chemical concentration found at other sites within this area, which have diverse site operations, it is an indication that metals are not specific to the site. Though background soils are not all identical to the site soils, the range of metals concentrations are similar in soils between background at this particular site. This is also indicative that past site operations did not have an influence on the site metals concentrations. The text will be edited to reflect this information.

46. Page 4-8: In the second paragraph, the text states that the area of concern is fenced, and that the only potentially exposed population under the current scenario is contractor personnel. Have any trespassing activities been documented at SWMU 14?

    Response: SWMU 14 is located within a fenced area. AOC E located slightly downgradient in the immediate vicinity, and has ongoing activities that require periodic visits to the site. No trespassing has been reported in this site or in other sites within this fenced area.

47. Page 4-10, Table 4-3: Please revise the units for ug/l to "ppb".

    Response: The typographical error will be corrected in the revised report.

48. Page 4-11, Table 4-5: Superscript 2 indicates that the EPC is based on either a normal, lognormal, or bootstrap 95UCL, based on distribution. EPA has statistical software package, PRO UCL, which will determine data distributions and calculate EPCs based on several nonparametric tests, including the jacknife and Chebyshev tests, as well as the bootstrap, and recommends the most appropriate UCL, based on the data. This software is available for use by CH2MHill, and can be obtained from EPA-ORD/NERL. Please contact the EPA Region 2 risk assessor for additional information on this software package.

Response: When the original NFA report was produced, the EPA's PRO UCL was not available for use. While use of this now available software may not significantly change the results of this analysis, the PRO UCL will be used to calculate the UCL_{95} at selected sites for one or two chemicals. This will be compared with the results of the currently used UCL_{95} estimation, and the results will be included in an appendix of the revised report.

49. Page 4-12, Section 4.4:

    A. In the first paragraph, the text states that the HI exceeds 1, and then states that no individual HQ exceeds 1. However, if the total HI exceeds 1, the next step is to evaluate the HI based on target organ. If no HI based on target organ exceeds 1, then the evaluation can stop; if the target organ-specific HI exceeds 1, then the evaluation continues to an assessment of each individual HQ. Please re-evaluate the process used in the NFA report, and include the necessary step of assessing the target organ-specific HIs.

Response: The text will be revised to list the chemicals and the respective target organs to determine their additivity. The revised tables will be formatted according to the RAGS Part D guidelines, which includes target organ listing.

    B. The second paragraph states that the site had no historical use of the COPC metals. However, these metals are commonly used in a variety of products and processes, and it is difficult to definitively state that metals such as aluminum, iron, and manganese were never introduced to a site through historical activities. Please revise the text to more clearly indicate the ubiquitous industrial nature of these metals.

Response: As previously included in response to several of the comments above, multiple sites across the Former NASD have very different historical site operations. However, many of the sites had the same metals with similar concentration levels, indicating that the observed metals are likely from regional native soils.

Furthermore, both surface and subsurface soils have similar aluminum and iron levels across multiple sites. The soil types for the sites located within the former administrative area, which includes seven of the nine sites proposed for NFA, have detected inorganic chemicals that are similar to the background soils, which also indicates that these metals as not specific to each site. If any metals were part of the vehicle washing operations, they are no longer apparent in the large number of samples collected from this relatively small site. No further action is required in regard to this comment.

50. Page 5-3, Table 5-1: The text in Section 5.2.1.1 states that lead is a COPC in SWMU-15, but it is not included in Table 5-1. Please revise the table to include all COPCs. Also, the link to the Region 9 PRG table connects to the updated table (October 2002),

and not the table from which the PRGs were referenced. Please provide the correct version of the table as an appendix.

Response: The maximum detected lead concentration (71 mg/kg) is below the PRG and SSL level of 400 mg/kg, as presented in Appendix B-1, Page 14 of 72. Therefore it is not selected as COPC. The text will be edited in the revised report to be consistent with the table results.

51. Figure 5-4: Please include the qualifier "R" in the key. Also, please delineate the appropriate SWMU boundary in the figure.

    Response: The suggested editorial change will be made to the figure. A buffer zone boundary was not identified for any of the individual sites within the Main Operational Area, and a boundary was drawn for the entire area instead. The gray triangular are of land was included for investigation as the former vehicle parking area.

52. Page 5-6, Table 5.2: Please revise the units for ug/l to "ppb".

    Response: The suggested typographical error will be corrected in the revised report.

53. Page 5-6, Section 5.2.1.2 : In the second paragraph of this section, the text states that, "...all other site inorganic chemicals are within background levels. Site inorganic chemicals are much lower, when compared to upgradient well associated with the adjacent site, SWMU 14." This text is confusing. Are the concentrations of inorganics consistent with background levels or less than background levels? If they are less than background levels, this may imply that the background levels are impacted by some unknown source. Please review this information and revise the text accordingly.

    Response: During background investigations, several of the background wells were eliminated from consideration as background wells due to the use of metal casings in these old Navy water supply wells. Therefore, the site investigation team concluded that site-specific background wells will be used for comparisons as appropriate. Since several of the sites are co-located within the Main Operational Area of the Former NASD, an available upgradient well installed for SWMU 14 was used for comparisons with the site data.

    When SWMU 14 groundwater concentrations when compared with the general background levels, only aluminum was above the background levels. However, when compared with the site-specific upgradient well (background well), none of the site metals were above this site-specific background level. The text will be edited for clarity in the revised report.

54. Page 5-9: The first paragraph states that the site is inactive and has "no current human activity." Is there evidence of trespassing? Could the site be accessed by recreational users? The text should be expanded to clearly define these scenarios.

Response: As previously addressed above in a similar comment, there is no reported trespassing within the fenced area of the Main Operational Area. The text will be edited for clarification in the revised report.

55. Page 5-10, Table 5-4: For the BEQ, the reported values for the mean detect and the best estimate of the mean are both 0.36 mg/kg. However, the frequency of detection is only19% (3/16). Please verify these values.

    Response: Appendix C-1, Page 4 of 18, presents the individual PAH constituents and their statistical summaries which have two mean values, the mean of the detected concentrations versus the best estimate of the mean. When each sample included non-detect concentrations at half the detection limits in estimating the BEQs, because of the presence of non-detects in all samples, concentration levels might be normalized resulting in similar mean values. Since only benzo[a]pyrene is above screening criteria, only this PAH will be evaluated as a COPC; thus, the calculation of BEQs is no longer pertinent to this site. No further action is required in regard to this comment.

56. Page 6-8: The text for the subsurface soils is very confusing. The text in Section 6.3 states that no contaminants in subsurface soils were identified above screening criteria. Table 6-2presents information for subsurface soils, but there are no screening criteria presented in the table - all chemicals have "NA" listed for the SSL value. Can chemical-specific SSLs be developed based on site-specific information? There cannot be a decision for no further action when there are no screening criteria available. Please provide additional support for the NFA decision, revise the table to include some type of screening values, and revise the text to more accurately state what happened in the screening process.

    Response: An SSL is developed if there is a drinking water standard for a chemical. EPA did not develop an SSL value for any of these chemicals. EPA Region 3 RBC tables will be reviewed for any listed SSL values during report revision. The chemicals will also be screened against RBCs in the revised report to determine if they are present above health-based levels.

57. Figure 7-4: Please identify the qualifier "L" in the key.

    Response: The suggested editorial change will be made in the revised report.

58. Page 7-6, Table 7-2: Please complete the table. If values are not available, please enter "NA" in the appropriate cells of the table.

    Response: The suggested editorial change will be made in the revised report.

59. Page 7-7, Table 7-4 : This table does not contain exposure factors. Please rename the table. Also, why is the conceptual site model presented in this format for this AOC? The CSM should be presented in a consistent format for all AOCs/SWMUs.

Response: The reference to Table 7-4 will be corrected. The Conceptual Site Model (CSM) will be edited to be consistent in format across all sites.

60. Page 8-4, Section 8.2.1.1: In the first sentence of the second paragraph, please correct the number of samples to "17."

    Response: The suggested change will be made in the revised report.

61. Page 8-4, Table 8-1 : For thallium, the reported values for the mean detect and the best estimate of the mean are both 1 mg/kg. However, the frequency of detection is only 14/17. Please verify these values.

    Response: Appendix C-2, Page 7 of 18, includes the details of these calculations. The rounding off used in Table 8-1 changed the values to the nearest full number. As can be noted in Appendix C-2, the mean of the detects is 0.76 mg/kg, and best estimate of the mean is 0.93 mg/kg and maximum is 1.7 mg/kg. No further action is required in regard to this comment.

62. Page 8-6, Table 8-2: Chromium is identified as a COPC in the text in Section 8.2.1.2, but it is not included in Table 8-2. Please revise the table to include chromium.

    Response: Appendix B-4 includes a sample-specific comparison of detected groundwater chemicals against criteria. None of the chromium detects were above criteria, thus it is not considered a COPC. However, rescreening as per EPA comments may change the list of COPCs. The text will be revised accordingly in the revised report.

63. Page 8-6, Section 8.2.2: The evaluation of chromium is incomplete and inconsistent. The text in this section states, "[s]ubsurface soils did not indicate the presence of any hazardous material specific to the site." On Page 8-4, Section 8.2.1.1, the text states that chromium was identified in the subsurface at concentrations which exceeded the migration to groundwater criterion. The second paragraph of Section 8.2.2 on Page 8-6, furthers the discussion that chromium in the subsurface is not of concern to the groundwater, and offers the low concentrations of dissolved chromium in the groundwater as support for this assumption. This conclusion is based on one round of sample data. Are other data available so that groundwater concentration trends can be evaluated to ensure that the dissolved chromium is not leaching over time? If not, with the paucity of groundwater data, it may be premature to conclusively state that the site is not contributing to ongoing chromium contamination in the aquifer. Additional groundwater sampling may be necessary. Please provide any additional information on groundwater or subsurface soil sampling that may be helpful in evaluating the potential for chromium migration to the groundwater.

    Response: We disagree with the statement that the chromium evaluation is incomplete and inconsistent. The shallower depth samples from each of the four borings is listed in Table B-2, Pages 39 and 40 of 72. The two shallower depth samples from the same soil boring where maximum chromium was detected (AF-

SB01) are within background range of concentrations and are below screening criteria. Though groundwater was sampled only once at this site, there are four downgradient wells and one upgradient well. The well data with the detected highest chromium are not in the well nearest to the highest soil concentration location. In addition, dissolved chromium levels are low in all wells including the site and background wells, indicating that site chromium is not different from any of the background wells. The pH measurements reported in Appendix D of the PA/SI report, Volume II, October 2000, are similar to all other wells within Main Operational Complex area. Thus, the site-specific elevation of chromium or conducive conditions for elevated metals levels (altered pH level) are reported at this site. None of the detected chromium levels in the wells are above MCLs. Thus, no further monitoring to follow up on chromium will be included for this site due to absence of contamination at this historical site. The text will edited to include some of the above technical reasoning in explaining site conditions and chromium presence in subsurface soils.

64. Page 8-9, Table 8-4: Was chromium included in the quantitative evaluation? If not, please clarify why it was not, since it was detected at concentrations which exceeded the tap water PRG.

    Response: The detected chromium levels are below the screening criteria (MCL for hexavalent chromium) of 100 $\mu g/L$, and therefore was not selected as a COPC. There is no PRG for total chromium, therefore it will be screened against the PRG for conservative hexavalent chromium to be conservative. However, it is important to note that groundwater samples were also evaluated for the presence of dissolved chromium, which is believed to be a more soluble form of chromium. The dissolved chromium levels were much lower, and similar in concentrations to background dissolved chromium levels.

65. Page 11-1, Table 11-1: This table is incomplete. As shown in Table 11-2, several sites are associated with HI values which exceed acceptable levels (for example, the HI for the residential child at AOC K is 8.1). It is not acceptable to respond "no" in the column "Unacceptable Human Health Risk?". The table should be expanded to more accurately present the risks and hazards associated with each site. If this cannot be done (due to the complexity of the sites), then the table should be removed.

    Response: The comment is noted. The table will be reformatted in the revised report to include the appropriate information.

66. Due to the presentation of data, the appendices were not thoroughly evaluated. EPA will reevaluate thc information included in these appendices when they are provided in the appropriate RAGS Part D format.

    Response: The revised report will include the RAGS Part D formatted tables, as requested by the EPA and EQB reviewers.
    /MAS

U.S. Environmental Protection Agency, Region II
Emergency and Remedial Response Division
Program Support Branch
290 Broadway, 18th Floor
New York, New York 10007-1866

Memorandum

TO: Helen Shannon-Project Manager
ERRD/NJRB

FROM: Andy Crossland-Geologist
ERRD/PSB/TST

DATE: Thursday, December 19, 2002

SUBJECT: Review of the Draft No Further Action Report for Nine Sites, NASD, Vieques Island, Puerto Rico

In response to your request, I have reviewed the document listed above. If you have any questions concerning these comments, please feel free to call me at x4436.

1. An issue with establishment of the background concentrations run through the report. In a number of cases, sample concentrations are found at levels which are above those noted in the Background Study. At the same time, the report sometimes uses 'background' to refer to concentrations typically found in the Main Operations Areas. It does appear that the Main Operations Area has un-impacted soil concentration which are slightly above those that resulted from Background Study. This issue needs to be addressed in the text so that it is clear what 'background' concentrations are being used for comparisons.

   Response: The revised report will have a subsection added to Section 1.0 explaining how the background data are used in this report. The background concentrations developed in the background report were used for comparison with individual samples. When data summaries are used for comparison, the range of concentrations (minimum and maximum values) of the site samples were compared against the range of background sample concentrations. Additionally, when inorganic chemical distributions are similar across other sites located within close proximity, comments regarding soil inorganic chemical levels in the area were added to the text. As agreed during the background study report review, groundwater values were compared against an upgradient well at the site. Each of the sites did not have an upgradient well, however since seven of the nine sites are located in close proximity to each other, the same upgradient well was used for comparison. There were no sediment or surface water sites, therefore this background was not an issue for this NFA report. The text of the revised report will include this information.

2. Exceedence of SSLD20 values are not smoothly integrated with the risk based approach being used for the site. The SSL guidance is intended o make an initial cut as to what contaminants should be looked in detail. Potential impacts to groundwater are then considered in conjunction with contaminant distribution and subsurface stratigraphy. If these factors suggest that groundwater samples need to be collected, those sample results would be used in the risk assessment process, evaluating exposure to groundwater. For example, in the case of SWMU-10, thallium is slightly above the SSL criteria in 1 out of 10 samples collected from 4 to 6 ft bgs, and in 5 out of 10 surface samples. The water table at this location is roughly 40 ft bgs and the soils are clay rich. These conditions suggest that it is not necessary to sample the groundwater; the low exceedences decrease quickly with depth and it is safe to conclude that thallium could not migrate through 40 ft of clay rich soils. Therefore, groundwater not sampled for inclusion in the risk assessment.

   Where SSL targets are exceeded and groundwater samples indicate no impact, it is safe to conclude that the levels in soil do not in fact pose a concern. In such a case, the conservative approach in the SSL guidance ensures that we consider the possibility of a problem, and the groundwater results determine that none actually exists. AOC C is an example of this case, in that thallium SSLD20 criteria are exceeded in deeper soils, but the groundwater is unimpacted.

   Response: We agree with the comment. The text will be edited to strengthen this reasoning in the revised report at the appropriate sites.

3. Figure ES-2: There are a number of things which should be amended or clarified on this figure. A) With an exceedence of backgrounds, it is not clear what distinguishes a "significant exceedence" from a simple "yes" for exceedences. As the PA/SI is only preliminary, an RI/FS would be triggered if there is any unacceptable risk with levels above background. Without this, we have path that leads to an FS without ever doing an RI, which is not appropriate. B) I do not understand the line that goes from NFA to Baseline RA. It appears to be tied by distinguishing between residential and industrial use, as is the line from Baseline RA to FS. The chart also seems to imply that if a site meets industrial targets, but not residential ones, it will go to and institutional controls ROD. This is not necessarily the case.

   Response: Figure ES-2 will be revised to indicate that if risk-based levels are exceeded, a risk assessment will be conducted and a comparison with background will be made. If the criteria for acceptable risk and background are exceeded, a risk assessment is conducted. If the risks are above acceptable limits and background levels are exceeded, an RI/FS will be conducted. If not, an NFA will be proposed, as is the case with the nine sites. One exception could be, if a "hot spot" that is fully defined is identified, a site may go to FS/removal actions without a full RI.

4. Table ES-1: The column titled "COPCs Site Related?" should probably read "COPCs above Background?" This is the criteria set-up in Figure ES-2. I would suggest switching the two right columns to better match the decision tree.

   Response: The suggested change will be made in the revised report.

5. Page ES-10: The discussions of AOC C and AOC F do not include a comparison to background, as is made for other sites. Is this because they exceed background levels? This should be clarified, and each of the summaries should indicate the path that the site has taken to reach NFA. Also, note that 'no historical evidence to suggest a release' is not part of the decision tree. It is quite possible to have a contaminant release without it being documented. Statements to this effect do not appear to belong in the document, as they do not have a bearing on whether that site should move to NFA.

   Response: At both sites, AOC C and AOC F, soil and groundwater data were compared against background levels (Tables 7-9 and 8-7 of Appendix E). Page ES-10 will be edited to remove references to historical activities versus the detected concentrations.

6. Page 3-4: The last paragraph appears to contradict itself. It states that the single elevated thallium detection is above background levels, and then later that the value is well within background concentration range. The former statement seems t be accurate one, when compared to the results of background study. Also the document rules out thallium as a COPC based on the level being "near the detection limit," which is not appropriate.

   Response: The logic presented in the referenced text did not have any contradiction. Thallium is not likely a true detection due to its presence near the detection limit, which is likely a false positive. Please see Attachment 1 to this document, which is a memorandum prepared by our staff chemists for a different project (to address low-level metals in groundwater) that is pertinent to this project as well. This memorandum explains why low-level metals detections are considered uncertain. Most of the low-level metals detections could be viewed from this perspective. This is a well recognized issue among chemists involved with analytical chemistry. The following text is an excerpt from the memorandum in Attachment 1.

   > ".....First, you must also recognize that these limits are calculated from a non-matrix, in other words, DI water spiked with a low level target. Gibbons and Maddalone published a paper in conjunction with EPRI discussing what they call the Alternative Minimum Level (AML) which calculates the statistic utilizing a matrix. Needless to say, the AML is significantly higher than the PQL defined above. The ASTM D-19 committee has recently put together a new method for quantitation limits very similar to the AML paper. The point is that a matrix adds

interferences or noise which affects any spectroscopic method in one way or another, even with all the correction techniques.

Thus, any value at or near the IDL or MDL, especially in a difficult matrix, may be a Type I or Type II error. As an example:

A trace ICP may have a thallium IDL or MDL between 2-8, depending on the instrument, the operator, etc. For this example, let us use Tl with an MDL of 4 ug/L. It would not be surprising to see continuing calibration blanks (CCB's) with results from a negative 6 to a positive 10. A matrix could yield a slightly higher range."

Some of this information will be added to the text of the revised report for clarity.

7. Page 3-6: The Contaminant Fate and Transport section has a few errors. As noted in the last comment, thallium is present above the SSLD20 in half of the surface samples and 1 of 10 subsurface samples. The concentrations are also higher than those noted in the background study, although the levels and distribution are not clearly indicative of a release.

   Response: Page 3-6 will be edited to follow the logic presented in Comment #2 above.

8. Table 4-1 and 4-2, Figure 4-4: Detections of VOCs, pesticides and mercury should be included in the tables and the figure. The detections are mentioned in the text but no levels are provided.

   Response: Appendix B-1 includes all the detected chemicals and their comparisons to the criteria. Only chemicals that were detected above the criteria levels and identified as COPCs are included in this table. The tables are complete for the COPCs. Figure 4-4 also presents only the exceeded chemicals, in order to prevent confusion with too much information. A reference to Appendix B will be added to the revised text.

9. Table 7-3: Please explain why chromium, which was detected in groundwater, is not included in the table.

   Response: Appendix B-4 (Page 64 of 72) includes a comparison of AOC C groundwater detections and the screening against comparison criteria used to selecting COPCs. Table 7-3 presents only the COPCs identified in the selection process. The maximum chromium from the site wells are within the range of chromium levels at other sites. The detected concentration of chromium was below the screening criteria, and to be consistent with the approach used for all other chemicals it is not identified as a COPC.

ATTACHMENT 1

MEMORANDUM **CH2MHILL**

Metals Results At or Near a Limit of Detection

TO: Vijaya Mylavarapu/GNV

COPIES: Herb Kelly/GNV
Tammy Carey/GNV

FROM: Kevin A. Sanders/GNV

DATE: May 31, 2000

This memo is intended to help clarify some of your questions regarding values at or near the detection limit. It is important to first understand the definitions of limits of detection and limits of quantitation.

Instrument Detection Limit (IDL) – The concentration equivalent to the analyte signal which is equal to three times the standard deviation of a series of ten replicate measurements of the calibration blank signal at the selected analytical wavelength.

The IDL can also be determined with a low level standard at a concentration of about 2-5 times the estimated IDL with 7 replicates on 3 non-consecutive days (CLP). Analyte concentrations at or near the IDL are neither accurate or precise and can vary as much as 300% from the true value. Type I and II errors are commonplace.

Method Detection Limit (MDL) – The minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero.

The MDL differs from the IDL in that the 7 replicates of a spiked solution are taken through the entire method, including preparation. Again, accuracy and precision are not reliable at this level and Type I and II errors will still occur.

Minimum Level (ML) – The lowest level at which the entire analytical system gives a recognizable signal and acceptable calibration point.

The ML is about 3 times the MDL, or 10 standard deviations from a MDL 7 replicate study. Accuracy and precision are better at this level, but not a certainty. Type I and II errors are significantly reduced.

Practical Quantitation Limit (PQL) – The PQL is about five times the MDL and represents a practical and routinely achievable detection limit with a relatively good certainty that any reported value is reliable.

The PQL represents a value which should yield good accuracy and precision within the limitations of the method. Type I and II errors should be eliminated.

The ratios of IDL:MDL:ML:PQL are about 1:5:15:20. All of these definitions and discussion should provide you with a better grasp of the relationships and significance

of these limits. There are limits of detection and quantitation, but these are the most frequently used in our business. Now what does this mean in real applications?

First, you must also recognize that these limits are calculated from a non-matrix, in other words, DI water spiked with a low level target. Gibbons and Maddalone published a paper in conjunction with EPRI discussing what they call the Alternative Minimum Level (AML) which calculates the statistic utilizing a matrix. Needless to say, the AML is significantly higher than the PQL defined above. The ASTM D-19 committee has recently put together a new method for quantitation limits very similar to the AML paper. The point is that a matrix adds interferences or noise which affects any spectroscopic method in one way or another, even with all the correction techniques.

Thus, any value at or near the IDL or MDL, especially in a difficult matrix, may be a Type I or Type II error. As an example:

A trace ICP may have a thallium IDL or MDL between 2-8, depending on the instrument, the operator, etc. For this example, let us use Tl with an MDL of 4 ug/L. It would not be surprising to see continuing calibration blanks (CCB's) with results from a negative 6 to a positive 10. A matrix could yield a slightly higher range.

Thus, many of the "estimated" values that are generated in the laboratory; results between the IDL/MDL and a reporting limit (RL) may indeed be Type I or Type II errors due to instrument noise, background shifts, or matrix interferences which are not accurately corrected for at low levels.

Review of CH2M Hill's Response to TRCs Comments on the Draft No Further Action for Nine Sites Vieques Island, Puerto Rico Incorporating Discussions from the April 21, 2000 Conference Call

Major Comments

1. - see exhibit 1

2. - see exhibit 1

3. - see exhibit 1

4. CH2M Hill agreed to include a brief summary in the NFA report

5. - see exhibit 1

General Comments:

1. CH2M Hill to reformat to RAGS Part D
3. Provide more details – CH2M Hill agreed to include a brief summary in the NFA report
4. Discuss in report –We agreed that we could get the information from the PA/SI
5. Should summarize - CH2M Hill agreed to include a brief summary in the NFA report
6. CH2M HILL response acceptable
7. CH2M Hill will include an additional section in the report to discuss background.
8. CH2M HILL response acceptable
9. Did not discuss. CH2M Hill should try to annotate site maps to better orient the reader to site specific features

Page Specific Comments

SWMU 5

Page 2-1, Section 2.1.3: CH2M Hill will provide text that states that groundwater was not found in the overburden.
Page 2-3, Table 2-1: CH2M HILL response acceptable
Page 2-2 ¶ 5: CH2M HILL response acceptable
Page 2-8 ¶ 5: CH2M HILL response acceptable

SWMU 10

Page 3-1 ¶ 1: CH2M HILL response acceptable

Pages 3-1 through 3.2.1: Subsurface soil sampling – leaching from surface soil. We did not discuss. This topic will be discussed on Wednesday when going over EPA comments.
Page 3-4¶ 3, Figure 3-5 and page E-3-2: CH2M HILL response acceptable
Page 3-7 ¶ 3: - see exhibit 1
Page 3-7 ¶ 6: CH2M HILL response acceptable
Figure 3-5: CH2M HILL response acceptable

SWMU 14:

Page 4-1 through 4-12: Adam requested that CH2M Hill perform additional research to locate a closure report for the OWS. CH2M Hill will provide additional text to summarize the closure of the OWS. CH2M Hill will state that sample collected closest to the OWS will serve as a clean closure sample.
Page 4-6 ¶ 1 and page E-4-2: CH2M HILL response acceptable
Page 4-6 Table 4-2: CH2M HILL response acceptable
Page 4-6 ¶ 2: CH2M Hill agreed to provide additional information in report.
Page 4-6, ¶ 2: CH2M Hill agreed to provide additional information in the report.
Page 4-6, ¶ 1 and Page 4-7, Section 4.2.2: See discussion of Comment Page 4-1 through 4-12 above
Page 4-7, ¶ 3: - see exhibit 1
Figure 4-5, Figure 4-5, and Page E-4-2: CH2M HILL response acceptable
Page 4-11 ¶ 1: CH2M HILL response acceptable

4.4 SWMU 15

Page 5-1 ¶ 1: CH2M Hill agreed to provide more detail on Site history in the report
Page 5-1 ¶ 2: - see exhibit 1
Page 5-3 ¶ 1: CH2M HILL response acceptable
Page 5-3 ¶ 3: CH2M HILL response acceptable
Figure 5-5, Figure 5-5, and page E-5-2: CH2M HILL response acceptable
Page 5-9 ¶ 5: CH2M HILL response acceptable
Page 5-10¶ 4: CH2M HILL response acceptable
Page 5-11 ¶ 4: The referenced paragraph does not identify the adult resident as having an unacceptable risk level. Did not discuss. Using RAGS Part D format will iron this out.

4.5 AOC B

Pages 6-1 through 6-5: - see exhibit 1
Table 6-1: CH2M HILL response acceptable
Page 6-5 ¶ 2: CH2M HILL response acceptable
AOC B Continued:

Page 6-6 ¶ 7, Figure 6-5, and Page E-6-2: CH2M HILL response acceptable
Page 6-8 ¶ 5: CH2M HILL response acceptable

4.6 AOC C

Page 7-1 ¶ 1: CH2M HILL response acceptable
Page 7-1 ¶ 4: Leaching over time. Did not discuss (EPA comment on this one as well). Will be discussed on Thursday.
Page 7-3 ¶ 1: CH2M HILL response acceptable
Page 7-3 ¶ 2: CH2M HILL response acceptable
Page 7-8 ¶ 7, Figure 7-5, and page E-7-2: CH2M HILL response acceptable

4.7 AOC F

Page 8-1, Section 8.1, and Paragraph 1: CH2M Hill will provide more detail on requested information.
Figure 8-3: CH2M HILL response acceptable
Figuer 8-4: CH2M HILL response acceptable
Page 8-4¶ 1 and 2: CH2M HILL response acceptable
Page 8-3 ¶ 3: CH2M Hill has agreed to provide more information to support their conclusion.
Page 8-7 ¶ 4 and Figure 8-5 and page E-8-1: CH2M HILL response acceptable
Page 9-1 ¶ 4: Could summarize in RA. CH2M Hill has agreed to provide a brief summary in the NFA report.
Page 9-6, Figure 9-5, and page E-9-1: CH2M HILL response acceptable

4.9 AOC L

Pages 10-1 through 10-5, Section 10.2.1: TRC request for Additional Sampling. - see exhibit 1
Page 10-6 ¶ 3: CH2M HILL response acceptable
Page 10-6 ¶ 3: - see exhibit 1
Page 10-6 ¶ 5: CH2M HILL response acceptable
Page 10-6 ¶ 5: CH2M HILL response acceptable (AOC L)

4.1 Summary and Recommendations by Site

Page 11-1, Table 11-1: CH2M HILL response acceptable
Page 11-3 ¶ 1: CH2M HILL response acceptable
Page 11-4 ¶ 1: CH2M HILL response acceptable
Page 11-4 ¶ 3: CH2M HILL response acceptable

4.11 Appendix B

Provide a complete data set: We agreed that we will consult with the data provided in the PA/SI report.

4.12 Appendix C

Provide all units for sample results and screening criteria: CH2M HILL response acceptable
Page 61 through 64: CH2M HILL response acceptable

4.13 Appendix D

1. CH2M HILL response acceptable

2. Vijaya recommended that she provide a summary of exposure profiles to Mike and Tracey, and that they have a quick meeting to discuss her recommended values.

3. Vijaya recommended that she provide a summary of exposure profiles to Mike and Tracey, and that they have a quick meeting to discuss her recommended values.

4. Vijaya recommended that she provide a summary of exposure profiles to Mike and Tracey, and that they have a quick meeting to discuss her recommended values.

Appendix D-1 and D-2: CH2M HILL response acceptable
Appendix D-3: CH2M HILL response acceptable
Appendix D-4: CH2M HILL response acceptable
Appendix D-6: CH2M HILL response acceptable
Appendix D-11, D-28, D-45, D-70, D-95, D-112, D-153, D-170: CH2M HILL response acceptable
Appendix D-62a through D-69: CH2M HILL response acceptable
Appendix D-62b, D-66, D-141, and D-149: CH2M HILL response acceptable
Appendix D-102: CH2M HILL response acceptable
Appendix D-151: CH2M HILL response acceptable
Appendix D-10 through D-186: CH2M HILL response acceptable

4.14 Appendix E

Page E-1-3 ¶ 1: The report was written in November 2002 and the latest version of the standards is Summer 2002. This one resulted in a great deal of discussion between Tracey, Mike and Vijaya. The outcome resulted in Vijaya agreeing to

use updated values for both the Primary Drinking Water Standards and the Region IX PRGs.

Page E-1-5 ¶ 7: CH2M HILL response acceptable

SWMU 10:

Page E-2-1¶ 5: CH2M HILL response acceptable

Page E-2-4: CH2M HILL response acceptable

SWMU 14

Page E-4-3: ¶s 2 and 3: CH2M HILL response acceptable

SWMU 15

CH2M Hill agreed to provide additional information pertaining to VOC lab contamination in the report.

Table E5-7: CH2M HILL response acceptable

AOC B:

Table 6-6: CH2M HILL response acceptable

AOC K:

Table 9-5: CH2M HILL response acceptable

EXHIBIT 1

DATE: **April 21, 2003**

TO: **Vijaya Mylavarapu, CH2M Hill**

FROM: **Drew Smyth**

SUBJECT: **Response to Comments NFA Report for Nine Sites**

As discussed in this mornings conference call by Tracey Kauffman, the following is TRC's recommended approach for dealing with the issue pertaining to TRC's request for additional sampling for the nine No Further Action (NFA) Sites.

As you may be aware, TRC did not participate in the work plan review for the nine sites that are recommended for NFA. As a result TRC has continued to have a number of reservations about the completeness and documentation of the various draft and final assessment reports. These comments have carried over throughout the process of the report reviews. At this point, TRC is aware that the field work has been completed and that the municipality now operates on the property. As a result, we are not asking CH2M Hill to conduct additional assessment unless the risk assessment team determines crucial data is not available that now requires new field work. Instead, we are just providing placeholders to show our continuing reservations about the initial field program. Moving forward we will be reviewing and commenting on new field work plans and we should not have these discrepancies in the future. For the technical subcommittee to approve the NFA report CH2M Hill will need to meet the risk assessment portion of our comments.

In reviewing the Risk Assessment Portion of our review, we find that the format of the report has significantly impeded our review and believe that if the report is prepared according to RAGS Part D, then we expect that NFA may be the final outcome.

Appendix A-2

Responses to Comments on the *Final Expanded PA/SI Report* (CH2M HILL, 2000) and the *Final Expanded PA/SI Report - Phase II* (CH2M HILL, 2001)

Draft Responses to Comments from EQB, EPA and TAPP on Draft Expanded PA/SI Phase II Report

Responses to EQB (TRC) Comments on Navy's Draft Expanded PA/SI Report

Comments Submitted 5/2/02

AOC B–Wastewater Treatment Plant

EQB Comment 1

AOC B – Wastewater Treatment Plant

Site Summary: The PA/SI indicates that since 1983, wastewater treatment plant effluent was drained into "...four wastewater lagoons with no discharge point..." The PA/SI indicates that the April 2000 Environmental Baseline Survey concluded that dumping of hazardous waste in the past is suspected.

PA/SI Investigation Summary: Four surface and subsurface soil samples were collected from the center of each lagoon and analyzed for VOCs, SVOCs, pesticides/PCBs, and inorganic compounds. Aluminum, manganese, lead, and vanadium were detected at concentrations above residential PRGs, but below NASD background levels in surface soils. Pesticides/PCBs, SVOCs, and VOCs were not detected above screening criteria in surface soil. Subsurface soil samples contained no contaminants above PRGs or background.

Response to EQB Comment 1

The second sentence will be re-worded to state that " According to the EBS Report "disposal of hazardous constituents may have occurred at the WWTP during past operations". The historical archive research and site data does not provide any evidence that hazardous waste was likely disposed of at the site. Metals occur naturally within the soils and groundwater, dichlorobenzene and toluene are byproducts of gasoline which may have been associated with surface water runoff of paved areas. A risk assessment will be conducted to evaluate if unacceptable risk are present.

Page-Specific Comments

Comment 2

Page 3-1, ¶4: The site description needs to indicate whether the lagoons are lined.

Response to Comment 2

The text will be expanded to state: There is no information available to determine if the lagoons are lined.

EQB Comment 3

Page 3-6: No ground water data are available to assess ground water quality impacts. Samples need to be collected from a minimum of two water table ground water monitoring wells and analyzed for the full suite of parameters.

Response to Comment 3

Four soil samples were completed in the wastewater lagoons and at each soil boring both surface and subsurface soil samples were analyzed for the metals, pesticides, PCBs, SVOCs, and VOCs. These soil samples were distributed over the four quadrants of the lagoons to characterize any releases from the lagoons. Although several metals were detected above PRGs in the surface soils they were the same metals detected in the background soils. None of the subsurface soils detected metals above PRGs. A preliminary risk evaluation indicates that the metal concentrations do not pose an unacceptable risk to human health. As a result, there has not been any groundwater sampling for this site.

AOC K–Water Well At Public Works

EQB Comment 4

Page 7-1, ¶5: The construction details of the former water well need to be provided to evaluate these wells as suitable monitoring points.

Response to EQB Comment 4

The well construction details of supply well AOC K will be presented in the Final PA/SI report. The water supply well was re-sampled prior to well abandonment in 1999 and the sampling results showed that benzene was not detected in the supply well. This information will be provided in the Final PA/SI Report.

AOC L–Septic Vault

EQB Comment 5

General Comment

Samples from a minimum of two ground water monitoring wells need to be collected and analyzed for the full suite of analytes. These results are necessary to evaluate the ground water quality impacts from the site.

Response to EQB Comment 5

The EBS states that "It is suspected that the vault was used in the 1940s for the treatment of installation sewage and no drainage field was present". Therefore, any releases from the vault would likely have resulted from overflow of the vault and not from discharge to groundwater. As a result, groundwater monitoring wells were not installed. Surface and subsurface soil samples were collected at the outlet of the vault at SB-01 and SB-02 as well.

In addition, soil samples were collected at two of the locations to provide analytical data for the entire perimeter around the vault. Although metals were detected above PRGs they are likely indicative of site background levels. A risk assessment will be completed to assess if the metals concentrations meet acceptable risk.

EQB Comment 6

Page 8-2, ¶5: It is not clear whether the subsurface soil samples at this site were obtained below the discharge depth of the vault. Data should be provided to indicated the depth of the subsurface samples. If they were not collected below the discharge depth of the vault, deeper samples should be obtained prior to recommending NFA for this site.

Response to EQB Comment 6

As stated above releases from the vault would likely have resulted from overflow of the vault and not from discharge to groundwater. As a result, surface and subsurface soil samples were collected below the discharge depth of the vault. at SB-01 and SB-02. In addition, soil samples were collected at two other locations below the discharge depth to provide analytical data for the entire perimeter around the vault. Although metals were detected above PRGs they are likely indicative of site background levels. A risk assessment will be completed to assess if the metals concentrations meet acceptable risk.

Draft Responses to EPA Comments on Navy's Draft Expanded PA/SI Phase II Report (July 2001)

EPA Comment 1

Section 1.6.2. Land Use: In developing the PRE and RI/FS for the site it is important to clearly define the land use following appropriate EPA guidance on land use. The current screening analysis used a residential scenario and changes from this assumption must be discussed in the site-specific risk assessments that are developed after this point.

Response to Comment 1

At screening phases of the risk evaluations, residential land use based criteria are used to provide a conservative assessment of potential risks to human health and the environment. An expanded discussion of risk based on the future land use for each of the sites will be addressed as part of a risk analysis in the RI/FS document(s).

EPA Comment 2

Section 2.11: The current report uses background data to determine whether chemicals are site-related but fails to describe the procedures used. As described above, this approach should be defined and the approach outlined by Dr. Singh should be followed.

For risk assessments developed under the RI/FS and PRE process, it is important to use the Agency's new guidance on background sampling that recommends that background no longer be used as a criteria for removing chemicals of concern but rather this information should be discussed in the risk characterization. This recent guidance on use of background

data clarifies earlier procedures on this topic as outlined in the Risk Assessment Guidance for Superfund. This approach should be followed in the second phase of this project.

Response to Comment 2

The risk assessment will follow the latest EPA guidance on background. exceedances will be addressed through a focused risk evaluation that incorporates appropriate procedures as outlined in the Risk Assessment Guidance for Superfund. The focused Risk assessment will follow the latest EPA guidance on background. All chemicals above RBCs/PRGs will be retained for risk assessment regardless of their presence within/below background levels and chemicals within/below background levels will be discussed at the end of risk characterization.

EPA Comment 3

AOC B - Wastewater Treatment Plant: Section 3.2 should provide additional site history information regarding the suspected dumping of hazardous waste that may have occurred at this site. Existing information regarding the types of hazardous material dumped should be included if available.

Response to Comment 3

The report of hazardous material dumping was documented as a potential source of release from the Initial Assessment Study conducted in 1984. Any additional information regarding hazardous waste dumping has not been discovered in the Environmental Baseline Survey, from interviews or archive searches that were conducted for the PA/SI..

EPA Comment 4

AOC H - Power Plant: Page 4-8, Section 4.7.1., last paragraph is missing text.

Response to Comment 4

The paragraph has been re-written, as follows:

Although detections of explosives (2,6-dinitrotoluene) were observed above the leachability criteria, all detections were within acceptable risk based screening criteria. Further, the groundwater analysis results for this site confirm that explosives have not leached from the soils to groundwater. The revised text is included in Attachment A.

EPA Comment 5

AOC H - Power Plant: Figure 4-4. It is unclear why the screening criteria M includes an exceedence of the MCL and Region 3 Drinking Water Regulations while T only includes exceedence of the Region 9 Tap Water PRG. The important information is whether the MCL is exceeded without a further determination of exceedence of the Region 9 Drinking Water Standard for regulatory purposes. If the Region 3 information is presented it should be presented as a separate individual criteria.

Response to Comment 5

The legend on Figure 4-4 has been changed to indicate exceedences of screening qualifier 'M' indicates above Maximum Contaminant Level per Drinking Water Standards and Health Advisories, EPA 2000. The revised figure is included in Attachment A.

EPA Comment 6

AOC I - Asphalt Plant: Under Section 5.7.2 the data indicate that the maximum concentration of chromium found at the site exceeds the background level. It is unclear how the determination is made that chromium may not be site related. In light of Dr. Singh's comments, this should be re-evaluated and the text changed as appropriate.

Response to Comment 6

The text has been changed as follows:

However, all exceedances will be addressed through a focused risk evaluation that incorporates appropriate procedures as outlined in the Risk Assessment Guidance for Superfund and Dr. Singh's comments (July 2, 2001). The revised text is included in Attachment A.

EPA Comment 7

AOC J - Former Staging and Disposal Site: There has been considerable discussion within the Agency regarding perchlorate sampling. During the proposed sampling in the next phase it may be helpful to discuss sampling for perchlorate with Region 9 risk assessors who has been involved in developing sampling procedures. Region 2 will help facilitate this contact.

Response to Comment 7

Comment Noted. Upon development of the RI/FS Workplan, these recommendations will be implemented.

EPA Comment 8

AOC J - Former Staging and Disposal Site: The discussion under Section 6.6.1 requires further clarification. As indicated earlier, the risk assessments do not use data from filtered samples as the basis for analysis. This section should present results for unfiltered samples as the basis for decision making regarding further evaluation. It is also important to note that 6 of the seven metals exceeded background samples. It is recommended that the unfiltered data should be evaluated in a risk assessment to determine the level of risk posed by this groundwater.

Response to Comment 8

Unfiltered groundwater data will be evaluated in the more detailed risk evaluation that will be conducted for the RI at this site. Filtered samples are collected for well development and turbidity purposes only and are not used in the risk assessment. Groundwater samples will be collected using low-flow sampling techniques during the RI. Exceedances of background values are discussed in Section 6.7.1.

Section 6.6.1 has been revised by adding the following text:

However, all metals that exceed MCLs will be evaluated in the risk assessment conducted for the RI. The revised text is included in Attachment A.

EPA Comment 9

AOC J - Former Staging and Disposal Site: On page 6-11, the text should clarify what criteria was used in the evaluation of sediment samples and the basis for this comparison. Review of Table 6-5 indicates comparison to ECOSD developed by Region 4. These criteria are not appropriate for human health risk assessments. It is recommended that the text clarify the location of the sediment, whether this is a completed exposure pathway, and how people may be exposed to the contaminated sediment. Based on this information a screening level may be determined.

Response to Comment 9

The text has been modified as follows:

No constituents were detected above comparison criteria. The site is very remote and people cannot easily access the sediment. No additional sediment sampling is recommended at this time. However, during the RI a conceptual site model will be developed and exposure pathways will be determined. If appropriate, human health risk will be evaluated during the risk assessment completed for the RI. Sediments typically more of a concern for aquatic ecological receptors , thus, sediment results at the early evaluation stage are screened against ecological criteria. The modified section is included in Attachment A.

EPA Comment 10

AOC K - Water Well: In Region 2, we do not perform risk assessments using unfiltered water samples as proposed for this AOC. It is recommended that the PRE should evaluate the groundwater data using unfiltered samples and present these results as the basis for decisions.

Response to Comment 10

It is not our intent to use filtered samples for risk assessments. Groundwater risk estimations will be based on unfiltered samples. However, filtered samples are useful in data interpretation, such as if there is an indication that observed metals are from suspended particulates rather than from being dissolved in the groundwater.

The last paragraph of section 7.7.1 has been re-worded, as follows:

Based on the interpretation of these results, a PRE is recommended to assess the potential risk to human health from metals that were detected above the screening criteria in the unfiltered groundwater samples. The revised section is included in Attachment A.

EPA Comment 11

AOC K - Water Well: In Section 7.7.1, the discussion regarding background is not clear. It appears that the document indicates that the detections are likely the result of background contamination and on this basis it is determined that there is no need for further evaluation. This discussion is confusing and requires clarification especially based on the criteria outlined in Dr. Singh's comments since it appears that the maximum concentration of

aluminum exceeds the background concentration found. The decision regarding whether additional analysis for these chemicals is required and will need to be revisited following the additional analysis described above.

Response to Comment 11

The estimates for background used in the screening do not take into account the data variability in the background data set. Additional statistical evaluations will be conducted during the PRE to determine if the site data are different from background data following existing background analysis guidance.

Section 7.7.1 text has been clarified as follows:

Background exceedances will be addressed through a focused risk evaluation that incorporates appropriate procedures as outlined in the Risk Assessment Guidance for Superfund and Dr. Singh's related memo (July 2, 2001). The revised section is included in Attachment A.

EPA Comment 12

AOC K - Water Well: The discussion regarding laboratory contamination with BEHP is unclear. There are specific criteria in RAGS-Part A that address evaluation of laboratory contamination and the RAGS-Part A approach should be used to evaluate whether BEHP is a laboratory contaminant or whether it is a site-related contaminant.

Response to Comment 12

BEHP, also known as bis(2-ethylhexyl)phthalate is a phthalate ester, which has been identified as a common laboratory contaminant within Chapter 5 of the RAGS, Part A document. As per this guidance, a sample concentration has to be at least 10 times that detected in the blanks, in order for it to be considered as potentially associated with the site. BEHP, like several other phthalates is a common constituent of plastics typically used in equipment during sampling and analysis, and is introduced in the sampling and analysis process. For this reason, EPA recognizes these as common laboratory contaminants. Therefore, the detected BEHP, since it is below the levels found in the blanks, was not considered related to the site. From the Data Quality Evaluation (DQE) in Appendix I, Attachment B indicates that BEHP was detected in a single ambient blank. Six samples were qualified as non-detect due to blank contamination by BEHP. Di-n-octylphthalate was reported in single equipment and lab blanks which resulted in six samples being qualified. Di-ethyl phthalate was detected in two laboratory blanks but resulted in no samples being qualified.

Comment 13

AOC L - Septic Vault: See previous comments regarding background contamination analysis and requested clarifications described above.

Response to Comment 13

The text in regard to background contamination analysis has been clarified as follows:

Background exceedances will be addressed through a focused risk evaluation that incorporates appropriate procedures as outlined in the Risk Assessment Guidance for Superfund and Dr. Singh's comments (July 2, 2001). The revised section is included in Attachment A.

EPA Comment 14

AOC R - Former Construction Staging Area: Section 9.7.1. The baseline risk assessment evaluates risks in the absence of institutional controls as described in the NCP and RAGS-Part A. The assumption that the contaminants are associated with a previous asphalt cover that may have been present is not clear. It is recommended that the SVOCs should be evaluated in the comprehensive risk assessment.

Response to Comment 14

As already stated in the report, a risk assessment will be conducted for the SVOC (mostly PAHs) data.

The final paragraph of section 9.7.1 has been re-written, as follows:

Based on the interpretation of the results, a comprehensive risk assessment is recommended to address human health risk potential associated with the SVOC exceedances and metals observed above background values. Further actions in regard to field investigations will be determined based on the results of the risk assessment. The revised section is included in Attachment A.

EPA Comment 15

AOC R - Former Construction Staging Area: See previous comment regarding evaluation of metals data.

Response to Comment 15

The text in this section has been updated to convey the following:

Background exceedances will be addressed through a focused risk evaluation that incorporates appropriate procedures as outlined in the Risk Assessment Guidance for Superfund and Dr. Singh's comments (July 2, 2001). The revised section is included in Attachment A.

General Comments

EPA Comment G.1

The document should clarify the decision process used for determining whether a Remedial Investigation/Feasibility Study is required or a Preliminary Risk Evaluation. In addition, the text should explain the decision points following the Preliminary Risk Evaluation (i.e., would an RI/FS be conducted if a specific target risk level were exceeded?).

Response to Comment G.1

A decision flow chart has been added to the PA/SI report. If the data indicate a need for further sampling, additional sampling will be proposed.

Section 2.11 Risk-Based Criteria Screening Procedure has been modified as follows:

A decision flow chart is shown in Figure 2-1. Constituents below risk-based screening criteria will be dropped out. However, all constituents exceeding screening criteria or background levels will be evaluated using a focused risk assessment. The revised section is included in Attachment A.

EPA Comment G.2

The ecological section of the document and the QA/QC of data were not reviewed as part of this evaluation and should be sent to appropriate reviewers.

Response to Comment G.2

Comment noted.

EPA Comment G.3

A decision flow chart is shown in Figure 2-1. Constituents below risk-based screening criteria will be dropped out. However, all constituents exceeding screening criteria or background levels will be evaluated using a focused risk assessment.

The July 2, 2001 memo from Dr. Anita Singh indicates that the 95% upper tolerance limit (UTL) is the preferred method for evaluating background level contaminant concentrations. The memo further indicates that "... in this approach, even a single exceedance of the background UTL by onsite (e.g., monitoring well) data is considered as an indication of contamination due to site activities (EPA, 1989, page 5-22). It is desirable that the Navy uses this approach consistently." As currently presented, it is unclear how background was evaluated at the individual AOCs since details are not presented in the document. At a minimum, the background analysis procedures should be clearly defined in the screening procedures section following the recommendations presented in Dr. Sing's memo described above. As appropriate, the reported screening procedures for the various AOCs may require modification and re-evaluation based on this analysis..

Response to Comment G.3

The background screening procedures have been added to Section 2.11 as follows:

A background sampling program was conducted at NASD Vieques to determine the naturally occurring concentrations of metals (inorganic constituents) in surface soil, subsurface soil, groundwater, surface water, and sediments at the site. Samples were collected from areas of NASD that had not been previously disturbed. Undisturbed sample locations were selected based on an analysis of aerial photographs from 1936-1999. The appropriate number of samples (for the range of 75 to 95 percent confidence level of the results) were collected. Background values of Upper Tolerance Limit (UTL) 95% were developed for detected constituents in each media.

A statistical approach was used as the primary method for developing the background concentrations. This approach was supported by a graphical method that showed similar background concentrations.

The background concentrations that were developed can be used as reliable indications of the naturally occurring inorganic constituents at NASD and can be used to evaluate whether constituents detected during future investigations are due to naturally occurring activities or to activities related to a specific site. Site data can be screened to the background concentrations and if the site data are below the background concentrations, it can be assumed that these constituents are naturally occurring and not related to site activities.

If inorganic constituents exceed the background concentrations for a specific site, and if other site-specific information indicates contamination is not likely to be site operations related, than additional statistical comparisons may be conducted. These evaluations could include comparisons of data distributions by different statistical methods such as UCL 95 percent comparisons and analysis of variance (ANOVA). For these evaluations, the entire site data population for a particular media is compared with the background population for that media. These additional comparisons may be used for future analysis when a UTL 95 percent based background value is exceeded for a specific site.

If site data are above MCLs, then a focused risk assessment will be conducted to determine the risk to human health and the environment.

EPA Comment G.4

At several AOCs, the unfiltered data showed exceedences of the PRGs. The authors then compared the PRGs to the filtered data and determined based on this analysis that the groundwater was acceptable based on sample contamination with particulates. This approach is not appropriate since EPA uses the unfiltered data for decision making.

Response to Comment G.4

Unfiltered groundwater data will be used for risk based decision making. Unfiltered inorganic groundwater constituents that exceed MCLs will be evaluated in a focused risk assessment.

Additional Comments (Submitted under separate cover)

EPA Comment A.1

1. pg. 1-4 (Previous Investigations) - next to last paragraph states "In Oct. 2000,CH2M Hill prepared a Final Expanded PA/SI" - This should be revised to state "A Final Phase 1 Expanded PA/SI".

Response to Comment A.1

The text has been changed accordingly. The revised section is included in Attachment A.

EPA Comment A.2

2. pg. 1-4 (Previous Investigations) - last paragraph states "A detailed description of the field investigations for the PA/SI was presented in the Site Specific Workplan" - This should be revised to state "for the Phase 2 Expanded PA/SI Seven Sites".

Response to Comment A.2

The text has been changed accordingly. The revised section is included in Attachment A.

EPA Comment A.3

3. pg. 3-4 (Laboratory Analytical Results) - 1'st paragraph 2'nd sentence states "Section 3.7 presents conclusions and recommendations" This should be revised to state "Section 3.6".

Response to Comment A.3

The text has been changed accordingly. The revised section is included in Attachment A.

EPA Comment A.4

4. pg.4-8 (Surface Soil) - last paragraph 2'nd sentence states "The concentrations for explosives were below the residential and industrial PRG but" This sentence is incomplete – please correct this.

Response to Comment A.4

The paragraph has been re-written in accordance with the specific comments for Section 4 described above. The revised section is included in Attachment A.

Responses to TAPP Comments on Navy's Draft Expanded PA/SI Report

Comments submitted 11/2001

Section II–Field Investigation Procedures

TAPP Comment 1

Specific references will need follow-up as the individual AOC sections are reviewed. For instance, this section notes that monitoring wells were discussed at AOCs K, J and H, but it is unclear whether any of the other four AOCs should have or did receive groundwater investigation.

Response to Comment 1

The other four AOCs (B, I, L, R) were identified as sites that may have been associated with potential releases at or near the ground surface. As a result, these site were investigated by the sampling of surface and subsurface soils. Should these investigations indicate that contaminant migration extends below the surface than groundwater samples would be collected. However, the initial investigations at these sites did not detect subsurface investigation.

Section III - Wastewater treatment Plant (AOC B)

TAPP Comment 2

With regard to previous investigations, note that the Environmental Baseline Survey reported that dumping of hazardous wastes may have occurred at the site. Interestingly, the compounds detected seem to suggest this may have been the case, as one would not suspect 1,4 dichlorobenzene to be a regular sewage sludge constituent. In the summary provided of this previous investigation, they do not discuss the source of the detections and indicate no

further sampling was needed based on this 2000 investigation because sludge criteria were not exceeded.

Response to Comment 2

The historical archive research and site data does not provide information that hazardous waste was likely disposed of at the site. Metals occur naturally within the soils and groundwater, dichlorobenzene and toluene are byproducts of gasoline which may have been associated with surface water runoff of paved areas. A risk assessment will be conducted to evaluate if unacceptable risk are present.

TAPP Comment 3

It is unclear what the evidence is for hazardous disposal at this site. However, given this report, there is some concern whether they analyzed for all the appropriate compounds. Specifically, measuring for polycyclic aromatic hydrocarbons, explosives and radiological parameters, should be considered.

Response to Comment 3

The archive search for the Environmental Baseline Survey did not identify any contaminant sources containing explosives, radiological waste or PAHs that could have potentially discharged these contaminants into the wastewater treatment plant.

TAPP Comment 4

At a minimum, a transparent discussion should take place about historical activities, the weaknesses of record keeping and the inevitable holes in historical record searches. Even if no evidence to date has been uncovered of the use of specific compounds, empirical data should be collected at a few agreed upon locations to confirm the absence of specific classes of compounds often found on military installations.

Response to Comment 4

Metals, SVOC, VOCs, Pesticides/PCBs were analyzed which are typically found on military bases. Explosives were detected only at locations directly below where ordnance was found. NASD was not a typical military installation in that there was not a significant generation of hazardous waste because the facility was primarily an ammunition support facility. A more detailed discussion of the site history will be provided in the final report.

Section IV–Power Plant (AOC H)

TAPP Comment 5

Some groundwater contours are provided for this site to justify the locations of monitoring wells located at the site. However, initial review of the well locations, and considering the known and inferred contour lines, leaves me to believe that two additional monitoring wells (one on each long side of the structure) are needed. The text itself suggests that tidal effects may influence groundwater flow. In turn, clear definition of the groundwater flow becomes critical to understanding where best to sample. Thus, not only are a few more monitoring wells important for proper contaminant investigation, collecting groundwater elevation data over time to evaluate tidal fluxes is also necessary to ensure an adequate under-

standing of potential contamination migration. This becomes particularly relevant given the various detections within the soil.

Response to Comment 5

AOC H has been recommended for a full Remedial Investigation/Feasibility Study. As part of this study additional monitoring wells will be installed, at least one along each side of the structure, will be installed for sampling and groundwater elevation monitoring.

TAPP Comment 6

It is also important to note that the reported history for the site does not explain the presence of 2,6 dinitrotoluene. In this regard, the explanation for the presence of the pesticides and SVOCs should also be discussed within the text. It is interesting to note that the propylamine compound is found in the same corner of the property as the 2,6-DNT. Additionally, it should be noted that these detections exceed the Region 9 soil screening level for migration to groundwater and that it is on this lateral side of the building where a monitoring well currently does not exist, which means groundwater flow in that vicinity cannot be delineated. Until such issues are clarified, conclusions about risks are more questionable.

Response to Comment 6

The former use of the site as a fire training facility may explain the presence of 2,6 dinitrtoluene, this will be explained in the Final PA/SI Report. As previously discussed, additional monitoring wells will be installed to further characterize the extent of groundwater impacts. The proposed locations of the investigations will be presented in a work plan for the RI/FS.

TAPP Comment 7

Again, the reasoning for not measuring other compounds should be discussed, including perchlorate a known contaminant of certain fuels and petroleum hydrocarbons given the storage tanks referenced.

Response to Comment 7

There is no evidence that perchlorate was used at the site. However, based on EPA's comment that this constituent is a potential site-related constituent at sites containing explosives, this constituent will be added to the analyte list for the investigations to be performed for the Remedial Investigation. Petroleum constituents VOCs and SVOCs were analyzed, TPH is used only an indicator and cannot be used to evaluate risk.

TAPP Comment 8

Also note that it needs to be clarified why compounds such as trichloroethene and tetrachloroethane were analyzed for in soil borings but not in groundwater samples. Additionally, it is unclear if other solvents, such as tetrachloroethane, were analyzed for.

Response to Comment 8

Volatile organic compounds including trichloroethelene and tetrachloroetylene were analyzed for in the groundwater. However, these constituents were not detected above

screening levels and are therefore not illustrated on the figures. Additional investigations will be conducted as part of the RI.

Section V–Asphalt Plant (AOC I)

TAPP Comment 9

The consistent levels of chromium and the TPHs clearly stand out at this site. The language in this section is confusing as it notes chromium exceedances of the background levels in both the surface and the subsurface, but notes only one of the subsurface detections exceed the background level and suggests that it "may be indicative of background conditions." Instead, there needs to be a discussion of the potential sources for the chromium detected.

Response to Comment 9

The reference to background refers to the condition that only 3/23 metals detected exceeded background levels and therefore "the majority of metal detections are likely indicative of background conditions". No known source of chromium is present at the site. However, a risk assessment will be completed to assess if there is an unacceptable risk of chromium at the site.

TAPP Comment 10

As for the TPHs, they note that 25 samples exceeded the 100 ppm comparison criterion, ranging from 103 to 1,200 ppm. While they note that this is indicative of a release, they note that none of the petroleum-derived hazardous constituents exceed their respective risk-based criteria. In turn, it appears that the RI/FS will focus on this issue to determine whether the documented release needs to be remediated.

Response to Comment 10

Total Petroleum Hydrocarbon (TPH) is an indicator parameter that does not have a human health risk levels associated with them. Therefore, the RI/FS will focus on the constituents that pose an unacceptable risk including: VOCs and SVOCs.

TAPP Comment 11

It should also be noted that no further sampling is recommended in the subsurface despite the surface detections. The text even states that "no evidence exists to indicate that a release to the subsurface soil has occurred as a result of site related activities." This statement in itself needs multi-stakeholder discussion to understand the conclusions being drawn and the impacts of such conclusion on future cleanup and use. Clearly, certain types of contaminant releases are to the surface but can migrate and impact subsurface soil and other media over time. These issues of risk, both to human and ecological receptors, and long-term fate will need to be looked at closely in the RI/FS process.

Response to Comment 11

The types of petroleum hydrocarbons present at the site, asphalt, have very low mobility in soils and the subsurface soil sampling confirmed that there were no impacts from the site on the subsurface sampling. The RI/FS will address the mobility of these constituents, the

ecological risk and the human health risk associated with the petroleum hydrocarbons detected at the site.

TAPP Comment 12

On a smaller note, it appears that various data results were qualified as being unusable in the section 5 tables. This issue should be discussed and clarified during a future working meeting.

Response to Comment 12

Any analytical data that any collected samples that are qualified as being unusable, and that could impact the conclusions and recommendations of the report ,will be will be re-sampled during the RI.

Former Staging and Disposal Area (AOC J)

TAPP Comment 13

This area is a perfect example of where information regarding the types of materials that may have been present are "non-existent" according to the text. In such a case, evidence must be significant that specific classes of compounds were not, used on the island before they should be left off of compound lists for analyses. In this site, radiological and petroleum hydrocarbons immediately come to mind. Upon further review, the latter becomes even more of a concern given that perchlorate was detected at the site and is known to be in certain military fuels.

Response to Comment 13

Petroleum hydrocarbons were analyzed using VOCs and SVOCs. TPH is an indicator parameter that is only required at EQB regulated petroleum sites. Perchlorate will be added to the RI. There is no information available that indicates that radiological contaminants may be present on-site, therefore, these constituents were not analyzed from the samples.

TAPP Comment 14

More attention must be given to conclusions presented in the text without the supporting logic. For instance, the authors do present the groundwater flow data for this site and indicate that monitoring well #3 is "upgradient." However, the materials provided do not provide any spatial information regarding where activities took place on the site map, such as specific areas of known, suspected or possible storage/dumping. In other words, if any dumping or debris storage took place on the western end of the fenced area, then clearly well #3 would be upgradient compared to the other wells installed but not necessarily upgradient of any potential residual contamination.

Response to Comment 14

Additional information will be presented on the site map in the Final PA/SI Report, including the estimated extent of the waste area, such that the groundwater flow direction across the waste site will be illustrated.

TAPP Comment 15

Toward this end, the selected areas for the groundwater wells appear inadequate to get a good feel for groundwater flow beneath the site, regardless of what contamination is found or not found in the paragraphs to follow. On this issue, one should acknowledge that this is not a significant concern in this case since further groundwater investigations are recommended for this site. It is assumed that additional wells will be considered in future investigations.

Response to Comment 15

Additional monitoring wells will be installed as part of the RI to better delineate the extent of groundwater impacts from the site. These well locations will be presented in a work plan for the RI.

TAPP Comment 16

In the conclusions regarding surface water copper and mercury were found to be above surface water criteria. In the case of copper, its detection below the background concentration causes the authors to imply that additional evaluation of this metal is not needed. The memorandum regarding the background study should be reviewed and considered in assessing the adequacy of the background data for making this decision.

Response to Comment 16

As part of the RI additional surface water and sediment samples will be collected upgradient and downgradient from the site and analyzed for metals (including copper and mercury). This data will be utilized to provide information on the background concentrations in the surface water.

TAPP Comment 17

For surface soil, the text indicates that no evidence exists to indicate a release to this medium and that further investigation is not recommended. While this may be a reasonable recommendation, the absence of site-specific discussion regarding evidence of activity, locations within the site of known storage, etc., makes it difficult to evaluate the soil sampling locations. Some concern exists with the simple observation that several of the samples appear to be adjacent to the perimeter fencing or along the woods line of the site. If this is the case, the soil sample locations may not have been placed in the ideal locations for detecting soil contamination. Further exploration of such issues, including a site visit, should be conducted among all stakeholders involved in assessing the adequacy of such investigative conclusions.

Response to Comment 17

A map will be provided within the Final RI Report to illustrate the sample locations with respect to the extent of the waste area. The locations of additional soil samples will be provided in the RI Work Plan. However, the collection of subsurface soil samples from within the waste material will be limited due to: 1) safety concerns drilling through waste, 2) the potential for vertical migration of waste to the groundwater, and 3) the unrepresentative nature of sampling waste materials.

Water Well at Public Works (AOC K)

TAPP Comment 18

As with other graphics within this document, the map depicting AOC K is very difficult to utilize in conjunction with the accompanying text. The boundary of the Public Works Compound and the location of the barracks are not evident in the figures but are used within the text to help the reader pinpoint the location of the AOC. Additionally, the location of the well where the benzene was detected in 1996 is not adequately shown.

Response to Comment 18

The Final RI Report will provide a figure illustrating the location of AOC K with respect to the Public Works Area, the barracks location, and the well where benzene was originally detected.

TAPP Comment 19

While someone with significant experience at the site may understand the figures, they should be drafted a) for use by other interested stakeholders and b) to adequately document the decision process so that future reviews can follow the scientific and logical conclusions drawn. (Note that maps from the next section clarified some features on the map in this section—clarity needs to be consistent and better legends could contribute to achieving such clarity).

Response to Comment 19

As discussed, a Site Map illustrating the features requested will be provided in the Final Report.

TAPP Comment 20

As for the contamination at the site, the evaluation of the results is simply inadequate. The main reason presented at the beginning of this section for the expanded PA/SI was the detection of benzene at 21 micrograms per liter. However, the results and conclusions do not discuss the significance or reasoning for what appears to be the non-detection of this carcinogen in this investigation. With the absence of such discussion, the reader is left completely in the dark regarding this peculiarity. Has the benzene plume, if it is a plume, simply not reached the closest down gradient well yet? Were the monitoring wells installed too far from the site where the benzene was originally detected (it appears the closest down-gradient well is more than 80 feet away)? Were the wells installed at the wrong depths? Neither the text nor the graphics present any information that would suggest the conclusion that "no further groundwater sampling is recommended" is reasonable and logical.

Response to Comment 20

Additional discussions of the rationale for the recommendation will be provided in the Final RI Report including: the well depths were installed at the same depth as the water supply well, the former supply well (AOC-K) is not used a water supply well, the benzene concentrations previously detected will likely meet acceptable risk-based concentrations and no sources of benzene contamination were detected during the investigation.

Septic Vault (AOC L)

TAPP Comment 21

The investigation of this site is simple and the results seem unremarkable. Yet, upon initial review, some questions exist regarding how the septic vault itself will be sampled and remediated, given the transfer of this property. Without direct involvement in the Vieques process, it is not clear if the findings in this section that "no further sampling is recommended for surface and subsurface soil" refers specifically to the suitability of transfer and soil or if this section proposes that no other investigation is required period. If the latter is the proposed conclusion, then a discussion regarding the drainage fields that were not located and other media (e.g., groundwater) should be included in this document.

Response to Comment 21

AOC L septic vault was empty at the time of sampling and, therefore, no samples were collected. Although there were no maps of drainage fields identified, soil samples were collected at a depth below the base of the septic tank which would provide a worst case of impacts to the soils within or adjacent to the drainfields, if they existed. This discussion will be provided in the Final PA/SI Report.

Former Construction Staging Area (AOC R)

Comment 22

In this investigation, the analysis for SVOCs include several compounds typically associated with PAH discussions, but the presence of these petroleum-related compounds is not discussed in this light for this AOC. However, SVOCs and petroleum hydrocarbons, including diesel range organics, gasoline range organics and BTEX compounds, were covered in another section (AOC I) of this document. In the development of an investigation and in the presentation of the results consistency and clarity needs to be a conscious focus. The reasons for the differences in analyte/compound discussions between the two sections are unclear. It also is not clear from the text that all the petroleum-based compounds were measured for. In other words, given the documented light vehicle maintenance from the site description for this AOC, the petroleum issue should not be left embedded in the SVOC results.

Response to Comment 22

Petroleum related contaminants were analyzed from 34 surface soil samples using VOC and SVOC analytical scans. These analytical scans provide analysis of BTEX and PAH compounds typically associated with petroleum hydrocarbons. The analytical parameter Total Petroleum Hydrocarbons (TPH) was analyzed at AOC I because it is an analytical requirement at petroleum storage facilities. However, this parameter does not provide a measure of the risk to human health at a site.

TAPP Comment 23

As for the conclusions and recommendations, the text does not provide any discussion or evidence that the SVOCs detected could not be the result of the documented light vehicle maintenance activities. Thus, it is not clear that the contaminants found can solely be

contributed to the asphalt previously present, as suggested in the text. In fact, the current language within this section does not even make clear whether asphalt was or may have been present at the site previously.

Response to Comment 23

The SVOCs detected are typically detected in asphalt pavement. A comprehensive risk assessment is proposed for the site. If the risk assessment demonstrates that unacceptable risks are present in association with the SVOCs than additional sampling will be conducted to further quantify the source and the extent of the SVOCs detected.

TAPP Comment 24

Lastly, it should be noted that the text indicates that "no evidence exists to suggest that a release of hazardous materials to the surface soil has occurred at this site as a result of site-related activities." With the presence of the SVOCs, it is not clear how the authors can draw such a conclusion based on the current information provided within this document, even if the SVOCs are there as a result of asphalt.

Response to Comment 24

This conclusion will be deleted from the report. The significance of whether or not a release has occurred will be dependent upon the results of the risk assessment. If the SVOCs detected show there is an unacceptable risk to human health than the source and extent of the SVOCs detected will be further delineated.

Comments Submitted 4/2002

Comment Responses Regarding TRC Approved Generic Site Investigation Work Plan and Site-wide Groundwater Assessment Process

The Navy's contractor prepared a Master Work Plan for Site Investigations conducted at NASD, Vieques Island, Puerto Rico . This work plan was reviewed and approved by EPA and provides the information needed for sampling procedures utilized for the PA/SI. Regarding the site-wide groundwater assessment, it is the Navy's policy to conduct groundwater investigation only at those sites that are known or suspected to have an impact on the groundwater, not to conduct a basewide investigation. However, The Deed transferring the property from the Navy to The Municipality of Vieques (MOV) allows MOV to notify the Navy within 90 days of any previously unidentified condition that may require a response action by the Navy, such as a known release to the groundwater.

TAPP Comment 1

Site Selection – The Section 1.1, *Background*, mentions 10 sites for which a Phase I PA/SI was completed in June 2000. It is assumed that the seven sites addressed in this Phase II document were selected from those sites addressed in the referenced Phase I effort. Please clarify. If this is the case, has the TRC discussed why the other three sites did not require any additional investigation?

Response to Comment 1

The sites addressed in the Phase II PA/SI are in addition to the sites reference in the Phase I effort.

TAPP Comment 2

Munition Disposal – Section 1.4, *NASD Description*, indicates that waste management activities included the storage of aged and inoperable munitions. Has the Navy developed a detailed description of how these items were disposed of during the existence of NASD? It would be helpful to have such a document as a reference for the upcoming TAPP work if such a document exists. It is suggested that, at a minimum, the cleanup process include field inspection of areas immediately surrounding identified AOCs, as well as areas not identified as AOCs but suspected to have been used for NASD activities. Note that such inspection is not only important for finding munitions disposal but also disposal of other potentially hazardous materials.

Response to Comment 2

[redacted] disposal of the waste ordnance at NASD took place at SWMU 4. This is discussed in the Phase I PA/SI report. Since that time this disposal of ordnance from NASD has been disposed of at AFTWTF. We are not aware of any document that describe how these items were disposed of. All of the SWMUs and AOCs identified in the Phase II PA/SI have been inspected for ordnance and evidence of hazardous waste.

TAPP Comment 3

FUDS Sites – It has been reported that at least one FUDS exists on Vieques. It is associated with the Vieques Municipal Airport, which is discussed in Section 1.6 of this document. What is the current use of this FUDS and has any initial characterization been integrated into the current characterization efforts of NASD?

Response to TAPP Comment 3

The PA/SI did not identify any sites in the vicinity of the Vieques Municipal Airport. As a result, it is unlikely that the FUDS site would be impacted by any of the sites at NASD.

Comment 4

Monitoring Well Installation – Section 2.2 addresses well installation for AOC H, J and K. Please clarify for the TAPP any differences in approaches used for these three sites.

Response to Comment 4

AOCs H and J are areas where a potential sources of contamination were attributed to subsurface conditions such as buried waste and underground storage tanks. As a result, surface and subsurface soil samples were collected to identify potential source areas. At AOC K the resampling of the well revealed that the source of benzene contamination was no longer present. As a result, the investigations included the installation of wells to characterize the potential downgradient extent of groundwater impacts.

Comment 5

Well Purging – Please indicate the guidance or policy associated with purging 3 well volumes before collecting samples.

Response to Comment 5

The purging of three well volumes of water before collecting samples is included in the Groundwater Sampling Procedure in the Master Work Plan that was reviewed and approved by EPA.

TAPP Comment 6

Groundwater Elevation – Please note the TAPP recommendation that additional groundwater elevation assessments will need to be conducted beyond the single field effort referenced in Section 2.4, *Groundwater Elevation Measurements*.

Response to Comment 6

For sites that will be carried forward to an RI/FS additional rounds of groundwater elevation measurement will be collected and evaluated. For sites that will likely be closed out under a No Further Action Document, no additional groundwater elevation data is anticipated.

TAPP Comment 7

Subsurface Soil Sampling – Please provide the logic behind collecting the subsurface sample from the 4-6 ft range. Within the response, please address why the soil samples were not collected from the 6-inch to 4-ft range since the drilling was being conducted anyway. Also, please address what made the project team select a 2-ft composite for sample collection versus 1-ft composite or discrete sample collection at specific intervals.

Response to TAPP Comment 7

The subsurface samples are collected from the 4-6 ft range since this is the range that there is potential risk exposure to either a construction worker or utility worker. The two-foot composite sample has been accepted by EPA for providing a indication of whether contamination is present or not. If contamination was detected at either of these intervals additional soil sampling would be considered. However, where no contamination is detected no additional sampling is proposed.

TAPP Comment 8

Surface and Sediment Sample Collection – Please explain the need for the two different surface water sample collection approaches noted in this section. Additionally, how did the collection team minimize sediment infiltration into the surface water sample if wading was employed?

Response to TAPP Comment 8

The two different approaches allow for the evaluation of risk to human health and ecological receptors. Evaluation of human health risks require the collection of unfiltered samples the evaluation of ecological risks requires the collection of filtered samples. As

stated in the Master Work Plan "the sample site is approached from the downstream manner that avoids the disturbance of bottom sediments" Specific details of the sampling procedures are included in the Master Work plan.

TAPP Comment 9

Comparison Criteria – Section 2.11 indicates that tap water risk-based concentrations (RBC)/ preliminary remediation goals (PRGs) and maximum contaminant levels (MCL) were used for screening groundwater. Given that these two criteria sources differ greatly, namely RBCs being strictly health based while MCLs are not, please provide more specific information on how these two-types of criteria were utilized in the screening process. Also, please indicate how the project team addressed any analytes/chemicals that were detected but did not have a comparison number for the media in question. Lastly, please confirm that the detection limits for each analyte/ compound of the analytical techniques employed were lower than the respective PRGs.

Response to TAPP Comment 9

The lowest, most conservative, PRGs were selected for comparison purposes to provide a conservative risk screening. These PRGs also included transfer from groundwater to soil criteria, which is some cases is more conservative than the RBCs. A more detailed assessment of risk will be presented in the risk assessment provided in the NFA documents. This detailed assessment will take into account those contaminants that are detected but have no PRGs

TAPP Comment 10

Explosives – Please indicate why only AOCs J and H were assessed for explosives. Please correct text in Section 2 that suggests explosives were sampled for at each of the seven sites. In the broader perspective, please provide the TAPP/TRC with the project team's approach on where and when to measure for explosives. For instance, did sites within the Phase I assessment get characterized for explosives before being removed from further consideration? Based on the activities on Vieques, it is strongly recommended that explosives be considered in every sampling protocol for each site investigated until findings suggest this is no longer necessary. This is one example of the issues that should be discussed in the broader generic investigation plan and groundwater process proposals above.

Response to TAPP Comment 10

Section 2 provides a description of sampling procedures for all the methods utilized and is not specific to each of the sites. AOCs J and H were the only two sites of the seven sites investigated that were suspected to potentially contain explosives. If the community is aware of other occurrences of explosives it is recommended that they notify the Navy in accordance with the procedures indicated in the Deed.

TAPP Comment 11

Sample Holding Times – Please explain why 3,364 records were qualified as estimated due to missing holding time requirements.

Response to TAPP Comment 11

The Data Validation was performed following EPA Region 2's Data Validation Standard Operating Procedures. If the Technical Holding Times were exceeded, the data were qualified. In the majority of cases where the holding times had been exceeded beyond 7 days, all positive results are flagged as estimated "J" and sample quantitation limits as estimated "UJ".

If analyses were done more than 14 days beyond holding time, either on the first analysis or the re-analysis, the reviewer must use professional judgement to determine the reliability of the data and the effects of additional storage on the sample results. At a minimum, all results must be qualified "J", but the reviewer may determine that non-detect data are unusable "R". If holding times are exceeded by more than 28 days, all non detect data are unusable "R".

Although 3,364 records were qualified as estimated due to the exceedances of holding times, no data were rejected as unusable due to holding time exceedances. On average the specified holding time was exceeded by approximately two days.

TAPP Comment 12

Analysis Calibration – Please clarify why 345 results were rejected for acetone and 2-butanone, but other data associated with calibration deficiencies were not rejected, but assigned only a J or UJ qualifier.

Response to TAPP Comment 12

Acetone and 2-Butanone are traditional poor performers. The laboratory case narrative indicated the two analytes to have a response factor of less than the minimum RRF of 0.05. Under the circumstance of depressed response factors, "detects" were estimated with a "J" flag and "non-detects" were rejected. This particular laboratory showed a pattern of very low RFs for these analytes and professional judgement was used. The other analytes cited for qualification were typically non-problematic with response factors greater than 0.05. The issue was non-compliance with the percent difference in the daily instrument calibration control limits as set forth by the project instruction to the laboratory. Therefore, "detects" were estimated with a "J" flag and "non-detects" were estimated and flagged "UJ".

TAPP Comment 13

Field and Lab Contamination – Section 2.13.6 indicates a significant variety of contaminants in the various blank samples analyzed. The number of blank contaminants and certain types of the contaminants identified seem unusual or unexpected. What efforts have been made by the project team to evaluate the sampling process and try to reduce blank contamination in the future?

Response to TAPP Comment 13

The project chemist for this event has reviewed the data and discussed these issues with both the project manager and the laboratory management team. A ongoing discussion between the principles on how the contamination could be eliminated and a review of standard operating procedures with updates as needed have been undertaken. These discussions included effective equipment cleaning procedures, specific quality control

procedures for cleaning operations, and efforts to use disposable sampling equipment to minimize the potential for cross contamination. Furthermore, a review of the 345 total results due to blank contamination indicates both common contaminates and one instance of ten organochlorine pesticides in one equipment blank but none of these compounds were found in any associated field sample. The organochlorine pesticides contamination is most likely a result of mishap of the sample handling in the field. For semi-volatiles, four phthalates and Pentachlorophenol were found in various blanks. Six samples were qualified as non-detects for Bis (2-ethylhexyl) phthalate and Di-n-octylphthalate. In regards to volatile compound analyses, disinfection by-products and Toluene were detected in ambient and equipment blanks.

TAPP Comment 14

Overall Reporting – The text in this section does not report the QA/QC information consistently. For instance, in the total versus dissolved metals discussion, the text indicates that "only 2 out of 507 results (less than 0.5%)" showed dissolved metal concentration being greater than the total concentration. However, for other sections, such as in the surrogate spike recovery section, the text only indicates that 2,971 samples were qualified as estimated because of recoveries outside of criteria. In this case no total number of samples was provided. Also, in this and other subsections, what the acceptable criteria are (i.e. 20%) is not discussed. The text in the document should provide a clear picture of the strengths and the weaknesses of the data quality and use a consistent approach to report the summary results.

Response to TAPP Comment 14

The comment is so noted. The format and content of the DQE is currently being reviewed internally to identify areas for improvement to assist the reader in understanding the results of the data quality evaluation. The revised presentation will demonstrate the impact of data validation by statistical analyses while presenting the relevance of particular data issues as they relate to the total sample population. The goal will be to provide clear and concise reporting of all QA/QC information.

Section 3: AOC B–Wastewater Treatment Plant

TAPP Comment 15

Ecological Survey – Section 3.2.1 indicates a qualitative ecological survey was conducted at AOC B and refers the reader to Appendix F. However, Appendix F focuses on 5 AOCs of which AOC B is not one of them. What was the reasoning for selecting only 5 of the 7 for the detailed description provided in this appendix?

Response to TAPP Comment 15

TAPP Comment 16

Soil Sampling – The text in section 3.4.1 indicates that soil samples were collected from the middle of each of the four quadrants in the sewage treatment lagoon. However, Figure 3.1 only indicates one of the four samples was collected from the middle of the quadrant. This may be significant depending on the grading of the different quadrants. Please clarify where the samples were actually collected from. Also, please clarify if the black lines on the figure represent the drain pipes from the quadrants.

Response to TAPP Comment 16

The description of the sample locations in the text will be clarified to match the actual locations shown on Figure 3.1. The black lines showing the drain lines will be presented in the legend of the figure.

TAPP Comment 17

Groundwater – Given the possibility of hazardous waste dumping at this site, please provide the reasoning for not conducting any groundwater sampling at this location?

Response to TAPP Comment 17

As responded previously there is no evidence, in either the records search or the soils and effluent data collected, that hazardous waste dumping occurred at this site.

TAPP Comment 18

Data Quality – This section should provide some explanation of why specific data from Table 3-1 were unusable.

Response to TAPP Comment 18

Due to a modification of the table 3-1 a letter "R" footnote was added to the results to which indicate which screening criterion had been exceeded. This "R" flag is identified in another part of the table and defines which samples are Regional IX Preliminary Remediation Goals – Residential Soil (R). There were no data in Table 3-1 rejected or considered unusable.

TAPP Comment 19

Conclusion – Please provide justification for the authors' assertion that toluene and 1,4 dichlorobenzene are present as a result of sewage or natural processes in order to support their conclusion that "no evidence exists to suggest that a release of hazardous materials to surface soil has occurred at this site as a result of site-related activities."

Response to TAPP Comment 19

The text does not state that "toluene and 1,4 dichlorobenzene are present as a result of sewage or natural processes". These constituents are petroleum constituents that were detected at low levels in the effluent sample and may be a result of petroleum releases to the plant rather than hazardous material releases. Furthermore, these constituents were not detected in the sludge sample or any of the 12 soil samples collected.

Section 4: AOC H–Power Plant

TAPP Comment 20

Previous Comments – To clarify an oversight in previous comments submitted by Theodore J Henry Consulting, please note that after closer review of Appendix H that, indeed, tri-chloroethene and tetrachloroethane were analyzed for in groundwater. Thus the inquiry in the previous set of comments can be disregarded. Beyond this, please refer to the previous comments for issues to be discussed at the TRC meeting.

Response to TAPP Comment 20

Comment noted

TAPP Comment 21

Quebradas/Lagoons – This PA/SI investigation does not appear to consider the potential for contamination in the surface water body directly adjacent AOC H. Considering pathways from runoff to historical tendencies for disposing of wastes in such features, please clarify why this topographic feature was not investigated with AOC H. Also, please indicate the Navy's current plan for how this will eventually be investigated.

Response to TAPP Comment 21

AOC H has been recommended for a full RI/FS. As part of the RI additional samples will be collected, including surface water samples of the quebrada adjacent to AOC H. Details of the sapling locations will be presented in the Work plan For the RI/FS.

Section 5: AOC I–Asphalt Plant

TAPP Comment 22

Site Characterization – TRC discussion should be conducted on the characterization of this site. Specific to the delineated asphalt plant area, a better understanding of site activities and the subsequent sampling locations is needed. For example, it is not possible to determine from Figure 5-1 and the associated text why soil samples were not collected from the area east of the gravel ramp area.

On the broader scale, it is clear that a much larger area than the specific plant section was used during NASD activities. In turn, it is not clear why the Phase II sampling did not include a broader characterization of the impacted site. In other words, only a relatively small fraction of the area visible in Figure 10 (Appendix F) has been sampled. While it is understandable for sampling to focus primarily on the asphalt plant, clearly some characterization of the larger footprint will be needed to install stakeholder confidence that the area will be suitable for future use.

Response to TAPP Comment 22

The soil samples were collected at areas where visually contaminated soils were identified. In areas where asphalt was released the impacted areas are readily apparent from the visually stained soils. AOC I has been recommended for a full RI/FS. As part of the RI additional samples will be collected, including soil samples to further characterize the extent of petroleum contamination. Details of the sampling locations will be presented in the Work plan For the RI/FS.

TAPP Comment 23

Petroleum Hydrocarbons – Please note that Section 5 text indicates sampling for TPH – Diesel Range Organics and TPH – Gasoline Range Organics. However, Appendix H only reports a single TPH value. Please clarify. Additionally, while the text indicates that none of the petroleum-derived hazardous substances exceeded their individual RBCs, these data do not appear to be included in the document for stakeholder review.

Response to TAPP Comment 23

The only TPH that was detected was Diesel Range Organics, this will be clarified in Appendix H. The petroleum-derived hazardous substances are included in Appendix H

TAPP Comment 24

Background Metals – Please note that the conclusions regarding which metal concentrations are within background and which exceed background are premature until issues surrounding the background study are resolved. In turn, it is important that the technical TRC meetings address the background issues first, before moving into the Phase II PA/SI or AOC E comments and concerns.

On this same issue, please note that previous comments on the chromium findings and the authors' association of these findings with background are still a significant issue for discussion. Again, consideration of how activities could have increased the soil levels of chromium in this area should be included in this document, instead of just focusing on how the chromium driver *may* be within background.

Response to TAPP Comment 24

The background issues have been resolved with representatives from the community, EPA and EQB. As a result, and the resolved approach does not change the conclusions regarding metals concentrations. The chromium comments have been previously addressed.

TAPP Comment 25

Future Characterization – With regard to subsurface soil, the document does not recommend any additional soil sampling. This decision requires further discussion. Besides the background issue previously mentioned, discussions should consider the fact that that the 6-inches to 4-ft range has not been characterized and that future soil characterization in the RI/FS should consider both lateral and vertical delineation of the areas with elevated chromium and TPH, noting that the surface concentrations of TPH would not be expected to be as high as concentrations found a few feet down due to volatilization.

Response to TAPP Comment 25

Comment noted. The purpose of the PA/SI is to assess whether or not contamination is present. Contaminants were detected at site AOC , I, which has been recommended for a full RI/FS. As part of the RI additional samples will be collected. Details of the sampling locations and rationale will be presented in the Work plan For the RI/FS.

TAPP Comment 26

With regard to groundwater, there is no current discussion of whether the proposed RI/FS work would address this issue. From the TAPP perspective, the current information suggests that some groundwater characterization should be conducted at this site, particularly since Figure 5-3 does indicate that subsurface (and surface) chromium levels exceeded screening levels for migration to groundwater.

Response to TAPP Comment 26

The PA/SI did not detect any site-related contamination in the subsurface soil samples. The chromium is likely attributed to background conditions. Based on this information and the nature of the asphalt, there is no evidence that support that there is a potential for groundwater contamination. As a result, groundwater characterization is not anticipated for this site.

Section 6: AOC J–Former Staging and Disposal Site

TAPP Comment 27

Potential Disposal Areas – In Figure 17 of Appendix F, a variety of less dense or cleared vegetation is visible in areas to the east and south of AOC-J. Please provide the TRC with information on what these areas might be and what, if any, field investigations have been conducted of these locations.

Response to TAPP Comment 27

There is no documented information available or visible indications that these areas are areas where there have been contaminants released. The Deed transferring the property from the Navy to The Municipality of Vieques (MOV) allows MOV to notify the Navy within 90 days of any previously unidentified condition that may require a response action by the Navy, such as a known release to the groundwater.

TAPP Comment 28

Unfiltered Groundwater Samples – Please clarify why the unfiltered groundwater samples were identified as a concern in this sampling process for this site. In the Section 2, *Field Investigation Procedures*, the purging of the well was identified as a normal part of the sampling process, which presumably is conducted to minimize the impacts of such sediments. How is this previously discussed protocol lacking assuming the proposed explanation for the elevated metals in this section is correct?

Additionally, the text indicates that dissolved metals were not observed above screening criteria, but no mention is made of whether the dissolved metals were above the draft background numbers. Please clarify. Additionally, if total metals exceeded comparison and background criteria but did not do so for dissolved parameters, it would seem logical that any assessment of this issue would have to consider solubility factors of the aquifer (i.e. maybe the metals are present at elevated levels but the aquifer environment results in the lower dissolved readings). In short, metals should probably be included in the planned RI/FS to address groundwater, particularly since open burning/open detonation (OB/OD) of military munitions may have taken place at this site.

Response to TAPP Comment 28

Unfiltered samples are required to be collected in CERCLA investigations to address human health risk associated with direct contact and incidental ingestion. Filtered samples are collected to provide an indication of the groundwater quality if it were to be used as a source of potable water , since water supply samples are filtered. Metals will be analyzed as part of the RI/FS. Details of the sampling locations and rationale will be presented in the Work plan For the RI/FS.

TAPP Comment 29

Surface Water – Note that surface water comparison criteria exceedances were noted for mercury and copper, yet only mercury was identified as warranting additional investigation. Please note that until background is resolved, copper should also be considered in any early planning for the AOC J RI/FS.

Response to TAPP Comment 29

The entire list of TAL Metals will be analyzed from the surface waters part of the RI/FS. Details of the sampling locations, including background locations, and rationale will be presented in the Work Plan For the RI/FS.

TAPP Comment 30

Of particular interest is the fact that perchlorate was detected in all surface water samples with one being as high as 82.2 ppb, but this was not mentioned in the surface water discussion. Please provide the comparison criterion used to delete this compound from consideration. Also note that the data from Appendix H appears to differ from Table 6-2, which does not report the perchlorate detection of 82.2 ppb, presumably because of different sampling techniques. Appendix H reports well 01 sample results as Sample ID NDE171 and NDE172FD1, while Table 6-2 appears to only report the NDE171 sample. Please clarify this issue.

Response to TAPP Comment 30

The discussion of the surface water pertaining to perchlorate is deferred to the author of the report on the nature and extent of any comparison criteria.

Table 6-2 is designed to convey risk assessment information and includes native samples only. Appendix H is the complete Data Summary Table reporting both NDE171 and the field duplicate NDE172FD1, a QC sample. The Perchlorate value that is missing in Table 6-2, sample NDE172FD1, was not included by the author since it was a QC sample.

TAPP Comment 31

Sediments – Section 6.6.5 only states that "no detections in sediments exceeded ecological screening criteria." Please confirm that all compounds detected actually had a screening value to compare to in the investigation.

Response to TAPP Comment 31

TAPP Comment 32

Well and Soil Sampling Locations – In follow-up to previous comments submitted, it is appropriate to reemphasize conclusions drawn regard sampling locations and what is considered up-gradient. This site has little historical information, so the Phase II data should be evaluated closely to determine what gradients may exist and where contamination may have been released. For example, vanadium was detected in wells 02, 03 and 04 at concentrations of 330, 39 and 160 parts per billion (ppb), respectively. However, detection of this metal in well 01 was only in the 7 ppb range approximately 5 to 50 times lower, suggesting its presence may not be due to background.

Response to TAPP Comment 32

The RI/FS Work Plan will provide proposed groundwater sampling locations for the site and the rationale for selecting those locations.

TAPP Comment 33

Explosives – Please provide the TRC/TAPP with additional information regarding the efforts to analyze for explosives, as there are many concerns that need to be discussed. First, please confirm that the explosives RDX and HMX were analyzed for; while Appendix H appears to indicate this to be the case, the appropriate references to confirm the chemical names of these compounds were not available at the time these comments were developed and submitted. Also note that it appears the chemical name for RDX may be incorrect in the Appendix H data.

Response to TAPP Comment 33

The data packages were reviewed to confirm that both RDX, Hexahydro-1,3,5-trinitro-1,3,5-triazine and HMX, Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine where analyzed for and both appear in the Target Analyte list. RDX was incorrectly referenced in Appendix H as Hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine. The laboratory analyzed all designated samples for explosives by SW846 Method 8330.

TAPP Comment 34

Regarding method detection limits, please note that it does not appear that the detection limits for several explosives were sufficient. While the Region 9 PRGs were not available at the time of these comments, note that Region 3 RBCs for several explosives are below the method detection limits reported. For instance, TNT RBC is 2.2 ppb while the detection limit reported in Appendix H is 5 ppb. For RDX, a military explosive most likely to be found in groundwater and a possible human carcinogen, the RBC is 0.61 ppb and the lifetime drinking water advisory is 2.0 ppb, but the detection limit in Appendix H is listed as 5 ppb.

Response to TAPP Comment 34

The values reported in appendix H are the Reporting Limits and not the Method Detection Limits. The laboratory MDLs were reviewed and found to be in compliance with the laboratory project instructions. The MDL for TNT is listed by the laboratory as 0.2 ppb. The MDL for RDX is listed by the laboratory as 0.21 ppb. The MDLs for SW-846 Method 8330 were low enough to support the assessment effort at the time of sampling.

TAPP Comment 35

Perchlorate is another one where the detection limit may not be sensitive enough depending on what comparison concentration is being used; current figures in use elsewhere range from 4-18 ppb, while the detection limit listed in Appendix H appears to be 8 ppb (except where 4 ppb was listed for one well). A review of detection limits for different media in association with the comparison criteria is critical for the explosives as well as other classes of compounds.

Response to TAPP Comment 35

The laboratory confirmed their Method Detection Limit of 0.8 ppb for Perchlorate, Method 314. The value listed in Appendix H is the Reporting Limit. A review of analyses including the MDL would indicate the data capable of supporting risk assessment.

TAPP Comment 36

Buffer Territory – Given the unknown activities at this site and the detection of military-related compounds such as perchlorate, it is particularly important to consider that additional activities may have taken place outside the perimeter of the area currently investigated. This issue needs to be addressed here as well as other sites and should be discussed in the broader context of the generic site investigation approach.

Response to TAPP Comment 36

It is the Navy's policy to conduct investigations only at those sites that are known or suspected to have an impact on the environment, not to conduct a basewide investigation. However, The Deed transferring the property from the Navy to The Municipality of Vieques (MOV) allows MOV to notify the Navy within 90 days of any previously unidentified condition that may require a response action by the Navy, such as a known release of explosives to the environment.

Section 7: AOC K–Water Well at Public Works

TAPP Comment 37

Groundwater Flow Direction – Note that Figure 7-2 is a good example of where additional water flow information is necessary. Beyond the questions posed in the previous comments submitted, note that it is quite possible that the benzene previously detected in the production well at AOC K is moving northeast and, thus, bypassing monitoring well 02.

Response to TAPP Comment 37

The groundwater elevation data shows that monitoring well MW-02 is directly downgradient of AOC K. Based on this information and the most recent data for AOC K, which showed that benzene was not detected, it is unlikely that the benzene would have bypassed the monitoring well network.

TAPP Comment 38

Groundwater Contamination – It is concluded that the phthalate BEHP is not worth further investigation simply based on the indication that this compound is a common laboratory artifact. Since the detected level exceeds certain RBCs and phthalates were likely used in NASD materials, more evidence should be provided for why this detection is being dismissed.

Response to TAPP Comment 38

TAPP Comment 39

Also, until the background issues are decided, the project team should not dismiss the thallium detections in two monitoring wells since these levels exceed the Region 3 RBC referenced for these comments.

Response to TAPP Comment 39

Comment noted

TAPP Comment 40

Soil Characterization – Referencing back to the need for a clear and agreed upon generic site investigation protocol, please explain why no soil sampling was conducted at this known public works site during this Phase II investigation. Limited groundwater sampling is not enough to determine that this site is ready for future unrestricted use.

Response to TAPP Comment 40

Prior to conducting any soil sampling, the groundwater data was developed in an attempt to track down the upgradient source of contamination. However, the upgradient well data ,which did not detect benzene, indicates there is no significant source of benzene . this data in conjunction with the most recent AOC-H data, which shows that no benzene was detected , does not provide any evidence that a benzene source remains and soil borings are warranted.

Section 8: AOC L–Septic Vault

TAPP Comment 41

Site Characterization – Noting the previous comments submitted, please clarify if the vault itself, the soil beneath the vault or the groundwater beneath the subsurface soil have been sampled as of yet. Clearly to characterize a site sufficiently, it is important to known whether any potential contaminants of concern exist within the vault where they would have been dumped.

Response to TAPP Comment 41

The EBS states that "It is suspected that the vault was used in the 1940s for the treatment of installation sewage and no drainage field was present". Therefore, any releases from the vault would likely have resulted from overflow of the vault and not from discharge to groundwater. As a result, groundwater monitoring wells were not installed. Surface and subsurface soil samples were collected at the outlet of the vault at SB-01 and SB-02 as well. In addition, soil samples were collected at two of the locations to provide analytical data for the entire perimeter around the vault.

TAPP Comment 42

Data and Comparison Criteria – This section provides a clear opportunity to highlight the criteria discussion that needs to take place. Using nitrobenzene as an example, note that the method detection limit is provided as somewhere between 427 and 500 ppb. While this

variation alone should be clarified, please also note that the EPA Region 3 RBC (Soil Screening Level) for transfers from soil to groundwater is 90 ppb. It is important to clarify that all detection levels are adequate to support the screening and risk assessment process.

Note that Table 8-1 reports the detection of 2-hexanone at levels of 0.00087 and 0.0012 ppm, but reports the compound as undetected in other samples at detection limits of 0.01 ppm, which is 10-fold higher than the actual concentrations reported for the other samples. Please clarify.

Response to TAPP Comment 42

The variation in the reporting limits between 427 and 500 ppb is affected by the weight of the sample and percent moisture. It should be noted that the quantitation values are the reporting limits and not the method detection limits. The laboratory obtained all reporting limits as set forth in the laboratory project instructions and are adequate to support the screening and risk assessment process.

Table 8-1 is reporting 2-hexanone at levels between the reporting limit and the method detection limit. These values are qualified with a "J" flag to indicate this condition. The signal to noise ratio is sufficiently large to positively identify the peak as the target analyte. Those samples that are reported "U" indicate a non-detected condition where no signal was recognized by the instrument.

Section 9: AOC R–Former Construction Staging Area

TAPP Comment 43

Site Characterization – Please note that AOC-R is another site where it is not clear that the sampling conducted thus far actually characterizes the entire site. Instead, sampling focuses on the northern cleared area and the concrete pad without sampling around the square concrete structure or the adjacent woods area.

Response to TAPP Comment 43

The site investigations were conducted in the vicinity of where the activities took place that would most likely have an impact on the environment: adjacent to the concrete pad where the work shops were located, within the vehicle maintenance area, near the aboveground storage tank. The Deed transferring the property from the Navy to The Municipality of Vieques (MOV) allows MOV to notify the Navy within 90 days of any previously unidentified condition that may require a response action by the Navy, such as a known release to the groundwater.

TAPP Comment 44

Previous Pavement – The current text is vague as far as whether previous areas of this AOC were, in fact, paved at some point or if they "may have been paved." If this is the basis for excluding additional investigation of the SVOCs detected, the document should clearly indicate where these paved areas use to be and how the project team is aware of this past source. Toward this issue, it is interesting to note that these SVOCs were detected at both the concrete pad and the northern cleared area locations.

Response to TAPP Comment 44

TAPP Comment 45

Groundwater – It is not clear how the authors can conclude that no other investigation is needed at this site given that some of the SVOCs detected exceed EPA Region 3 industrial and residential soil RBC, as well as the soil screening level for transfer of at least one contaminant from soil to groundwater.

Response to TAPP Comment 45

A more detailed risk evaluation will be conducted for the site. Should the assessment demonstrate that the site does not meet an acceptable risk than additional soil sampling will be conducted.

Appendix F–Qualitative Ecological Survey

TAPP Comment 46

Risk Assessment – The introduction indicates that an ecological risk assessment was conducted as part of the Phase II effort, but does not appear to be included in the report, as Appendix F is only a qualitative ecological survey. Please clarify when this information will be come available?

Response to TAPP Comment 46

The risk assessment was a qualitative assessment that is performed to assess if a more detailed survey is warranted. At the sites that an RI/FS is to be conducted will be conducted a more detailed ecological survey will be conducted. At those sites where site-related contaminants are not present a more detailed ecological survey will not be conducted.

TAPP Comment 47

Control Sites – For the five AOCs assessed in this appendix, it appears that control sites were selected that were in the same proximity of the sites under investigation. Please provide the basis for the control site selection process as it appear somewhat odd to select control sites so close to sites where past activity has been documented. It is not clear that the control sites would provide unbiased comparison.

Response to TAPP Comment 47

The background sampling locations are discussed in the Background Investigation Report.

TAPP Comment 48

Vegetation Clearance – Please explain why the qualitative ecological surveys were conducted at several sites that had recently been cleared of overgrown vegetation. Text from Appendix F indicates that the quality of plant life and ecological receptors in the area were temporarily impacted by clearance activities and that the assessments conducted were, thus, altered. Would it not have been more reflective of the site to wait until such sites better reflected undisturbed areas?

Note that both the assessment of a recently cleared area and its comparison to adjacent control sites may, unnecessarily, reduce the quality and accuracy of such an assessment.

Response to TAPP Comment 48

See responses to comments 46 and 47.

Appendix B
Data Screening Tables

Appendix B-1
Screening Criteria Used for COPC Selection

APPENDIX B-1

Screening Criteria Used for COPC Selection

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

			2002 Preliminary Remedial Goals (PRGs)							Soil Screening Level
Chemical	Alternate Name/Surogate	Class	Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Tap Water (ug/l)		MCL (ug/L)	DAF=20 (mg/kg)
1,1-DICHLOROETHENE	1,1-Dichloroethylene	VOC	12.353068	nc	41.332545	nc	33.884365	nc		0.06
1,2-DICHLOROETHANE	1,2-Dichloroethane (EDC)	VOC	0.2777311	ca*	0.6034881	ca*	0.1231428	ca*	5	0.02
1,4-DICHLOROBENZENE		VOC								
2-HEXANONE		VOC								
2-METHYLNAPHTHALENE[1]	Naphthalene	SVOC	5.5916057	nc	18.769091	nc	0.6202941	nc		84
3,3'-DICHLOROBENZIDINE		SVOC	1.0808456	ca	3.8304391	ca	0.1494034	ca		0.007
4-CHLOROANILINE		SVOC	24.441239	nc	246.24252	nc	14.599998	nc		0.7
ACENAPHTHENE		SVOC	368.17057	nc	2921.9327	nc	36.5	nc		570
ACENAPHTHYLENE[2]	Pyrene	SVOC	231.59511	nc	2912.6201	nc	18.25	nc		4200
ALDRIN		PEST/PCB	0.0286106	ca*	0.1013939	ca	0.0039548	ca		0.5
ALUMINUM		METS	7614.1951	nc	10000	max	3649.8668	nc		
ANTHRACENE		SVOC	2189.6121	nc	10000	max	182.5	nc		12000
ANTIMONY		METS	3.1285712	nc	40.879967	nc	1.46	nc	6.0	5
ARSENIC		METS	0.3896239	ca*	1.5904075	ca	0.044821	ca	10	29
BARIUM		METS	537.49058	nc	6657.7349	nc	255.49935	nc	2,000	1600
BENZENE		VOC	0.6010835	ca*	1.3146578	ca*	0.3361769	ca*	5.0	0.03
BENZO(a)ANTHRACENE		SVOC	0.6214567	ca	2.1096229	ca	0.092098	ca		2
BENZO(a)PYRENE		SVOC	0.0621457	ca	0.2109623	ca	0.0092098	ca		8
BENZO(b)FLUORANTHENE		SVOC	0.6214567	ca	2.1096229	ca	0.092098	ca		5
BENZO(g,h,i)PERYLENE[2]	Pyrene	SVOC	231.59511	nc	2912.6201	nc	18.25	nc		4200
BENZO(k)FLUORANTHENE		SVOC	6.2145673	ca	21.096229	ca	0.9209799	ca		49
BENZYL BUTYL PHTHALATE	Butyl benzyl phthalate	SVOC	1222.0619	nc	10000	max	729.99467	nc		930
BERYLLIUM		METS	15.437416	nc	1940.6903	ca**	7.2999995	nc	4.0	63
bis(2-ETHYLHEXYL) PHTHALATE	DEHP	SVOC	34.741465	ca*	123.12126	ca	4.8022524	ca	6.0	
CADMIUM		METS	3.7033278	nc	45.141322	nc	1.825	nc		8
CALCIUM		METS								
CARBAZOLE		SVOC	24.319026	ca	86.184881	ca	3.3615767	ca		0.6
CARBON DISULFIDE		VOC	35.534037	nc	72	sat	104.28571	nc		32
CHLOROBENZENE		VOC	15.065786	nc	53.046611	nc	10.606838	nc		1
CHROMIUM, TOTAL	(Cr^{+6})	METS	30.096489	ca**	64.045325	ca	10.949999	nc	100	38
CHRYSENE		SVOC	62.145673	ca	210.96229	ca	9.2097991	ca		160
COBALT		METS	902.89311	ca**	1921.3526	ca*	72.999947	nc		
COPPER		METS	312.85519	nc	4087.6658	nc	145.99979	nc	1,300	
CRESOLS, m & p		SVOC								
DIBENZ(a,h)ANTHRACENE		SVOC	0.0621457	ca	0.2109623	ca	0.0092098	ca		2
DIBENZOFURAN		SVOC	29.052623	nc	312.6679	nc	2.4333333	nc		
DIELDRIN		PEST/PCB	0.0303988	ca	0.107731	ca	0.004202	ca		0.004
DIETHYL PHTHALATE		SVOC	4888.2478	nc	10000	max	2919.9147	nc		
DIMETHYL PHTHALATE		SVOC	10000	max	10000	max	36486.682	nc		
DI-n-BUTYL PHTHALATE	Dibutyl phthalate	SVOC	611.03097	nc	6156.0629	nc	364.99867	nc		2300
ETHYLBENZENE		VOC	8.9190691	ca	19.528309	ca	2.9106475	ca	700	13

APPENDIX B-1

Screening Criteria Used for COPC Selection

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

			2002 Preliminary Remedial Goals (PRGs)							Soil Screening Level
Chemical	Alternate Name/Surogate	Class	Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Tap Water (ug/l)		MCL (ug/L)	DAF=20 (mg/kg)
FLUORANTHENE		SVOC	229.36102	nc	2200.0353	nc	145.99979	nc		4300
FLUORENE		SVOC	274.71066	nc	2628.1433	nc	24.333333	nc		560
INDENO(1,2,3-c,d)PYRENE		SVOC	0.6214567	ca	2.1096229	ca	0.092098	ca		14
IRON		METS	2346.3185	nc	10000	max	1094.988	nc		
LEAD		METS	400	nc	750	nc			15	
MAGNESIUM		METS								
MANGANESE		METS	176.23532	nc	1945.8107	nc	87.599923	nc		
MERCURY		METS	2.3464285	nc	30.659981	nc	1.095	nc	2.0	
METHOXYCHLOR		PEST/PCB	30.551549	nc	307.80315	nc	18.249997	nc		160
METHYL ETHYL KETONE		VOC	732.53774	nc	2710.2009	nc	190.43478	nc		
METHYL ISOBUTYL KETONE		VOC	78.653167	nc	283.67713	nc	15.783784	nc		
METHYLENE CHLORIDE		VOC	9.1069899	ca	20.526525	ca	4.2756318	ca		0.02
NAPHTHALENE		SVOC	5.5916057	nc	18.769091	nc	0.6202941	nc		84
NICKEL		METS	156.42808	nc	2043.9164	nc	72.999947	nc		130
p,p'-DDD	DDD	PEST/PCB	2.4366033	ca	9.9514365	ca	0.2801314	ca		16
p,p'-DDE	DDE	PEST/PCB	1.7199552	ca	7.0245434	ca	0.1977398	ca		54
p,p'-DDT	DDT	PEST/PCB	1.7199554	ca*	7.0245447	ca*	0.1977398	ca*		32
PCB-1260	Aroclor 1260	PEST/PCB	0.2218572	ca	0.7436003	ca	0.0336158	ca		
PHENANTHRENE[3]	Anthracene	SVOC	2189.6121	nc	10000	max	182.5	nc		12000
PHENOL		SVOC								
POTASSIUM		METS								
PYRENE		SVOC	231.59511	nc	2912.6201	nc	18.25	nc		4200
SELENIUM		METS	39.107112	nc	510.99478	nc	18.249997	nc	50	5
SILVER		METS	39.107112	nc	510.99478	nc	18.249997	nc		34
SODIUM		METS								
STYRENE		VOC	170	sat	170	sat	164.10853	nc		4
TETRACHLOROETHYLENE	**PCE**	VOC	1.5052628	ca*	3.4223243	ca*	0.6591582	ca		0.06
THALLIUM		METS	0.5162143	nc	6.7451991	nc	0.2409	nc	2.0	0.7
TOLUENE		VOC	52	sat	52	sat	72.342342	nc	1,000	12
TRICHLOROETHYLENE	**TCE**	VOC	0.0529833	ca	0.1147377	ca	0.028015	ca		0.06
VANADIUM		METS	54.74994	nc	715.38976	nc	25.549993	nc		6000
XYLENES, TOTAL		VOC	27.498008	nc	42	sat	20.996033	nc	10,000	210
ZINC		METS	2346.3185	nc	10000	max	1094.988	nc		12000

Units in mg/kg

[1] Naphthalene PRG used as surrogate.

[2] Pyrene PRG used as surrogate.

[3] Anthracene used as surrogate.

Appendix B-2
Screening Criteria Comparison (*Draft NFA Report for Nine Sites* [CH2M HILL, 2002] and *Draft Final NFA Report for Nine Sites*[CH2M HILL, 2003])

APPENDIX B-2
Screening Criteria Comparison (*Draft NFA Report for Nine Sites* vs. *Draft Final NFA Report for Nine Sites*)
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

			NFA Report Screening Criteria					2002 Preliminary Remedial Goals (PRGs)		Soil Screening Level
Chemical	Alternate Name/Surogate	Class	Residential PRG (2000, HI=0.1, mg/Kg)	SSL (1996, DAF = 20, mg/Kg)		Tap Water PRG (2000, HI=0.1, ug/Kg)	MCL (ug/L)	Residential Soil (HI=0.1, mg/kg)	Tap Water (HI=0.1, ug/l)	DAF=20 (mg/kg)
1,1-DICHLOROETHENE	1,1-Dichloroethylene	VOC	0.054	0.060				1.24E+01 nc	3.39E+01 nc	0.06
1,2-DICHLOROETHANE	1,2-Dichloroethane (EDC)	VOC	0.35	0.020		0.50	75	2.78E-01 ca*	1.23E-01 ca*	0.02
1,4-DICHLOROBENZENE		VOC		0.007	Reg III					
2-HEXANONE		VOC								
2-METHYLNAPHTHALENE[1]	Naphthalene	SVOC	5.6	0.15	Reg III			5.59E+00 nc	6.20E-01 nc	84
3,3'-DICHLOROBENZIDINE		SVOC	1.1	0.0070				1.08E+00 ca	1.49E-01 ca	0.007
4-CHLOROANILINE		SVOC	24	0.70				2.44E+01 nc	1.46E+01 nc	0.7
ACENAPHTHENE		SVOC	368	570				3.68E+02 nc	3.65E+01 nc	570
ACENAPHTHYLENE[2]	Pyrene	SVOC	230	680	Reg III			2.32E+02 nc	1.83E+01 nc	4200
ALDRIN		PEST/PCB		12,000				2.86E-02 ca*	3.95E-03 ca	0.5
ALUMINUM		METS	7,614			3,650		7.61E+03 nc	3.65E+03 nc	
ANTHRACENE		SVOC	2,190	12,000				2.19E+03 nc	1.83E+02 nc	12000
ANTIMONY		METS	3.1	5.0		1.5	6.0	3.13E+00 nc	1.46E+00 nc	5
ARSENIC		METS	0.39	29				3.90E-01 ca*	4.48E-02 ca	29
BARIUM		METS	537	1,600		255	2,000	5.37E+02 nc	2.55E+02 nc	1600
BENZENE		VOC	0.67	0.030		0.35	5.0	6.01E-01 ca*	3.36E-01 ca*	0.03
BENZO(a)ANTHRACENE		SVOC	0.62	2.0				6.21E-01 ca	9.21E-02 ca	2
BENZO(a)PYRENE		SVOC	0.062	8.0				6.21E-02 ca	9.21E-03 ca	8
BENZO(b)FLUORANTHENE		SVOC	0.62	5.0				6.21E-01 ca	9.21E-02 ca	5
BENZO(g,h,i)PERYLENE[2]	Pyrene	SVOC	230	420				2.32E+02 nc	1.83E+01 nc	4200
BENZO(k)FLUORANTHENE		SVOC	6.2	49				6.21E+00 ca	9.21E-01 ca	49
BENZYL BUTYL PHTHALATE	Butyl benzyl phthalate	SVOC	1,222	930				1.22E+03 nc	7.30E+02 nc	930
BERYLLIUM		METS	15	63		7.3	4.0	1.54E+01 nc	7.30E+00 nc	63
bis(2-ETHYLHEXYL) PHTHALATE	DEHP	SVOC	35	3600		4.8	6.0	3.47E+01 ca*	4.80E+00 ca	
CADMIUM		METS	3.7	8.0				3.70E+00 nc	1.82E+00 nc	8
CALCIUM		METS								
CARBAZOLE		SVOC	24	0.60				2.43E+01 ca	3.36E+00 ca	0.6
CARBON DISULFIDE		VOC	36	32				3.55E+01 nc	1.04E+02 nc	32
CHLOROBENZENE		VOC		1.0				1.51E+01 nc	1.06E+01 nc	1
CHROMIUM, TOTAL	(Cr^{+6})	METS	211	38		11	100	3.01E+01 ca**	1.09E+01 nc	38
CHRYSENE		SVOC	62	160				6.21E+01 ca	9.21E+00 ca	160
COBALT		METS	469	1.10E+04	Reg III	219		9.03E+02 ca**	7.30E+01 nc	
COPPER		METS	291			136	1,300	3.13E+02 nc	1.46E+02 nc	
CRESOLS, m & p		SVOC				18				
DI-n-BUTYL PHTHALATE	Dibutyl phthalate	SVOC	611	2,300				6.11E+02 nc	3.65E+02 nc	2300
DIBENZ(a,h)ANTHRACENE		SVOC	0.062	2.0				6.21E-02 ca	9.21E-03 ca	2
DIBENZOFURAN		SVOC	29					2.91E+01 nc	2.43E+00 nc	
DIELDRIN		PEST/PCB	0.030	0.0040		0.0042		3.04E-02 ca	4.20E-03 ca	0.004
DIETHYL PHTHALATE		SVOC	4,888	470		2,920		4.89E+03 nc	2.92E+03 nc	
DIMETHYL PHTHALATE		SVOC	100,000					1.00E+04 max	3.65E+04 nc	
ETHYLBENZENE		VOC	230	13		134	700	8.92E+00 ca	2.91E+00 ca	13
FLUORANTHENE		SVOC	229	4,300				2.29E+02 nc	1.46E+02 nc	4300
FLUORENE		SVOC	264	560				2.75E+02 nc	2.43E+01 nc	560
INDENO(1,2,3-c,d)PYRENE		SVOC	0.62	14				6.21E-01 ca	9.21E-02 ca	14
IRON		METS	2,346			1,095		2.35E+03 nc	1.09E+03 nc	
LEAD		METS	400	400			15	4.00E+02 nc		

APPENDIX B-2
Screening Criteria Comparison (*Draft NFA Report for Nine Sites* vs. *Draft Final NFA Report for Nine Sites*)
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

			NFA Report Screening Criteria					2002 Preliminary Remedial Goals (PRGs)		Soil Screening Level
Chemical	Alternate Name/Surogate	Class	Residential PRG (2000, HI=0.1, mg/Kg)	SSL (1996, DAF = 20, mg/Kg)		Tap Water PRG (2000, HI=0.1, ug/Kg)	MCL (ug/L)	Residential Soil (HI=0.1, mg/kg)	Tap Water (HI=0.1, ug/l)	DAF=20 (mg/kg)
MAGNESIUM		METS								
MANGANESE		METS	178	950	Reg III	88		1.76E+02 nc	8.76E+01 nc	
MERCURY		METS	2.3	2		1.1	2.0	2.35E+00 nc	1.09E+00 nc	
METHOXYCHLOR		PEST/PCB	31	160				3.06E+01 nc	1.82E+01 nc	160
METHYL ETHYL KETONE		VOC	733	7.9	Reg III			7.33E+02 nc	1.90E+02 nc	
METHYL ISOBUTYL KETONE		VOC	79	1.3	Reg III			7.87E+01 nc	1.58E+01 nc	
METHYLENE CHLORIDE		VOC	8.9	0.020				9.11E+00 ca	4.28E+00 ca	0.02
NAPHTHALENE		SVOC	5.6	84				5.59E+00 nc	6.20E-01 nc	84
NICKEL		METS	156	130		73		1.56E+02 nc	7.30E+01 nc	130
p,p'-DDD	DDD	PEST/PCB	2.4	16				2.44E+00 ca	2.80E-01 ca	16
p,p'-DDE	DDE	PEST/PCB	1.7	54				1.72E+00 ca	1.98E-01 ca	54
p,p'-DDT	DDT	PEST/PCB	1.7	32				1.72E+00 ca*	1.98E-01 ca*	32
PCB-1260[4]	Aroclor 1260	PEST/PCB	0.22	1.1	Reg III			2.22E-01 ca	3.36E-02 ca	
PHENANTHRENE[3]	Anthracene	SVOC	231	4,200				2.19E+03 nc	1.83E+02 nc	12000
PHENOL		SVOC		130	Reg III	2,190				
POTASSIUM		METS								
PYRENE		SVOC	231	4,200				2.32E+02 nc	1.83E+01 nc	4200
SELENIUM		METS	39	5.0		18	50	3.91E+01 nc	1.82E+01 nc	5
SILVER		METS	39	34				3.91E+01 nc	1.82E+01 nc	34
SODIUM		METS								
STYRENE		VOC	170	4.0				1.70E+02 sat	1.64E+02 nc	4
TETRACHLOROETHYLENE	PCE	VOC	5.7	0.060				1.51E+00 ca*	6.59E-01 ca	0.06
THALLIUM		METS	0.52	0.7		0.24	2.0	5.16E-01 nc	2.41E-01 nc	0.7
TOLUENE		VOC	52	12		72	1,000	5.20E+01 sat	7.23E+01 nc	12
TRICHLOROETHYLENE	TCE	VOC	2.8	0.060				5.30E-02 ca	2.80E-02 ca	0.06
VANADIUM		METS	55	6,000		26		5.47E+01 nc	2.55E+01 nc	6000
XYLENES, TOTAL		VOC	210	210		143	10,000	2.75E+01 nc	2.10E+01 nc	210
ZINC		METS	2,346	12,000		1,095		2.35E+03 nc	1.09E+03 nc	12000

Units in mg/kg
[1] Naphthalene PRG used as surrogate.
[2] Pyrene PRG used as surrogate.
[3] Anthracene used as surrogate.
[4] Aroclor-1254 SSL used as a surrogate.
Chemicals where the PRG (and SSL) values are lower in the 2002 PRG table than were used in the NFA Report are shaded.

Appendix B-3
Data Screening for Surface Soils

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	ALUMINUM	METS	9,600	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	ALUMINUM	METS	9,200	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	ALUMINUM	METS	8,930	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	ALUMINUM	METS	8,910	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	ALUMINUM	METS	8,280	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	ALUMINUM	METS	8,150	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	ALUMINUM	METS	8,130	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	ALUMINUM	METS	7,890	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	ALUMINUM	METS	7,860	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	ALUMINUM	METS	7,670	=	mg/kg	7.61E+03		X	NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	ALUMINUM	METS	6,600	=	mg/kg	7.61E+03			NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	ALUMINUM	METS	6,250	=	mg/kg	7.61E+03			NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	ALUMINUM	METS	5,900	=	mg/kg	7.61E+03			NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	ALUMINUM	METS	5,240	=	mg/kg	7.61E+03			NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	ALUMINUM	METS	4,130	=	mg/kg	7.61E+03			NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	ANTIMONY	METS	0.19	J	mg/kg	3.13E+00	5.00E+00		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	ARSENIC	METS	2.1	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	ARSENIC	METS	1.2	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	ARSENIC	METS	0.95	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	ARSENIC	METS	0.76	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	ARSENIC	METS	0.75	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	ARSENIC	METS	0.72	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	ARSENIC	METS	0.64	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	ARSENIC	METS	0.56	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	ARSENIC	METS	0.50	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	ARSENIC	METS	0.48	J	mg/kg	3.90E-01	2.90E+01	X	
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	ARSENIC	METS	0.36	J	mg/kg	3.90E-01	2.90E+01		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	BARIUM	METS	264	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	BARIUM	METS	69	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	BARIUM	METS	63	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	BARIUM	METS	62	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	BARIUM	METS	55	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	BARIUM	METS	53	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	BARIUM	METS	53	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	BARIUM	METS	51	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	BARIUM	METS	50	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	BARIUM	METS	46	=	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	BARIUM	METS	43	J	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	BARIUM	METS	41	J	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	BARIUM	METS	39	J	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	BARIUM	METS	34	J	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	BARIUM	METS	30	J	mg/kg	5.37E+02	1.60E+03		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	BENZENE	VOC	3.00E-04	J	mg/kg	6.01E-01	3.00E-02		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	BENZENE	VOC	1.00E-04	J	mg/kg	6.01E-01	3.00E-02		
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.27	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	BERYLLIUM	METS	0.24	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	BERYLLIUM	METS	0.23	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.22	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	BERYLLIUM	METS	0.22	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.20	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	BERYLLIUM	METS	0.19	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.16	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.18	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.16	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.15	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.095	J	mg/kg	1.54E+01	6.30E+01		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	CALCIUM	METS	12,600	=	mg/kg			NA	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	CALCIUM	METS	4,720	=	mg/kg			NA	NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	CALCIUM	METS	4,690	=	mg/kg			NA	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	CALCIUM	METS	4,320	=	mg/kg			NA	NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	CALCIUM	METS	3,490	=	mg/kg			NA	NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	CALCIUM	METS	3,280	=	mg/kg			NA	NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	CALCIUM	METS	3,260	=	mg/kg			NA	NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	CALCIUM	METS	3,190	=	mg/kg			NA	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	CALCIUM	METS	3,050	=	mg/kg			NA	NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	CALCIUM	METS	2,850	=	mg/kg			NA	NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	CALCIUM	METS	2,600	=	mg/kg			NA	NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	CALCIUM	METS	2,380	=	mg/kg			NA	NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	CALCIUM	METS	2,230	=	mg/kg			NA	NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	CALCIUM	METS	1,870	=	mg/kg			NA	NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	CALCIUM	METS	1,410	=	mg/kg			NA	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	14	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	CHROMIUM, TOTAL	METS	14	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	9.7	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	9.2	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	8.5	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	8.3	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	8.1	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.5	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.3	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.0	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.0	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	6.3	=	mg/kg	3.01E+01	3.80E+01		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	COBALT	METS	20	=	mg/kg	9.03E+02			NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	COBALT	METS	9.9	J	mg/kg	9.03E+02			NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	COBALT	METS	9.6	J	mg/kg	9.03E+02			NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	COBALT	METS	9.2	J	mg/kg	9.03E+02			NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	COBALT	METS	9.0	J	mg/kg	9.03E+02			NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	COBALT	METS	8.6	J	mg/kg	9.03E+02			NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	COBALT	METS	8.3	J	mg/kg	9.03E+02			NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	COBALT	METS	8.2	J	mg/kg	9.03E+02			NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	COBALT	METS	8.1	J	mg/kg	9.03E+02			NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	COBALT	METS	7.5	J	mg/kg	9.03E+02			NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	COBALT	METS	6.6	J	mg/kg	9.03E+02			NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	COBALT	METS	6.6	J	mg/kg	9.03E+02			NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	COBALT	METS	6.5	J	mg/kg	9.03E+02			NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	COBALT	METS	6.5	J	mg/kg	9.03E+02			NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	COBALT	METS	5.2	J	mg/kg	9.03E+02			NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	COPPER	METS	34	=	mg/kg	3.13E+02			NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	COPPER	METS	33	=	mg/kg	3.13E+02			NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	COPPER	METS	30	=	mg/kg	3.13E+02			NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	COPPER	METS	29	=	mg/kg	3.13E+02			NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	COPPER	METS	28	=	mg/kg	3.13E+02			NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	COPPER	METS	27	=	mg/kg	3.13E+02			NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	COPPER	METS	25	=	mg/kg	3.13E+02			NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	COPPER	METS	25	=	mg/kg	3.13E+02			NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	COPPER	METS	25	=	mg/kg	3.13E+02			NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	COPPER	METS	24	=	mg/kg	3.13E+02			NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	COPPER	METS	24	=	mg/kg	3.13E+02			NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	COPPER	METS	19	=	mg/kg	3.13E+02			NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	COPPER	METS	18	=	mg/kg	3.13E+02			NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	COPPER	METS	18	=	mg/kg	3.13E+02			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	COPPER	METS	13	=	mg/kg	3.13E+02			NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	DI-n-BUTYL PHTHALATE	SVOC	0.11	J	mg/kg	6.11E+02	2.30E+03		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	ETHYLBENZENE	VOC	0.0030	J	mg/kg	8.92E+00	1.30E+01		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	ETHYLBENZENE	VOC	0.0010	J	mg/kg	8.92E+00	1.30E+01		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	ETHYLBENZENE	VOC	0.0010	J	mg/kg	8.92E+00	1.30E+01		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	IRON	METS	21,100	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	IRON	METS	18,500	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	IRON	METS	18,300	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	IRON	METS	17,800	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	IRON	METS	16,400	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	IRON	METS	15,800	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	IRON	METS	15,400	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	IRON	METS	14,800	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	IRON	METS	14,200	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	IRON	METS	14,200	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	IRON	METS	14,100	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	IRON	METS	11,800	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	IRON	METS	11,500	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	IRON	METS	11,500	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	IRON	METS	9,770	=	mg/kg	2.35E+03		X	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	LEAD	METS	8.4	=	mg/kg	4.00E+02			NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	LEAD	METS	7.1	=	mg/kg	4.00E+02			NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	LEAD	METS	6.7	=	mg/kg	4.00E+02			NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	LEAD	METS	6.5	=	mg/kg	4.00E+02			NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	LEAD	METS	5.4	=	mg/kg	4.00E+02			NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	LEAD	METS	4.3	=	mg/kg	4.00E+02			NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	LEAD	METS	3.7	=	mg/kg	4.00E+02			NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	LEAD	METS	3.4	=	mg/kg	4.00E+02			NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	LEAD	METS	3.4	=	mg/kg	4.00E+02			NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	LEAD	METS	3.2	=	mg/kg	4.00E+02			NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	LEAD	METS	2.1	=	mg/kg	4.00E+02			NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	LEAD	METS	2.0	=	mg/kg	4.00E+02			NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	LEAD	METS	1.7	=	mg/kg	4.00E+02			NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	LEAD	METS	1.4	=	mg/kg	4.00E+02			NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	LEAD	METS	1.1	=	mg/kg	4.00E+02			NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0080	J	mg/kg	4.00E+02			NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg	4.00E+02			NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg	4.00E+02			NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	MAGNESIUM	METS	4,200	=	mg/kg			NA	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	MAGNESIUM	METS	3,770	=	mg/kg			NA	NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	MAGNESIUM	METS	3,190	=	mg/kg			NA	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	MAGNESIUM	METS	3,160	=	mg/kg			NA	NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	MAGNESIUM	METS	2,860	=	mg/kg			NA	NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	MAGNESIUM	METS	2,790	=	mg/kg			NA	NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	MAGNESIUM	METS	2,730	=	mg/kg			NA	NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	MAGNESIUM	METS	2,620	=	mg/kg			NA	NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	MAGNESIUM	METS	2,620	=	mg/kg			NA	NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	MAGNESIUM	METS	2,610	=	mg/kg			NA	NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	MAGNESIUM	METS	2,190	=	mg/kg			NA	NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	MAGNESIUM	METS	2,040	=	mg/kg			NA	NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	MAGNESIUM	METS	1,840	=	mg/kg			NA	NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	MAGNESIUM	METS	1,810	=	mg/kg			NA	NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	MAGNESIUM	METS	1,330	=	mg/kg			NA	NA
AOC C	AC-SB14	NDA211DL1	04/11/00	0	0.5	SS	**MANGANESE**	METS	2,190	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	**MANGANESE**	METS	713	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	**MANGANESE**	METS	527	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	**MANGANESE**	METS	520	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	**MANGANESE**	METS	462	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	**MANGANESE**	METS	458	=	mg/kg	1.76E+02		X	NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	MANGANESE	METS	436	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	MANGANESE	METS	414	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	MANGANESE	METS	405	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	MANGANESE	METS	401	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	MANGANESE	METS	397	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	MANGANESE	METS	377	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	MANGANESE	METS	349	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	MANGANESE	METS	288	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	MANGANESE	METS	249	=	mg/kg	1.76E+02		X	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	MERCURY	METS	0.025	J	mg/kg	2.35E+00			NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	MERCURY	METS	0.021	J	mg/kg	2.35E+00			NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	NICKEL	METS	11	=	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	NICKEL	METS	7.8	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	NICKEL	METS	6.8	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	NICKEL	METS	6.7	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	NICKEL	METS	5.5	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	NICKEL	METS	5.1	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	NICKEL	METS	5.0	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	NICKEL	METS	4.3	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	NICKEL	METS	4.2	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	NICKEL	METS	4.0	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	NICKEL	METS	3.8	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	NICKEL	METS	3.6	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	NICKEL	METS	3.2	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	NICKEL	METS	3.2	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	NICKEL	METS	2.5	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0020	J	mg/kg	1.56E+02	1.30E+02		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	p,p'-DDD	PEST/PCB	0.0021	J	mg/kg	2.44E+00	1.60E+01		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0064	=	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0014	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	9.40E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	8.00E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	7.00E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	5.80E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	5.80E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	p,p'-DDE	PEST/PCB	5.30E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	4.80E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.016	=	mg/kg	1.72E+00	3.20E+01		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	p,p'-DDT	PEST/PCB	8.20E-04	J	mg/kg	1.72E+00	3.20E+01		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	p,p'-DDT	PEST/PCB	8.10E-04	J	mg/kg	1.72E+00	3.20E+01		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	p,p'-DDT	PEST/PCB	8.10E-04	J	mg/kg	1.72E+00	3.20E+01		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	p,p'-DDT	PEST/PCB	4.70E-04	J	mg/kg	1.72E+00	3.20E+01		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	POTASSIUM	METS	1,340	=	mg/kg			NA	NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	POTASSIUM	METS	1,290	=	mg/kg			NA	NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	POTASSIUM	METS	1,260	=	mg/kg			NA	NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	POTASSIUM	METS	1,260	J	mg/kg			NA	NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	POTASSIUM	METS	1,150	=	mg/kg			NA	NA
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	POTASSIUM	METS	1,130	=	mg/kg			NA	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	POTASSIUM	METS	1,130	J	mg/kg			NA	NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	POTASSIUM	METS	1,120	=	mg/kg			NA	NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	POTASSIUM	METS	1,020	J	mg/kg			NA	NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	POTASSIUM	METS	988	J	mg/kg			NA	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	POTASSIUM	METS	939	J	mg/kg			NA	NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	POTASSIUM	METS	878	J	mg/kg			NA	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	POTASSIUM	METS	768	J	mg/kg			NA	NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	POTASSIUM	METS	745	J	mg/kg			NA	NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	POTASSIUM	METS	672	J	mg/kg			NA	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	SELENIUM	METS	0.90	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	SELENIUM	METS	0.84	J	mg/kg	3.91E+01	5.00E+00		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	SELENIUM	METS	0.80	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	SELENIUM	METS	0.80	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	SELENIUM	METS	0.76	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	SELENIUM	METS	0.74	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	SELENIUM	METS	0.71	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	SELENIUM	METS	0.68	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	SELENIUM	METS	0.68	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	SELENIUM	METS	0.67	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	SELENIUM	METS	0.63	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	SELENIUM	METS	0.58	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	SELENIUM	METS	0.55	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	SELENIUM	METS	0.45	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	SELENIUM	METS	0.42	J	mg/kg	3.91E+01	5.00E+00		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	SODIUM	METS	205	J	mg/kg			NA	NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	SODIUM	METS	195	J	mg/kg			NA	NA
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	SODIUM	METS	172	J	mg/kg			NA	NA
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	SODIUM	METS	154	J	mg/kg			NA	NA
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	SODIUM	METS	144	J	mg/kg			NA	NA
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	SODIUM	METS	120	J	mg/kg			NA	NA
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	SODIUM	METS	114	J	mg/kg			NA	NA
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	SODIUM	METS	111	J	mg/kg			NA	NA
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	SODIUM	METS	96	J	mg/kg			NA	NA
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	SODIUM	METS	91	J	mg/kg			NA	NA
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	SODIUM	METS	90	J	mg/kg			NA	NA
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	SODIUM	METS	79	J	mg/kg			NA	NA
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	SODIUM	METS	75	J	mg/kg			NA	NA
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	SODIUM	METS	73	J	mg/kg			NA	NA
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	SODIUM	METS	46	J	mg/kg			NA	NA
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	THALLIUM	METS	0.65	J	mg/kg	5.16E-01	7.00E-01	X	
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	THALLIUM	METS	0.56	J	mg/kg	5.16E-01	7.00E-01	X	
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	THALLIUM	METS	0.52	J	mg/kg	5.16E-01	7.00E-01	X	
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	THALLIUM	METS	0.52	J	mg/kg	5.16E-01	7.00E-01	X	
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	THALLIUM	METS	0.47	J	mg/kg	5.16E-01	7.00E-01		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	THALLIUM	METS	0.43	J	mg/kg	5.16E-01	7.00E-01		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	THALLIUM	METS	0.38	J	mg/kg	5.16E-01	7.00E-01		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	THALLIUM	METS	0.37	J	mg/kg	5.16E-01	7.00E-01		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	THALLIUM	METS	0.31	J	mg/kg	5.16E-01	7.00E-01		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	TOLUENE	VOC	0.0050	J	mg/kg	5.20E+01	1.20E+01		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	TOLUENE	VOC	0.0010	J	mg/kg	5.20E+01	1.20E+01		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	TOLUENE	VOC	0.0010	J	mg/kg	5.20E+01	1.20E+01		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	TRICHLOROETHYLENE (TCE)	VOC	3.00E-04	J	mg/kg	5.30E-02	6.00E-02		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	VANADIUM	METS	68	=	mg/kg	5.47E+01	6.00E+03	X	
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	VANADIUM	METS	59	=	mg/kg	5.47E+01	6.00E+03	X	
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	VANADIUM	METS	56	=	mg/kg	5.47E+01	6.00E+03	X	
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	VANADIUM	METS	52	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	VANADIUM	METS	51	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	VANADIUM	METS	50	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	VANADIUM	METS	49	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	VANADIUM	METS	46	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	VANADIUM	METS	45	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	VANADIUM	METS	42	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	VANADIUM	METS	40	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	VANADIUM	METS	37	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	VANADIUM	METS	35	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	VANADIUM	METS	34	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	VANADIUM	METS	32	=	mg/kg	5.47E+01	6.00E+03		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.026	J	mg/kg	2.75E+01	2.10E+02		
AOC C	AC-SB02	NDA198	04/10/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.011	J	mg/kg	2.75E+01	2.10E+02		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.010	J	mg/kg	2.75E+01	2.10E+02		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.75E+01	2.10E+02		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.75E+01	2.10E+02		
AOC C	AC-SB01	NDA196	04/10/00	0	0.5	SS	ZINC	METS	57	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB08	NDA204	04/11/00	0	0.5	SS	ZINC	METS	47	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB03	NDA199	04/10/00	0	0.5	SS	ZINC	METS	45	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB07	NDA203	04/11/00	0	0.5	SS	ZINC	METS	40	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB04	NDA200	04/10/00	0	0.5	SS	ZINC	METS	36	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB15	NDA212	04/11/00	0	0.5	SS	ZINC	METS	35	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB12	NDA209	04/11/00	0	0.5	SS	ZINC	METS	31	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB02	NDA196	04/10/00	0	0.5	SS	ZINC	METS	30	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB09	NDA206	04/11/00	0	0.5	SS	ZINC	METS	29	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB06	NDA202	04/11/00	0	0.5	SS	ZINC	METS	28	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB10	NDA207	04/11/00	0	0.5	SS	ZINC	METS	25	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB14	NDA211	04/11/00	0	0.5	SS	ZINC	METS	25	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB11	NDA208	04/11/00	0	0.5	SS	ZINC	METS	20	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB05	NDA201	04/11/00	0	0.5	SS	ZINC	METS	16	=	mg/kg	2.35E+03	1.20E+04		
AOC C	AC-SB13	NDA210	04/11/00	0	0.5	SS	ZINC	METS	13	=	mg/kg	2.35E+03	1.20E+04		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	2-HEXANONE	VOC	0.0012	J	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	2-HEXANONE	VOC	8.70E-04	J	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	ALUMINUM	METS	9,150	=	mg/kg	7.61E+03		X	NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	ALUMINUM	METS	8,180	=	mg/kg	7.61E+03		X	NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	ALUMINUM	METS	7,310	=	mg/kg	7.61E+03			NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	ALUMINUM	METS	6,350	=	mg/kg	7.61E+03			NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	ANTIMONY	METS	0.71	J	mg/kg	3.13E+00	5.00E+00		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	ANTIMONY	METS	0.62	J	mg/kg	3.13E+00	5.00E+00		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	ANTIMONY	METS	0.50	J	mg/kg	3.13E+00	5.00E+00		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	ANTIMONY	METS	0.50	J	mg/kg	3.13E+00	5.00E+00		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	ARSENIC	METS	1.0	J	mg/kg	3.90E-01	2.90E+01	X	
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	ARSENIC	METS	0.51	J	mg/kg	3.90E-01	2.90E+01	X	
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	ARSENIC	METS	0.46	J	mg/kg	3.90E-01	2.90E+01	X	
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	BARIUM	METS	113	=	mg/kg	5.37E+02	1.60E+03		
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	BARIUM	METS	66	=	mg/kg	5.37E+02	1.60E+03		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	BARIUM	METS	62	=	mg/kg	5.37E+02	1.60E+03		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	BARIUM	METS	40	J	mg/kg	5.37E+02	1.60E+03		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	CALCIUM	METS	36,500	=	mg/kg			NA	NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	CALCIUM	METS	7,280	=	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	CALCIUM	METS	4,880	=	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	CALCIUM	METS	4,300	=	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.01E+01	3.80E+01		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	CHROMIUM, TOTAL	METS	8.5	=	mg/kg	3.01E+01	3.80E+01		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.4	=	mg/kg	3.01E+01	3.80E+01		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.3	=	mg/kg	3.01E+01	3.80E+01		
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	COBALT	METS	8.1	J	mg/kg	9.03E+02			NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	COBALT	METS	6.9	J	mg/kg	9.03E+02			NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	COBALT	METS	5.8	J	mg/kg	9.03E+02			NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	COBALT	METS	5.3	J	mg/kg	9.03E+02			NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	COPPER	METS	34	=	mg/kg	3.13E+02			NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	COPPER	METS	22	=	mg/kg	3.13E+02			NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	COPPER	METS	20	=	mg/kg	3.13E+02			NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	COPPER	METS	18	=	mg/kg	3.13E+02			NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	IRON	METS	17,700	=	mg/kg	2.35E+03		X	NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	IRON	METS	14,100	=	mg/kg	2.35E+03		X	NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	IRON	METS	13,800	=	mg/kg	2.35E+03		X	NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	IRON	METS	12,600	=	mg/kg	2.35E+03		X	NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	LEAD	METS	9.9	=	mg/kg	4.00E+02			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	LEAD	METS	8.6	=	mg/kg	4.00E+02			NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	LEAD	METS	8.0	=	mg/kg	4.00E+02			NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	LEAD	METS	7.8	=	mg/kg	4.00E+02			NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	MAGNESIUM	METS	3,430	=	mg/kg			NA	NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	MAGNESIUM	METS	3,250	=	mg/kg			NA	NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	MAGNESIUM	METS	1,810	=	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	MAGNESIUM	METS	1,750	=	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	**MANGANESE**	METS	**472**	=	mg/kg	1.76E+02		X	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	**MANGANESE**	METS	**444**	=	mg/kg	1.76E+02		X	NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	**MANGANESE**	METS	**340**	=	mg/kg	1.76E+02		X	NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	**MANGANESE**	METS	**332**	=	mg/kg	1.76E+02		X	NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	MERCURY	METS	0.071	=	mg/kg	2.35E+00			NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	MERCURY	METS	0.044	J	mg/kg	2.35E+00			NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	MERCURY	METS	0.037	J	mg/kg	2.35E+00			NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	MERCURY	METS	0.033	J	mg/kg	2.35E+00			NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	NICKEL	METS	7.2	J	mg/kg	1.56E+02	1.30E+02		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	NICKEL	METS	3.8	J	mg/kg	1.56E+02	1.30E+02		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	NICKEL	METS	3.5	J	mg/kg	1.56E+02	1.30E+02		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	NICKEL	METS	3.4	J	mg/kg	1.56E+02	1.30E+02		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0023	J	mg/kg	1.72E+00	5.40E+01		
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0016	J	mg/kg	1.72E+00	5.40E+01		
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.0091	=	mg/kg	1.72E+00	3.20E+01		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.0012	J	mg/kg	1.72E+00	3.20E+01		
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	POTASSIUM	METS	1,350	=	mg/kg			NA	NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	POTASSIUM	METS	1,320	=	mg/kg			NA	NA
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	POTASSIUM	METS	1,100	J	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	POTASSIUM	METS	849	J	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	SELENIUM	METS	1.2	J	mg/kg	3.91E+01	5.00E+00		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	SELENIUM	METS	0.95	J	mg/kg	3.91E+01	5.00E+00		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	SELENIUM	METS	0.84	J	mg/kg	3.91E+01	5.00E+00		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	SELENIUM	METS	0.78	J	mg/kg	3.91E+01	5.00E+00		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	SODIUM	METS	275	J	mg/kg			NA	NA
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	SODIUM	METS	91	J	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	SODIUM	METS	85	J	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	SODIUM	METS	61	J	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	VANADIUM	METS	51	=	mg/kg	5.47E+01	6.00E+03		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	VANADIUM	METS	42	=	mg/kg	5.47E+01	6.00E+03		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	VANADIUM	METS	36	=	mg/kg	5.47E+01	6.00E+03		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	VANADIUM	METS	36	=	mg/kg	5.47E+01	6.00E+03		
AOC-L	AOCLSB001	NDE121	11/29/00	0	0.5	SS	ZINC	METS	82	=	mg/kg	2.35E+03	1.20E+04		
AOC-L	AOCLSB004	NDE127	11/29/00	0	0.5	SS	ZINC	METS	57	=	mg/kg	2.35E+03	1.20E+04		
AOC-L	AOCLSB002	NDE123	11/29/00	0	0.5	SS	ZINC	METS	57	=	mg/kg	2.35E+03	1.20E+04		
AOC-L	AOCLSB003	NDE125	11/29/00	0	0.5	SS	ZINC	METS	54	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	**ALUMINUM**	METS	**10,000**	=	mg/kg	7.61E+03		X	NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	ALUMINUM	METS	7,080	=	mg/kg	7.61E+03			NA
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	ALUMINUM	METS	6,930	=	mg/kg	7.61E+03			NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	ALUMINUM	METS	6,460	=	mg/kg	7.61E+03			NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	ALUMINUM	METS	4,610	=	mg/kg	7.61E+03			NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	ALUMINUM	METS	4,390	=	mg/kg	7.61E+03			NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	ALUMINUM	METS	4,340	=	mg/kg	7.61E+03			NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	ALUMINUM	METS	4,130	=	mg/kg	7.61E+03			NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	ALUMINUM	METS	4,070	=	mg/kg	7.61E+03			NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	ALUMINUM	METS	3,740	=	mg/kg	7.61E+03			NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	ANTIMONY	METS	1.3	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	ANTIMONY	METS	0.91	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	ANTIMONY	METS	0.77	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	ANTIMONY	METS	0.61	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	ANTIMONY	METS	0.49	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	ANTIMONY	METS	0.47	J	mg/kg	3.13E+00	5.00E+00		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	ANTIMONY	METS	0.44	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	ANTIMONY	METS	0.42	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	ANTIMONY	METS	0.26	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	ANTIMONY	METS	0.24	J	mg/kg	3.13E+00	5.00E+00		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	ARSENIC	METS	6.4	=	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	ARSENIC	METS	4.4	=	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	ARSENIC	METS	2.8	=	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	ARSENIC	METS	1.4	J	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	ARSENIC	METS	1.4	J	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	ARSENIC	METS	1.3	J	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	ARSENIC	METS	1.1	J	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	ARSENIC	METS	1.1	J	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	ARSENIC	METS	0.74	J	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	ARSENIC	METS	0.70	J	mg/kg	3.90E-01	2.90E+01	X	
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	BARIUM	METS	299	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	BARIUM	METS	115	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	BARIUM	METS	114	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	BARIUM	METS	110	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	BARIUM	METS	105	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	BARIUM	METS	96	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	BARIUM	METS	94	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	BARIUM	METS	77	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	BARIUM	METS	66	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	BARIUM	METS	66	=	mg/kg	5.37E+02	1.60E+03		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	BENZO(a)PYRENE	SVOC	0.040	J	mg/kg	6.21E-02	8.00E+00		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	BENZO(b)FLUORANTHENE	SVOC	0.043	J	mg/kg	6.21E-01	5.00E+00		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	BENZYL BUTYL PHTHALATE	SVOC	0.063	J	mg/kg	1.22E+03	9.30E+02		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.19	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	CALCIUM	METS	7,330	=	mg/kg			NA	NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	CALCIUM	METS	6,500	=	mg/kg			NA	NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	CALCIUM	METS	4,900	=	mg/kg			NA	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	CALCIUM	METS	4,110	=	mg/kg			NA	NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	CALCIUM	METS	3,450	=	mg/kg			NA	NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	CALCIUM	METS	1,840	=	mg/kg			NA	NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	CALCIUM	METS	1,630	=	mg/kg			NA	NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	CALCIUM	METS	1,290	=	mg/kg			NA	NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	CALCIUM	METS	1,210	J	mg/kg			NA	NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	CALCIUM	METS	1,150	=	mg/kg			NA	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	35	=	mg/kg	3.01E+01	3.80E+01	X	
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	33	=	mg/kg	3.01E+01	3.80E+01	X	
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	32	=	mg/kg	3.01E+01	3.80E+01	X	
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	13	=	mg/kg	3.01E+01	3.80E+01		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	8.3	=	mg/kg	3.01E+01	3.80E+01		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	8.1	=	mg/kg	3.01E+01	3.80E+01		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	6.4	=	mg/kg	3.01E+01	3.80E+01		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	6.2	=	mg/kg	3.01E+01	3.80E+01		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	6.0	=	mg/kg	3.01E+01	3.80E+01		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	5.4	=	mg/kg	3.01E+01	3.80E+01		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	COBALT	METS	13	=	mg/kg	9.03E+02			NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	COBALT	METS	8.3	J	mg/kg	9.03E+02			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	COBALT	METS	8.2	J	mg/kg	9.03E+02			NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	COBALT	METS	7.5	J	mg/kg	9.03E+02			NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	COBALT	METS	7.1	J	mg/kg	9.03E+02			NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	COBALT	METS	7.0	J	mg/kg	9.03E+02			NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	COBALT	METS	6.8	J	mg/kg	9.03E+02			NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	COBALT	METS	6.5	J	mg/kg	9.03E+02			NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	COBALT	METS	5.6	J	mg/kg	9.03E+02			NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	COBALT	METS	4.4	J	mg/kg	9.03E+02			NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	COPPER	METS	87	=	mg/kg	3.13E+02			NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	COPPER	METS	67	=	mg/kg	3.13E+02			NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	COPPER	METS	52	=	mg/kg	3.13E+02			NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	COPPER	METS	51	=	mg/kg	3.13E+02			NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	COPPER	METS	50	=	mg/kg	3.13E+02			NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	COPPER	METS	43	=	mg/kg	3.13E+02			NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	COPPER	METS	36	=	mg/kg	3.13E+02			NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	COPPER	METS	35	=	mg/kg	3.13E+02			NA
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	COPPER	METS	35	=	mg/kg	3.13E+02			NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	COPPER	METS	16	=	mg/kg	3.13E+02			NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	DIETHYL PHTHALATE	SVOC	0.20	J	mg/kg	4.89E+03			NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	DIETHYL PHTHALATE	SVOC	0.12	J	mg/kg	4.89E+03			NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	DIETHYL PHTHALATE	SVOC	0.085	J	mg/kg	4.89E+03			NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	IRON	METS	18,200	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	IRON	METS	13,000	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	IRON	METS	12,900	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	IRON	METS	12,500	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	IRON	METS	10,300	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	IRON	METS	10,100	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	IRON	METS	9,250	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	IRON	METS	8,830	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	IRON	METS	8,830	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	IRON	METS	8,190	=	mg/kg	2.35E+03		X	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	LEAD	METS	98	=	mg/kg	4.00E+02			NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	LEAD	METS	97	=	mg/kg	4.00E+02			NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	LEAD	METS	34	=	mg/kg	4.00E+02			NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	LEAD	METS	31	=	mg/kg	4.00E+02			NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	LEAD	METS	23	=	mg/kg	4.00E+02			NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	LEAD	METS	22	=	mg/kg	4.00E+02			NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	LEAD	METS	18	=	mg/kg	4.00E+02			NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	LEAD	METS	17	=	mg/kg	4.00E+02			NA
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	LEAD	METS	16	=	mg/kg	4.00E+02			NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	LEAD	METS	8.3	=	mg/kg	4.00E+02			NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	5.00E-04	J	mg/kg	4.00E+02			NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	MAGNESIUM	METS	6,440	=	mg/kg			NA	NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	MAGNESIUM	METS	4,420	=	mg/kg			NA	NA
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	MAGNESIUM	METS	3,860	=	mg/kg			NA	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	MAGNESIUM	METS	2,860	=	mg/kg			NA	NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	MAGNESIUM	METS	1,640	=	mg/kg			NA	NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	MAGNESIUM	METS	1,390	=	mg/kg			NA	NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	MAGNESIUM	METS	1,350	=	mg/kg			NA	NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	MAGNESIUM	METS	1,290	=	mg/kg			NA	NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	MAGNESIUM	METS	1,150	J	mg/kg			NA	NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	MAGNESIUM	METS	994	J	mg/kg			NA	NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	MANGANESE	METS	735	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	MANGANESE	METS	703	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	MANGANESE	METS	681	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	MANGANESE	METS	652	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	MANGANESE	METS	643	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	MANGANESE	METS	594	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	MANGANESE	METS	576	=	mg/kg	1.76E+02		X	NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	MANGANESE	METS	566	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	MANGANESE	METS	563	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	MANGANESE	METS	534	=	mg/kg	1.76E+02		X	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	MERCURY	METS	0.079	=	mg/kg	2.35E+00			NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	MERCURY	METS	0.056	=	mg/kg	2.35E+00			NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	MERCURY	METS	0.043	=	mg/kg	2.35E+00			NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	MERCURY	METS	0.034	J	mg/kg	2.35E+00			NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	MERCURY	METS	0.031	J	mg/kg	2.35E+00			NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	MERCURY	METS	0.030	J	mg/kg	2.35E+00			NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	MERCURY	METS	0.019	J	mg/kg	2.35E+00			NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	MERCURY	METS	0.019	J	mg/kg	2.35E+00			NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	MERCURY	METS	0.018	J	mg/kg	2.35E+00			NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	NICKEL	METS	21	=	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	NICKEL	METS	13	=	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	NICKEL	METS	9.2	=	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	NICKEL	METS	7.8	J	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	NICKEL	METS	4.7	J	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	NICKEL	METS	4.2	J	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	NICKEL	METS	3.9	J	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	NICKEL	METS	3.5	J	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	NICKEL	METS	3.3	J	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	NICKEL	METS	2.9	J	mg/kg	1.56E+02	1.30E+02		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	p,p'-DDD	PEST/PCB	8.00E-04	J	mg/kg	2.44E+00	1.60E+01		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	p,p'-DDD	PEST/PCB	7.70E-04	J	mg/kg	2.44E+00	1.60E+01		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	p,p'-DDD	PEST/PCB	4.30E-04	J	mg/kg	2.44E+00	1.60E+01		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.055	=	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.050	=	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.016	=	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.014	=	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.013	=	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.010	=	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0049	=	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0027	J	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0012	J	mg/kg	1.72E+00	5.40E+01		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.044	=	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.026	=	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.010	J	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.0094	J	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.0071	J	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.0057	J	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.0049	=	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	0.0044	=	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	p,p'-DDT	PEST/PCB	8.20E-04	J	mg/kg	1.72E+00	3.20E+01		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	POTASSIUM	METS	1,600	=	mg/kg			NA	NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	POTASSIUM	METS	1,410	=	mg/kg			NA	NA
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	POTASSIUM	METS	1,370	=	mg/kg			NA	NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	POTASSIUM	METS	1,170	J	mg/kg			NA	NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	POTASSIUM	METS	1,020	J	mg/kg			NA	NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	POTASSIUM	METS	900	J	mg/kg			NA	NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	POTASSIUM	METS	750	J	mg/kg			NA	NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	POTASSIUM	METS	699	J	mg/kg			NA	NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	POTASSIUM	METS	683	J	mg/kg			NA	NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	POTASSIUM	METS	621	J	mg/kg			NA	NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	SELENIUM	METS	0.70	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	SELENIUM	METS	0.70	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	SELENIUM	METS	0.61	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	SELENIUM	METS	0.60	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	SELENIUM	METS	0.56	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	SELENIUM	METS	0.58	J	mg/kg	3.91E+01	5.00E+00		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	SELENIUM	METS	0.57	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	SELENIUM	METS	0.56	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	SELENIUM	METS	0.42	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	SELENIUM	METS	0.40	J	mg/kg	3.91E+01	5.00E+00		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	SILVER	METS	0.065	J	mg/kg	3.91E+01	3.40E+01		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	SILVER	METS	0.060	J	mg/kg	3.91E+01	3.40E+01		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	SILVER	METS	0.054	J	mg/kg	3.91E+01	3.40E+01		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	SODIUM	METS	179	J	mg/kg			NA	NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	SODIUM	METS	109	J	mg/kg			NA	NA
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	SODIUM	METS	109	J	mg/kg			NA	NA
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	SODIUM	METS	76	J	mg/kg			NA	NA
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	SODIUM	METS	72	J	mg/kg			NA	NA
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	SODIUM	METS	63	J	mg/kg			NA	NA
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	SODIUM	METS	59	J	mg/kg			NA	NA
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	SODIUM	METS	58	J	mg/kg			NA	NA
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	SODIUM	METS	55	J	mg/kg			NA	NA
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	THALLIUM	METS	1.2	J	mg/kg	5.16E-01	7.00E-01	X	X
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	THALLIUM	METS	0.62	J	mg/kg	5.16E-01	7.00E-01	X	
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	THALLIUM	METS	0.62	J	mg/kg	5.16E-01	7.00E-01	X	
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	THALLIUM	METS	0.54	J	mg/kg	5.16E-01	7.00E-01	X	
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	THALLIUM	METS	0.52	J	mg/kg	5.16E-01	7.00E-01	X	
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	THALLIUM	METS	0.45	J	mg/kg	5.16E-01	7.00E-01		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	THALLIUM	METS	0.40	J	mg/kg	5.16E-01	7.00E-01		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	THALLIUM	METS	0.35	J	mg/kg	5.16E-01	7.00E-01		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	THALLIUM	METS	0.35	J	mg/kg	5.16E-01	7.00E-01		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	TOLUENE	VOC	0.0010	J	mg/kg	5.20E+01	1.20E+01		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	TOLUENE	VOC	0.0010	J	mg/kg	5.20E+01	1.20E+01		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	TOLUENE	VOC	7.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	TOLUENE	VOC	4.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	VANADIUM	METS	55	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	VANADIUM	METS	37	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	VANADIUM	METS	36	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	VANADIUM	METS	35	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	VANADIUM	METS	29	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	VANADIUM	METS	28	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	VANADIUM	METS	26	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	VANADIUM	METS	25	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	VANADIUM	METS	24	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	VANADIUM	METS	22	J	mg/kg	5.47E+01	6.00E+03		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	XYLENES, TOTAL	VOC	5.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM10	W10-SB03	NDA131	04/04/00	0	0.5	SS	ZINC	METS	1,130	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB06	NDA137	04/04/00	0	0.5	SS	ZINC	METS	134	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB04	NDA133	04/04/00	0	0.5	SS	ZINC	METS	132	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB05	NDA135	04/04/00	0	0.5	SS	ZINC	METS	128	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB07	NDA139	04/04/00	0	0.5	SS	ZINC	METS	117	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB08	NDA141	04/04/00	0	0.5	SS	ZINC	METS	110	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB09	NDA143	04/04/00	0	0.5	SS	ZINC	METS	93	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB02	NDA127	04/04/00	0	0.5	SS	ZINC	METS	68	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB01	NDA125	04/04/00	0	0.5	SS	ZINC	METS	68	=	mg/kg	2.35E+03	1.20E+04		
SWM10	W10-SB10	NDA145	04/04/00	0	0.5	SS	ZINC	METS	38	=	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	1,2-DICHLOROETHANE	VOC	4.00E-04	J	mg/kg	2.76E-01	2.00E-02		
SWM14	W14-SB09	NDA168	04/06/00	0	0.5	SS	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.78E-01	2.00E-02		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	ALUMINUM	METS	16,300	=	mg/kg	7.61E+03		X	NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	ALUMINUM	METS	13,600	=	mg/kg	7.61E+03		X	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	ALUMINUM	METS	13,400	=	mg/kg	7.81E+03		X	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	ALUMINUM	METS	11,000	=	mg/kg	7.61E+03		X	NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	ALUMINUM	METS	10,400	=	mg/kg	7.61E+03		X	NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	ALUMINUM	METS	7,140	=	mg/kg	7.61E+03			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	ALUMINUM	METS	6,900	=	mg/kg	7.61E+03			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	ALUMINUM	METS	6,460	=	mg/kg	7.61E+03			NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	ALUMINUM	METS	6,320	=	mg/kg	7.61E+03			NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	ALUMINUM	METS	5,970	=	mg/kg	7.61E+03			NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	ALUMINUM	METS	5,960	=	mg/kg	7.61E+03			NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	ALUMINUM	METS	5,330	=	mg/kg	7.61E+03			NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	ALUMINUM	METS	4,910	=	mg/kg	7.61E+03			NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	ALUMINUM	METS	4,900	=	mg/kg	7.61E+03			NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	ANTIMONY	METS	0.74	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	ANTIMONY	METS	0.61	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	ANTIMONY	METS	0.58	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	ANTIMONY	METS	0.57	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	ANTIMONY	METS	0.38	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	ANTIMONY	METS	0.36	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	ANTIMONY	METS	0.33	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	ANTIMONY	METS	0.21	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	ANTIMONY	METS	0.20	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	ANTIMONY	METS	0.20	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	ANTIMONY	METS	0.18	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	ANTIMONY	METS	0.17	J	mg/kg	3.13E+00	5.00E+00		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	ARSENIC	METS	3.0	=	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	ARSENIC	METS	1.7	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	ARSENIC	METS	1.5	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	ARSENIC	METS	1.5	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	ARSENIC	METS	1.3	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	ARSENIC	METS	1.2	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	ARSENIC	METS	0.76	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	ARSENIC	METS	0.65	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	ARSENIC	METS	0.58	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	ARSENIC	METS	0.52	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	ARSENIC	METS	0.50	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	ARSENIC	METS	0.48	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	ARSENIC	METS	0.40	J	mg/kg	3.90E-01	2.90E+01	X	
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	BARIUM	METS	159	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	BARIUM	METS	97	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	BARIUM	METS	84	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	BARIUM	METS	76	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB08	NDA154	04/06/00	0	0.5	SS	BARIUM	METS	74	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	BARIUM	METS	68	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	BARIUM	METS	54	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	BARIUM	METS	59	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	BARIUM	METS	56	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	BARIUM	METS	54	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	BARIUM	METS	54	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	BARIUM	METS	51	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	BARIUM	METS	44	=	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	BARIUM	METS	27	J	mg/kg	5.37E+02	1.60E+03		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	BENZENE	VOC	2.00E-04	J	mg/kg	6.01E-01	3.00E-02		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	BENZYL BUTYL PHTHALATE	SVOC	0.33	J	mg/kg	1.22E+03	9.30E+02		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	BENZYL BUTYL PHTHALATE	SVOC	0.076	J	mg/kg	1.22E+03	9.30E+02		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	BERYLLIUM	METS	0.27	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	BERYLLIUM	METS	0.25	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	BERYLLIUM	METS	0.21	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	BERYLLIUM	METS	0.19	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	BERYLLIUM	METS	0.19	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	BERYLLIUM	METS	0.16	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	BERYLLIUM	METS	0.15	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	BERYLLIUM	METS	0.12	J	mg/kg	1.54E+01	6.30E+01		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	BERYLLIUM	METS	0.12	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	BERYLLIUM	METS	0.098	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	BERYLLIUM	METS	0.072	J	mg/kg	1.54E+01	6.30E+01		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.16	J	mg/kg	3.47E+01			NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.12	J	mg/kg	3.47E+01			NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.078	J	mg/kg	3.47E+01			NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.073	J	mg/kg	3.47E+01			NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.066	J	mg/kg	3.47E+01			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.058	J	mg/kg	3.47E+01			NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.042	J	mg/kg	3.47E+01			NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	CADMIUM	METS	3.2	=	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	CADMIUM	METS	2.0	=	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	CADMIUM	METS	1.8	=	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	CADMIUM	METS	1.2	J	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	CADMIUM	METS	0.80	J	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	CADMIUM	METS	0.54	J	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	CADMIUM	METS	0.41	J	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	CADMIUM	METS	0.34	J	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	CADMIUM	METS	0.12	J	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	CADMIUM	METS	0.073	J	mg/kg	3.70E+00	8.00E+00		
SWM14	W14-SB14	NDA176DL1	04/06/00	0	0.5	SS	CALCIUM	METS	82,400	=	mg/kg			NA	NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	CALCIUM	METS	27,600	=	mg/kg			NA	NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	CALCIUM	METS	25,100	=	mg/kg			NA	NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	CALCIUM	METS	19,800	=	mg/kg			NA	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	CALCIUM	METS	18,300	=	mg/kg			NA	NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	CALCIUM	METS	16,600	=	mg/kg			NA	NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	CALCIUM	METS	13,400	=	mg/kg			NA	NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	CALCIUM	METS	11,100	=	mg/kg			NA	NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	CALCIUM	METS	10,100	=	mg/kg			NA	NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	CALCIUM	METS	5,900	=	mg/kg			NA	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	CALCIUM	METS	3,150	=	mg/kg			NA	NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	CALCIUM	METS	2,970	=	mg/kg			NA	NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	CALCIUM	METS	2,720	=	mg/kg			NA	NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	CALCIUM	METS	1,710	=	mg/kg			NA	NA
SWM14	W14-SB14	NDA178	04/06/00	0	0.5	SS	CARBON DISULFIDE	VOC	9.00E-04	J	mg/kg	3.55E+01	3.20E+01		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	CHROMIUM, TOTAL	METS	32	=	mg/kg	3.01E+01	3.60E+01	X	
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	CHROMIUM, TOTAL	METS	30	=	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	CHROMIUM, TOTAL	METS	21	=	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	CHROMIUM, TOTAL	METS	20	=	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	CHROMIUM, TOTAL	METS	18	J	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	CHROMIUM, TOTAL	METS	17	J	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	CHROMIUM, TOTAL	METS	16	J	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	CHROMIUM, TOTAL	METS	10	J	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	CHROMIUM, TOTAL	METS	10	=	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	CHROMIUM, TOTAL	METS	9.7	J	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.6	=	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	CHROMIUM, TOTAL	METS	5.8	J	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	CHROMIUM, TOTAL	METS	5.3	J	mg/kg	3.01E+01	3.60E+01		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	COBALT	METS	13	=	mg/kg	9.03E+02			NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	COBALT	METS	12	=	mg/kg	9.03E+02			NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	COBALT	METS	11	J	mg/kg	9.03E+02			NA
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	COBALT	METS	10	J	mg/kg	9.03E+02			NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	COBALT	METS	8.6	J	mg/kg	9.03E+02			NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	COBALT	METS	8.2	J	mg/kg	9.03E+02			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	COBALT	METS	7.9	J	mg/kg	9.03E+02			NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	COBALT	METS	7.7	J	mg/kg	9.03E+02			NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	COBALT	METS	7.7	J	mg/kg	9.03E+02			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	COBALT	METS	7.6	J	mg/kg	9.03E+02			NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	COBALT	METS	7.0	J	mg/kg	9.03E+02			NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	COBALT	METS	7.0	J	mg/kg	9.03E+02			NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	COBALT	METS	6.8	J	mg/kg	9.03E+02			NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	COBALT	METS	6.1	J	mg/kg	9.03E+02			NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	COPPER	METS	97	=	mg/kg	3.13E+02			NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	COPPER	METS	78	=	mg/kg	3.13E+02			NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	COPPER	METS	73	=	mg/kg	3.13E+02			NA
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	COPPER	METS	66	=	mg/kg	3.13E+02			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	COPPER	METS	47	=	mg/kg	3.13E+02			NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	COPPER	METS	45	=	mg/kg	3.13E+02			NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	COPPER	METS	39	=	mg/kg	3.13E+02			NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	COPPER	METS	38	=	mg/kg	3.13E+02			NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	COPPER	METS	35	=	mg/kg	3.13E+02			NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	COPPER	METS	26	=	mg/kg	3.13E+02			NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	COPPER	METS	25	=	mg/kg	3.13E+02			NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	COPPER	METS	21	=	mg/kg	3.13E+02			NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	COPPER	METS	20	=	mg/kg	3.13E+02			NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	COPPER	METS	14	=	mg/kg	3.13E+02			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	DI-n-BUTYL PHTHALATE	SVOC	0.040	J	mg/kg	6.11E+02	2.30E+03		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	DIELDRIN	PEST/PCB	4.50E-04	J	mg/kg	3.04E-02			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	DIMETHYL PHTHALATE	SVOC	5.8	J	mg/kg	1.00E+04			NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	ETHYLBENZENE	VOC	0.0010	J	mg/kg	8.92E+00	1.30E+01		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	IRON	METS	28,300	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	IRON	METS	24,600	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	IRON	METS	24,500	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	IRON	METS	21,600	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	IRON	METS	18,300	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	IRON	METS	15,500	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	IRON	METS	14,900	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	IRON	METS	14,200	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	IRON	METS	13,800	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	IRON	METS	12,600	=	mg/kg	2.35E+03		X	NA
SWM14	W14-BB13	NDA174	04/06/00	0	0.5	SS	IRON	METS	12,300	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	IRON	METS	10,300	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	IRON	METS	9,130	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	IRON	METS	7,490	=	mg/kg	2.35E+03		X	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	LEAD	METS	71	=	mg/kg	4.00E+02			NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	LEAD	METS	56	=	mg/kg	4.00E+02			NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	LEAD	METS	44	=	mg/kg	4.00E+02			NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	LEAD	METS	44	=	mg/kg	4.00E+02			NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	LEAD	METS	40	=	mg/kg	4.00E+02			NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	LEAD	METS	21	=	mg/kg	4.00E+02			NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	LEAD	METS	15	=	mg/kg	4.00E+02			NA
SWM14	W14-SB14	NDA178	04/06/00	0	0.5	SS	LEAD	METS	13	=	mg/kg	4.00E+02			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	LEAD	METS	13	=	mg/kg	4.00E+02			NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	LEAD	METS	11	=	mg/kg	4.00E+02			NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	LEAD	METS	10	=	mg/kg	4.00E+02			NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	LEAD	METS	10	=	mg/kg	4.00E+02			NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	LEAD	METS	8.1	=	mg/kg	4.00E+02			NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	LEAD	METS	2.5	=	mg/kg	4.00E+02			NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0050	J	mg/kg	4.00E+02			NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0010	J	mg/kg	4.00E+02			NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	4.00E-04	J	mg/kg	4.00E+02			NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	4.00E-04	J	mg/kg	4.00E+02			NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg	4.00E+02			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg	4.00E+02			NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg	4.00E+02			NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg	4.00E+02			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM14	W14-SB10	NDA166	04/06/00	0	0.5	SS	MAGNESIUM	METS	6,910	=	mg/kg			NA	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	MAGNESIUM	METS	5,600	=	mg/kg			NA	NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	MAGNESIUM	METS	5,080	=	mg/kg			NA	NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	MAGNESIUM	METS	4,870	=	mg/kg			NA	NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	MAGNESIUM	METS	4,660	=	mg/kg			NA	NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	MAGNESIUM	METS	4,660	=	mg/kg			NA	NA
SWM14	W14-SB14	NDA175	04/06/00	0	0.5	SS	MAGNESIUM	METS	4,250	=	mg/kg			NA	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	MAGNESIUM	METS	3,520	=	mg/kg			NA	NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	MAGNESIUM	METS	3,320	=	mg/kg			NA	NA
SWM14	W14-SB09	NDA156	04/06/00	0	0.5	SS	MAGNESIUM	METS	3,280	=	mg/kg			NA	NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	MAGNESIUM	METS	2,340	=	mg/kg			NA	NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	MAGNESIUM	METS	1,760	=	mg/kg			NA	NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	MAGNESIUM	METS	1,380	=	mg/kg			NA	NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	MAGNESIUM	METS	1,320	=	mg/kg			NA	NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	**MANGANESE**	METS	**907**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	**MANGANESE**	METS	**792**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	**MANGANESE**	METS	**710**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	**MANGANESE**	METS	**607**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	**MANGANESE**	METS	**587**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	**MANGANESE**	METS	**544**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	**MANGANESE**	METS	**506**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	**MANGANESE**	METS	**449**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB09	NDA168	04/06/00	0	0.5	SS	**MANGANESE**	METS	**435**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	**MANGANESE**	METS	**419**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	**MANGANESE**	METS	**375**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	**MANGANESE**	METS	**374**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	**MANGANESE**	METS	**369**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	**MANGANESE**	METS	**263**	J	mg/kg	1.76E+02		X	NA
SWM14	W14-SB14	NDA176DL1	04/06/00	0	0.5	SS	MERCURY	METS	2.3	=	mg/kg	2.35E+00			NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	MERCURY	METS	0.14	=	mg/kg	2.35E+00			NA
SWM14	W14-SS01	NDA147	04/05/00	0	0.5	SS	MERCURY	METS	0.11	=	mg/kg	2.35E+00			NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	MERCURY	METS	0.086	=	mg/kg	2.35E+00			NA
SWM14	W14-SB10	NDA166	04/06/00	0	0.5	SS	MERCURY	METS	0.074	=	mg/kg	2.35E+00			NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	MERCURY	METS	0.054	=	mg/kg	2.35E+00			NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	MERCURY	METS	0.040	=	mg/kg	2.35E+00			NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	MERCURY	METS	0.030	J	mg/kg	2.35E+00			NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	MERCURY	METS	0.030	J	mg/kg	2.35E+00			NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	MERCURY	METS	0.025	J	mg/kg	2.35E+00			NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	METHOXYCHLOR	PEST/PCB	0.0012	J	mg/kg	3.06E+01	1.60E+02		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.018	J	mg/kg	7.33E+02			NA
SWM14	W14-SB10	NDA166	04/06/00	0	0.5	SS	NICKEL	METS	16	=	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	NICKEL	METS	10	=	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	NICKEL	METS	9.0	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	NICKEL	METS	8.3	=	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	NICKEL	METS	8.0	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	NICKEL	METS	7.6	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	NICKEL	METS	7.5	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	NICKEL	METS	7.0	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	NICKEL	METS	5.5	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	NICKEL	METS	4.9	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	NICKEL	METS	4.1	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	NICKEL	METS	3.9	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	NICKEL	METS	3.9	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	NICKEL	METS	3.8	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0020	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	4.00E-04	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	3.00E-04	J	mg/kg	1.56E+02	1.30E+02		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	p,p'-DDD	PEST/PCB	6.80E-04	J	mg/kg	2.44E+00	1.60E+01		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0030	J	mg/kg	1.72E+00	5.40E+01		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0010	J	mg/kg	1.72E+00	5.40E+01		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	p,p'-DDE	PEST/PCB	7.70E-04	J	mg/kg	1.72E+00	5.40E+01		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	p,p'-DDE	PEST/PCB	7.70E-04	J	mg/kg	1.72E+00	5.40E+01		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	p,p'-DDE	PEST/PCB	6.90E-04	J	mg/kg	1.72E+00	5.40E+01		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	p,p'-DDE	PEST/PCB	5.00E-04	J	mg/kg	1.72E+00	5.40E+01		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	POTASSIUM	METS	2,740	=	mg/kg			NA	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	POTASSIUM	METS	1,590	=	mg/kg			NA	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	POTASSIUM	METS	1,480	=	mg/kg			NA	NA
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	POTASSIUM	METS	1,160	J	mg/kg			NA	NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	POTASSIUM	METS	1,160	=	mg/kg			NA	NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	POTASSIUM	METS	1,140	J	mg/kg			NA	NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	POTASSIUM	METS	1,130	=	mg/kg			NA	NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	POTASSIUM	METS	1,000	J	mg/kg			NA	NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	POTASSIUM	METS	885	J	mg/kg			NA	NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	POTASSIUM	METS	782	J	mg/kg			NA	NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	POTASSIUM	METS	778	J	mg/kg			NA	NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	POTASSIUM	METS	747	J	mg/kg			NA	NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	POTASSIUM	METS	740	J	mg/kg			NA	NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	POTASSIUM	METS	460	J	mg/kg			NA	NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	SELENIUM	METS	0.64	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	SELENIUM	METS	0.58	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	SELENIUM	METS	0.57	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	SELENIUM	METS	0.56	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	SELENIUM	METS	0.47	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	SELENIUM	METS	0.45	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	SELENIUM	METS	0.43	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	SELENIUM	METS	0.40	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	SELENIUM	METS	0.40	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	SELENIUM	METS	0.39	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	SELENIUM	METS	0.36	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB05	NDA167	04/06/00	0	0.5	SS	SELENIUM	METS	0.30	J	mg/kg	3.91E+01	5.00E+00		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	SILVER	METS	0.096	J	mg/kg	3.91E+01	3.40E+01		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	SILVER	METS	0.056	J	mg/kg	3.91E+01	3.40E+01		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	SODIUM	METS	475	J	mg/kg			NA	NA
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	SODIUM	METS	337	J	mg/kg			NA	NA
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	SODIUM	METS	267	J	mg/kg			NA	NA
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	SODIUM	METS	243	J	mg/kg			NA	NA
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	SODIUM	METS	241	J	mg/kg			NA	NA
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	SODIUM	METS	204	J	mg/kg			NA	NA
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	SODIUM	METS	186	J	mg/kg			NA	NA
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	SODIUM	METS	171	J	mg/kg			NA	NA
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	SODIUM	METS	149	J	mg/kg			NA	NA
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	SODIUM	METS	128	J	mg/kg			NA	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	SODIUM	METS	102	J	mg/kg			NA	NA
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	SODIUM	METS	101	J	mg/kg			NA	NA
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	SODIUM	METS	96	J	mg/kg			NA	NA
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	SODIUM	METS	51	J	mg/kg			NA	NA
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	THALLIUM	METS	1.7	J	mg/kg	5.16E-01	7.00E-01	X	X
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	THALLIUM	METS	1.2	J	mg/kg	5.16E-01	7.00E-01	X	X
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	THALLIUM	METS	0.77	J	mg/kg	5.16E-01	7.00E-01	X	X
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	THALLIUM	METS	0.70	J	mg/kg	5.16E-01	7.00E-01	X	
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	THALLIUM	METS	0.58	J	mg/kg	5.16E-01	7.00E-01	X	
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	THALLIUM	METS	0.57	J	mg/kg	5.16E-01	7.00E-01	X	
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	THALLIUM	METS	0.52	J	mg/kg	5.16E-01	7.00E-01	X	
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	THALLIUM	METS	0.45	J	mg/kg	5.16E-01	7.00E-01		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	THALLIUM	METS	0.43	J	mg/kg	5.16E-01	7.00E-01		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	THALLIUM	METS	0.40	J	mg/kg	5.16E-01	7.00E-01		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	THALLIUM	METS	0.40	J	mg/kg	5.16E-01	7.00E-01		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	TOLUENE	VOC	0.0010	J	mg/kg	5.20E+01	1.20E+01		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	TOLUENE	VOC	0.0010	J	mg/kg	5.20E+01	1.20E+01		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	TOLUENE	VOC	5.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	TOLUENE	VOC	4.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	TOLUENE	VOC	4.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	TOLUENE	VOC	3.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	**VANADIUM**	METS	74	=	mg/kg	5.47E+01	6.00E+03	X	
SWM14	W14-SB10	NDA188	04/06/00	0	0.5	SS	**VANADIUM**	METS	69	=	mg/kg	5.47E+01	6.00E+03	X	
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	**VANADIUM**	METS	68	=	mg/kg	5.47E+01	6.00E+03	X	
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	**VANADIUM**	METS	61	=	mg/kg	5.47E+01	6.00E+03	X	
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	VANADIUM	METS	53	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	VANADIUM	METS	39	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	VANADIUM	METS	37	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	VANADIUM	METS	37	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	VANADIUM	METS	36	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB07	NDA181	04/05/00	0	0.5	SS	VANADIUM	METS	34	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	VANADIUM	METS	32	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	VANADIUM	METS	26	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	VANADIUM	METS	25	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	VANADIUM	METS	20	=	mg/kg	5.47E+01	6.00E+03		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0070	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0020	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	XYLENES, TOTAL	VOC	5.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	XYLENES, TOTAL	VOC	4.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	XYLENES, TOTAL	VOC	4.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM14	W14-SB10	NDA168	04/06/00	0	0.5	SS	ZINC	METS	229	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB11	NDA170	04/06/00	0	0.5	SS	ZINC	METS	172	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB07	NDA161	04/05/00	0	0.5	SS	ZINC	METS	139	=	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB08	NDA164	04/06/00	0	0.5	SS	ZINC	METS	136	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB14	NDA176	04/06/00	0	0.5	SS	ZINC	METS	94	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB02	NDA149	04/05/00	0	0.5	SS	ZINC	METS	94	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB12	NDA172	04/06/00	0	0.5	SS	ZINC	METS	74	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB01	NDA147	04/05/00	0	0.5	SS	ZINC	METS	69	=	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB03	NDA153	04/05/00	0	0.5	SS	ZINC	METS	56	=	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB13	NDA174	04/06/00	0	0.5	SS	ZINC	METS	49	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB09	NDA166	04/06/00	0	0.5	SS	ZINC	METS	48	J	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB05	NDA157	04/05/00	0	0.5	SS	ZINC	METS	45	=	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB06	NDA159	04/05/00	0	0.5	SS	ZINC	METS	34	=	mg/kg	2.35E+03	1.20E+04		
SWM14	W14-SB04	NDA155	04/05/00	0	0.5	SS	ZINC	METS	17	=	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.78E-01	2.00E-02		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.78E-01	2.00E-02		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.78E-01	2.00E-02		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	2-HEXANONE	VOC	0.0020	J	mg/kg			NA	NA
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	**ALUMINUM**	METS	21,400	J	mg/kg	7.61E+03		X	NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	**ALUMINUM**	METS	11,000	=	mg/kg	7.61E+03		X	NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	**ALUMINUM**	METS	9,800	J	mg/kg	7.61E+03		X	NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	**ALUMINUM**	METS	9,660	J	mg/kg	7.61E+03		X	NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	**ALUMINUM**	METS	9,030	=	mg/kg	7.61E+03		X	NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	**ALUMINUM**	METS	7,810	=	mg/kg	7.61E+03		X	NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	ALUMINUM	METS	7,180	=	mg/kg	7.61E+03			NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	ALUMINUM	METS	6,900	J	mg/kg	7.61E+03			NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	ALUMINUM	METS	6,550	J	mg/kg	7.61E+03			NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	ALUMINUM	METS	6,480	J	mg/kg	7.61E+03			NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	ALUMINUM	METS	6,430	J	mg/kg	7.61E+03			NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	ALUMINUM	METS	6,120	J	mg/kg	7.61E+03			NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	ALUMINUM	METS	5,950	J	mg/kg	7.61E+03			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	ALUMINUM	METS	5,720	=	mg/kg	7.81E+03			NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	ALUMINUM	METS	5,510	=	mg/kg	7.81E+03			NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	ALUMINUM	METS	5,030	J	mg/kg	7.61E+03			NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	ANTHRACENE	SVOC	0.017	J	mg/kg	2.19E+03	1.20E+04		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	ANTIMONY	METS	0.84	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	ANTIMONY	METS	0.67	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	ANTIMONY	METS	0.62	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	ANTIMONY	METS	0.62	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	ANTIMONY	METS	0.60	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	ANTIMONY	METS	0.55	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB08	NDA188	04/12/00	0	0.5	SS	ANTIMONY	METS	0.45	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	ANTIMONY	METS	0.44	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	ANTIMONY	METS	0.43	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	ANTIMONY	METS	0.39	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	ANTIMONY	METS	0.36	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	ANTIMONY	METS	0.36	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	ANTIMONY	METS	0.32	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	ANTIMONY	METS	0.27	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	ANTIMONY	METS	0.23	J	mg/kg	3.13E+00	5.00E+00		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	ARSENIC	METS	4.8	=	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	ARSENIC	METS	3.1	=	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	ARSENIC	METS	1.6	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	ARSENIC	METS	1.2	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	ARSENIC	METS	1.1	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	ARSENIC	METS	1.0	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	ARSENIC	METS	1.0	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	ARSENIC	METS	0.99	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	ARSENIC	METS	0.86	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	ARSENIC	METS	0.77	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	ARSENIC	METS	0.72	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	ARSENIC	METS	0.62	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	ARSENIC	METS	0.58	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	ARSENIC	METS	0.50	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	ARSENIC	METS	0.45	J	mg/kg	3.90E-01	2.90E+01	X	
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	BARIUM	METS	80	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	BARIUM	METS	79	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	BARIUM	METS	77	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	BARIUM	METS	73	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	BARIUM	METS	69	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	BARIUM	METS	66	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	BARIUM	METS	66	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	BARIUM	METS	65	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	BARIUM	METS	63	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	BARIUM	METS	62	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	BARIUM	METS	62	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	BARIUM	METS	59	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	BARIUM	METS	57	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	BARIUM	METS	56	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	BARIUM	METS	47	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	BARIUM	METS	44	=	mg/kg	5.37E+02	1.60E+03		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	BENZENE	VOC	2.00E-04	J	mg/kg	6.01E-01	3.00E-02		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	BENZO(a)ANTHRACENE	SVOC	0.061	J	mg/kg	6.21E-01	2.00E+00		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	BENZO(a)ANTHRACENE	SVOC	0.032	J	mg/kg	6.21E-01	2.00E+00		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	BENZO(a)PYRENE	SVOC	0.071	J	mg/kg	6.21E-02	8.00E+00	X	
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	BENZO(a)PYRENE	SVOC	0.053	J	mg/kg	6.21E-02	8.00E+00		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	BENZO(b)FLUORANTHENE	SVOC	0.12	J	mg/kg	6.21E-01	5.00E+00		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	BENZO(b)FLUORANTHENE	SVOC	0.059	J	mg/kg	6.21E-01	5.00E+00		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	BENZO(b)FLUORANTHENE	SVOC	0.027	J	mg/kg	6.21E-01	5.00E+00		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	BENZO(g,h,i)PERYLENE	SVOC	0.041	J	mg/kg	6.21E-01	5.00E+00		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	BENZO(k)FLUORANTHENE	SVOC	0.098	J	mg/kg	6.21E+00	4.90E+01		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	BENZO(k)FLUORANTHENE	SVOC	0.042	J	mg/kg	6.21E+00	4.90E+01		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	BENZO(k)FLUORANTHENE	SVOC	0.034	J	mg/kg	6.21E+00	4.90E+01		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	BENZYL BUTYL PHTHALATE	SVOC	0.18	J	mg/kg	1.22E+03	9.30E+02		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.18	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.17	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.16	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.15	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.14	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.12	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.10	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.10	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.10	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.10	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.092	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	BERYLLIUM	METS	0.091	J	mg/kg	1.54E+01	6.30E+01		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.31	J	mg/kg	3.47E+01			NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	CADMIUM	METS	2.5	=	mg/kg	3.70E+00	8.00E+00		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	CADMIUM	METS	0.56	J	mg/kg	3.70E+00	8.00E+00		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	CADMIUM	METS	0.31	J	mg/kg	3.70E+00	8.00E+00		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	CADMIUM	METS	0.15	J	mg/kg	3.70E+00	8.00E+00		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	CADMIUM	METS	0.10	J	mg/kg	3.70E+00	8.00E+00		
SWM15	W15-SB18	NDA195	04/12/00	0	0.5	SS	CALCIUM	METS	22,700	J	mg/kg			NA	NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	CALCIUM	METS	15,800	=	mg/kg			NA	NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	CALCIUM	METS	6,090	=	mg/kg			NA	NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	CALCIUM	METS	5,560	=	mg/kg			NA	NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	CALCIUM	METS	4,550	J	mg/kg			NA	NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	CALCIUM	METS	4,470	J	mg/kg			NA	NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	CALCIUM	METS	3,930	=	mg/kg			NA	NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	CALCIUM	METS	3,540	J	mg/kg			NA	NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	CALCIUM	METS	3,500	J	mg/kg			NA	NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	CALCIUM	METS	3,450	=	mg/kg			NA	NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	CALCIUM	METS	3,200	J	mg/kg			NA	NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	CALCIUM	METS	3,120	J	mg/kg			NA	NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	CALCIUM	METS	3,110	J	mg/kg			NA	NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	CALCIUM	METS	2,990	J	mg/kg			NA	NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	CALCIUM	METS	2,570	=	mg/kg			NA	NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	CALCIUM	METS	1,920	J	mg/kg			NA	NA
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	48	J	mg/kg	3.01E+01	3.80E+01	X	X
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	28	=	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	18	=	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	15	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	14	=	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	13	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	13	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	12	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	11	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB10	NDA186	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	11	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB04	NDA161	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	10	=	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	9.4	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	9.2	=	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	CHROMIUM, TOTAL	METS	9.0	=	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	6.7	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	CHROMIUM, TOTAL	METS	6.6	J	mg/kg	3.01E+01	3.80E+01		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	CHRYSENE	SVOC	0.17	J	mg/kg	6.21E+01	1.60E+02		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	CHRYSENE	SVOC	0.077	J	mg/kg	6.21E+01	1.60E+02		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	CHRYSENE	SVOC	0.038	J	mg/kg	6.21E+01	1.60E+02		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	COBALT	METS	17	J	mg/kg	9.03E+02			NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	COBALT	METS	11	=	mg/kg	9.03E+02			NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	COBALT	METS	11	J	mg/kg	9.03E+02			NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	COBALT	METS	10	J	mg/kg	9.03E+02			NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	COBALT	METS	9.1	J	mg/kg	9.03E+02			NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	COBALT	METS	8.8	J	mg/kg	9.03E+02			NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	COBALT	METS	8.2	J	mg/kg	9.03E+02			NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	COBALT	METS	8.1	J	mg/kg	9.03E+02			NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	COBALT	METS	7.8	J	mg/kg	9.03E+02			NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	COBALT	METS	7.8	J	mg/kg	9.03E+02			NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	COBALT	METS	7.7	J	mg/kg	9.03E+02			NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	COBALT	METS	7.8	J	mg/kg	9.03E+02			NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	COBALT	METS	7.5	J	mg/kg	9.03E+02			NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	COBALT	METS	7.4	J	mg/kg	9.03E+02			NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	COBALT	METS	7.3	J	mg/kg	9.03E+02			NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	COBALT	METS	6.5	J	mg/kg	9.03E+02			NA
SWM15	W15-SB03	NDA160	04/11/00	0	0.5	SS	COPPER	METS	75	=	mg/kg	3.13E+02			NA
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	COPPER	METS	67	J	mg/kg	3.13E+02			NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	COPPER	METS	50	J	mg/kg	3.13E+02			NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	COPPER	METS	46	J	mg/kg	3.13E+02			NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	COPPER	METS	45	=	mg/kg	3.13E+02			NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	COPPER	METS	36	=	mg/kg	3.13E+02			NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	COPPER	METS	35	=	mg/kg	3.13E+02			NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	COPPER	METS	32	J	mg/kg	3.13E+02			NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	COPPER	METS	32	J	mg/kg	3.13E+02			NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	COPPER	METS	32	=	mg/kg	3.13E+02			NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	COPPER	METS	31	J	mg/kg	3.13E+02			NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	COPPER	METS	27	J	mg/kg	3.13E+02			NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	COPPER	METS	25	J	mg/kg	3.13E+02			NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	COPPER	METS	23	J	mg/kg	3.13E+02			NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	COPPER	METS	22	=	mg/kg	3.13E+02			NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	COPPER	METS	21	J	mg/kg	3.13E+02			NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	DIELDRIN	PEST/PCB	4.50E-04	J	mg/kg	3.04E-02			NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	DIETHYL PHTHALATE	SVOC	0.039	J	mg/kg	4.89E+03			NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	ETHYLBENZENE	VOC	0.0010	J	mg/kg	8.92E+00	1.30E+01		
SWM15	W15-SB03	NDA160	04/11/00	0	0.5	SS	ETHYLBENZENE	VOC	6.00E-04	J	mg/kg	8.92E+00	1.30E+01		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	ETHYLBENZENE	VOC	4.00E-04	J	mg/kg	8.92E+00	1.30E+01		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	FLUORANTHENE	SVOC	0.31	J	mg/kg	2.29E+02	4.30E+03		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	FLUORANTHENE	SVOC	0.085	J	mg/kg	2.29E+02	4.30E+03		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	FLUORANTHENE	SVOC	0.051	J	mg/kg	2.29E+02	4.30E+03		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	FLUORANTHENE	SVOC	0.044	J	mg/kg	2.29E+02	4.30E+03		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	INDENO(1,2,3-c,d)PYRENE	SVOC	0.053	J	mg/kg	6.21E-01	1.40E+01		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	IRON	METS	30,100	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	IRON	METS	22,200	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	IRON	METS	19,700	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	IRON	METS	18,500	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	IRON	METS	16,700	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	IRON	METS	16,400	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	IRON	METS	15,400	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	IRON	METS	15,300	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	IRON	METS	15,000	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	IRON	METS	14,700	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	IRON	METS	14,600	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	IRON	METS	13,700	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	IRON	METS	12,900	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	IRON	METS	12,800	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	IRON	METS	12,200	=	mg/kg	2.35E+03		X	NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	IRON	METS	11,900	=	mg/kg	2.35E+03		X	NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	LEAD	METS	68	=	mg/kg	4.00E+02			NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	LEAD	METS	67	=	mg/kg	4.00E+02			NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	LEAD	METS	48	=	mg/kg	4.00E+02			NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	LEAD	METS	35	=	mg/kg	4.00E+02			NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	LEAD	METS	23	=	mg/kg	4.00E+02			NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	LEAD	METS	21	=	mg/kg	4.00E+02			NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	LEAD	METS	20	=	mg/kg	4.00E+02			NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	LEAD	METS	14	=	mg/kg	4.00E+02			NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	LEAD	METS	13	=	mg/kg	4.00E+02			NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	LEAD	METS	9.7	=	mg/kg	4.00E+02			NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	LEAD	METS	9.4	=	mg/kg	4.00E+02			NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	LEAD	METS	8.1	=	mg/kg	4.00E+02			NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	LEAD	METS	6.7	=	mg/kg	4.00E+02			NA
SWM15	W15-SB18	NDA195	04/12/00	0	0.5	SS	LEAD	METS	5.9	=	mg/kg	4.00E+02			NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	LEAD	METS	5.0	=	mg/kg	4.00E+02			NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	LEAD	METS	2.4	=	mg/kg	4.00E+02			NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0020	J	mg/kg	4.00E+02			NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0010	J	mg/kg	4.00E+02			NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0010	J	mg/kg	4.00E+02			NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0010	J	mg/kg	4.00E+02			NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	8.00E-04	J	mg/kg	4.00E+02			NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	8.00E-04	J	mg/kg	4.00E+02			NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	7.00E-04	J	mg/kg	4.00E+02			NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	7.00E-04	J	mg/kg	4.00E+02			NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	5.00E-04	J	mg/kg	4.00E+02			NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	4.00E-04	J	mg/kg	4.00E+02			NA
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	MAGNESIUM	METS	14,200	J	mg/kg			NA	NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	MAGNESIUM	METS	6,660	=	mg/kg			NA	NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	MAGNESIUM	METS	4,870	J	mg/kg			NA	NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	MAGNESIUM	METS	4,130	=	mg/kg			NA	NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	MAGNESIUM	METS	3,850	=	mg/kg			NA	NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	MAGNESIUM	METS	3,010	J	mg/kg			NA	NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	MAGNESIUM	METS	2,570	J	mg/kg			NA	NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	MAGNESIUM	METS	2,490	J	mg/kg			NA	NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	MAGNESIUM	METS	2,330	J	mg/kg			NA	NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	MAGNESIUM	METS	2,290	J	mg/kg			NA	NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	MAGNESIUM	METS	2,110	J	mg/kg			NA	NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	MAGNESIUM	METS	2,100	=	mg/kg			NA	NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	MAGNESIUM	METS	1,930	=	mg/kg			NA	NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	MAGNESIUM	METS	1,830	=	mg/kg			NA	NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	MAGNESIUM	METS	1,710	J	mg/kg			NA	NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	MAGNESIUM	METS	1,060	J	mg/kg			NA	NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	MANGANESE	METS	786	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	MANGANESE	METS	740	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	MANGANESE	METS	720	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	MANGANESE	METS	704	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	MANGANESE	METS	701	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	MANGANESE	METS	690	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	MANGANESE	METS	688	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	MANGANESE	METS	644	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	MANGANESE	METS	637	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	MANGANESE	METS	627	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	MANGANESE	METS	605	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB18	NDA195	04/12/00	0	0.5	SS	MANGANESE	METS	579	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	MANGANESE	METS	572	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	MANGANESE	METS	524	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	MANGANESE	METS	520	=	mg/kg	1.76E+02		X	NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	MANGANESE	METS	370	=	mg/kg	1.76E+02		X	NA

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	MERCURY	METS	0.11	=	mg/kg	2.35E+00			NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	MERCURY	METS	0.038	J	mg/kg	2.35E+00			NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	MERCURY	METS	0.021	J	mg/kg	2.35E+00			NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	MERCURY	METS	0.020	J	mg/kg	2.35E+00			NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	MERCURY	METS	0.020	J	mg/kg	2.35E+00			NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	MERCURY	METS	0.017	J	mg/kg	2.35E+00			NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	MERCURY	METS	0.014	J	mg/kg	2.35E+00			NA
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	NICKEL	METS	28	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	NICKEL	METS	13	=	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	NICKEL	METS	9.3	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	NICKEL	METS	9.2	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	NICKEL	METS	8.5	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB01	NDA176	04/11/00	0	0.5	SS	NICKEL	METS	8.2	=	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	NICKEL	METS	6.2	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	NICKEL	METS	5.8	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	NICKEL	METS	5.1	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	NICKEL	METS	5.0	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	NICKEL	METS	4.9	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	NICKEL	METS	4.9	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	NICKEL	METS	4.6	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	NICKEL	METS	4.5	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	NICKEL	METS	3.4	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	NICKEL	METS	3.3	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	7.00E-04	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	6.00E-04	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	5.00E-04	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	3.00E-04	J	mg/kg	1.56E+02	1.30E+02		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0011	J	mg/kg	1.72E+00	5.40E+01		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	p,p'-DDE	PEST/PCB	6.20E-04	J	mg/kg	1.72E+00	5.40E+01		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	p,p'-DDE	PEST/PCB	4.20E-04	J	mg/kg	1.72E+00	5.40E+01		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	p,p'-DDT	PEST/PCB	5.50E-04	J	mg/kg	1.72E+00	3.20E+01		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	PCB-1260 (AROCHLOR 1260)	PEST/PCB	0.021	J	mg/kg	2.22E-01			NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	PHENANTHRENE	SVOC	0.074	J	mg/kg	2.22E-01			NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	POTASSIUM	METS	1,600	=	mg/kg			NA	NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	POTASSIUM	METS	1,350	=	mg/kg			NA	NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	POTASSIUM	METS	1,140	J	mg/kg			NA	NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	POTASSIUM	METS	1,110	J	mg/kg			NA	NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	POTASSIUM	METS	1,080	J	mg/kg			NA	NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	POTASSIUM	METS	1,070	J	mg/kg			NA	NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	POTASSIUM	METS	921	J	mg/kg			NA	NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	POTASSIUM	METS	876	J	mg/kg			NA	NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	POTASSIUM	METS	874	J	mg/kg			NA	NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	POTASSIUM	METS	872	J	mg/kg			NA	NA
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	POTASSIUM	METS	845	J	mg/kg			NA	NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	POTASSIUM	METS	838	J	mg/kg			NA	NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	POTASSIUM	METS	828	J	mg/kg			NA	NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	POTASSIUM	METS	778	J	mg/kg			NA	NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	POTASSIUM	METS	772	J	mg/kg			NA	NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	POTASSIUM	METS	670	J	mg/kg			NA	NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	PYRENE	SVOC	0.23	J	mg/kg	2.32E+02	4.20E+03		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	PYRENE	SVOC	0.072	J	mg/kg	2.32E+02	4.20E+03		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	PYRENE	SVOC	0.038	J	mg/kg	2.32E+02	4.20E+03		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	PYRENE	SVOC	0.036	J	mg/kg	2.32E+02	4.20E+03		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	SELENIUM	METS	0.97	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	SELENIUM	METS	0.82	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	SELENIUM	METS	0.73	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	SELENIUM	METS	0.65	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	SELENIUM	METS	0.61	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	SELENIUM	METS	0.60	J	mg/kg	3.91E+01	5.00E+00		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	SELENIUM	METS	0.53	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	SELENIUM	METS	0.42	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	SELENIUM	METS	0.41	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	SELENIUM	METS	0.39	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	SELENIUM	METS	0.37	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	SELENIUM	METS	0.36	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	SELENIUM	METS	0.31	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	SELENIUM	METS	0.24	J	mg/kg	3.91E+01	5.00E+00		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	SODIUM	METS	870	J	mg/kg			NA	NA
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	SODIUM	METS	224	J	mg/kg			NA	NA
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	SODIUM	METS	217	J	mg/kg			NA	NA
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	SODIUM	METS	205	J	mg/kg			NA	NA
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	SODIUM	METS	161	J	mg/kg			NA	NA
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	SODIUM	METS	160	J	mg/kg			NA	NA
SWM15	W16-SB09	NDA187	04/12/00	0	0.5	SS	SODIUM	METS	136	J	mg/kg			NA	NA
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	SODIUM	METS	136	J	mg/kg			NA	NA
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	SODIUM	METS	123	J	mg/kg			NA	NA
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	SODIUM	METS	119	J	mg/kg			NA	NA
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	SODIUM	METS	117	J	mg/kg			NA	NA
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	SODIUM	METS	104	J	mg/kg			NA	NA
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	SODIUM	METS	94	J	mg/kg			NA	NA
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	SODIUM	METS	94	J	mg/kg			NA	NA
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	SODIUM	METS	82	J	mg/kg			NA	NA
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	SODIUM	METS	49	J	mg/kg			NA	NA
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	STYRENE	VOC	2.00E-04	J	mg/kg	1.70E+02	4.00E+00		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	**THALLIUM**	METS	0.85	J	mg/kg	5.16E-01	7.00E-01	X	X
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	**THALLIUM**	METS	0.81	J	mg/kg	5.16E-01	7.00E-01	X	X
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	**THALLIUM**	METS	0.76	J	mg/kg	5.16E-01	7.00E-01	X	X
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	**THALLIUM**	METS	0.62	J	mg/kg	5.16E-01	7.00E-01	X	
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	**THALLIUM**	METS	0.52	J	mg/kg	5.16E-01	7.00E-01	X	
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	THALLIUM	METS	0.47	J	mg/kg	5.16E-01	7.00E-01		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	THALLIUM	METS	0.45	J	mg/kg	5.16E-01	7.00E-01		
SWM15	W15-SB09	NDA167	04/12/00	0	0.5	SS	THALLIUM	METS	0.45	J	mg/kg	5.16E-01	7.00E-01		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	THALLIUM	METS	0.41	J	mg/kg	5.16E-01	7.00E-01		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	THALLIUM	METS	0.34	J	mg/kg	5.16E-01	7.00E-01		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	THALLIUM	METS	0.33	J	mg/kg	5.16E-01	7.00E-01		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	TOLUENE	VOC	7.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	TOLUENE	VOC	5.00E-04	J	mg/kg	5.20E+01	1.20E+01		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	TRICHLOROETHYLENE (TCE)	VOC	5.00E-04	J	mg/kg	5.30E-02	6.00E-02		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	TRICHLOROETHYLENE (TCE)	VOC	5.00E-04	J	mg/kg	5.30E-02	6.00E-02		
SWM15	W15-SB09	NDA167	04/12/00	0	0.5	SS	TRICHLOROETHYLENE (TCE)	VOC	3.00E-04	J	mg/kg	5.30E-02	6.00E-02		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	**VANADIUM**	METS	96	J	mg/kg	5.47E+01	6.00E+03	X	
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	**VANADIUM**	METS	63	=	mg/kg	5.47E+01	6.00E+03	X	
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	**VANADIUM**	METS	57	J	mg/kg	5.47E+01	6.00E+03	X	
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	VANADIUM	METS	47	=	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	VANADIUM	METS	46	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	VANADIUM	METS	46	=	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	VANADIUM	METS	46	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	VANADIUM	METS	46	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	VANADIUM	METS	44	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	VANADIUM	METS	42	=	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	VANADIUM	METS	41	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	VANADIUM	METS	41	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	VANADIUM	METS	41	=	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	VANADIUM	METS	40	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	VANADIUM	METS	36	J	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	VANADIUM	METS	35	=	mg/kg	5.47E+01	6.00E+03		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0040	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0027	J	mg/kg	2.75E+01	2.10E+02		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0016	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB09	NDA187	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0010	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0010	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0010	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	0.0010	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	XYLENES, TOTAL	VOC	8.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	7.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	5.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	XYLENES, TOTAL	VOC	4.00E-04	J	mg/kg	2.75E+01	2.10E+02		
SWM15	W15-SB02	NDA179	04/11/00	0	0.5	SS	ZINC	METS	219	=	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB03	NDA180	04/11/00	0	0.5	SS	ZINC	METS	195	=	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB05	NDA182	04/11/00	0	0.5	SS	ZINC	METS	84	=	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB08	NDA186	04/12/00	0	0.5	SS	ZINC	METS	80	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB11	NDA189	04/12/00	0	0.5	SS	ZINC	METS	59	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB04	NDA181	04/11/00	0	0.5	SS	ZINC	METS	53	=	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB01	NDA178	04/11/00	0	0.5	SS	ZINC	METS	52	=	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB14	NDA193	04/12/00	0	0.5	SS	ZINC	METS	51	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB12	NDA190	04/12/00	0	0.5	SS	ZINC	METS	49	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB09	NDA167	04/12/00	0	0.5	SS	ZINC	METS	48	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB16	NDA195	04/12/00	0	0.5	SS	ZINC	METS	48	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB10	NDA188	04/12/00	0	0.5	SS	ZINC	METS	40	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB06	NDA183	04/11/00	0	0.5	SS	ZINC	METS	36	=	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB13	NDA191	04/12/00	0	0.5	SS	ZINC	METS	35	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB15	NDA194	04/12/00	0	0.5	SS	ZINC	METS	29	J	mg/kg	2.35E+03	1.20E+04		
SWM15	W15-SB07	NDA185	04/12/00	0	0.5	SS	ZINC	METS	27	J	mg/kg	2.35E+03	1.20E+04		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	BENZO(a)ANTHRACENE	SVOC	0.036	J	mg/kg	6.21E-01	2.00E+00		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	BENZO(a)ANTHRACENE	SVOC	0.023	J	mg/kg	6.21E-01	2.00E+00		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	BENZO(a)PYRENE	SVOC	0.088	J	mg/kg	6.21E-02	8.00E+00	X	
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	BENZO(a)PYRENE	SVOC	0.075	J	mg/kg	6.21E-02	8.00E+00	X	
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	BENZO(b)FLUORANTHENE	SVOC	0.14	J	mg/kg	6.21E-01	5.00E+00		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	BENZO(b)FLUORANTHENE	SVOC	0.050	J	mg/kg	6.21E-01	5.00E+00		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	BENZO(g,h,i)PERYLENE	SVOC	0.093	J	mg/kg	6.21E-01	5.00E+00		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	BENZO(g,h,i)PERYLENE	SVOC	0.041	J	mg/kg	6.21E-01	5.00E+00		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	BENZO(k)FLUORANTHENE	SVOC	0.074	J	mg/kg	6.21E+00	4.90E+01		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	BENZO(k)FLUORANTHENE	SVOC	0.059	J	mg/kg	6.21E+00	4.90E+01		
SWMU5	W5-SB02	NDA086	04/14/00	0	0.8	SS	CARBON DISULFIDE	VOC	7.00E-04	J	mg/kg	3.55E+01	3.20E+01		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	CARBON DISULFIDE	VOC	6.00E-04	J	mg/kg	3.55E+01	3.20E+01		
SWMU5	W5-SB03	NDA088	04/14/00	0	2	SS	CARBON DISULFIDE	VOC	5.00E-04	J	mg/kg	3.55E+01	3.20E+01		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	CHRYSENE	SVOC	0.062	J	mg/kg	6.21E+01	1.60E+02		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	CHRYSENE	SVOC	0.060	J	mg/kg	6.21E+01	1.60E+02		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	FLUORANTHENE	SVOC	0.068	J	mg/kg	2.29E+02	4.30E+03		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	FLUORANTHENE	SVOC	0.041	J	mg/kg	2.29E+02	4.30E+03		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	INDENO(1,2,3-c,d)PYRENE	SVOC	0.068	J	mg/kg	6.21E-01	1.40E+01		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	INDENO(1,2,3-c,d)PYRENE	SVOC	0.037	J	mg/kg	6.21E-01	1.40E+01		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0020	J	mg/kg	7.33E+02			NA
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	PYRENE	SVOC	0.067	J	mg/kg	2.32E+02	4.20E+03		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	PYRENE	SVOC	0.065	J	mg/kg	2.32E+02	4.20E+03		
SWMU5	W5-SB04	NDA091	04/17/00	0	2	SS	STYRENE	VOC	6.00E-04	J	mg/kg	1.70E+02	4.00E+00		
SWMU5	W5-SB01	NDA084	04/13/00	0	0.5	SS	TOLUENE	VOC	4.00E-04	J	mg/kg	5.20E+01	1.20E+01		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	1,1-DICHLOROETHENE	VOC	5.80E-04	J	mg/kg	1.24E+01	6.00E-02		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	2-HEXANONE	VOC	8.10E-04	J	mg/kg			NA	NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	2-HEXANONE	VOC	6.60E-04	J	mg/kg			NA	NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	4-CHLOROANILINE	SVOC	0.14	J	mg/kg	2.44E+01	7.00E-01		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	4-CHLOROANILINE	SVOC	0.10	J	mg/kg	2.44E+01	7.00E-01		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	ALUMINUM	METS	14,000	=	mg/kg	7.61E+03		X	NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	ALUMINUM	METS	10,600	=	mg/kg	7.61E+03		X	NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	ALUMINUM	METS	10,300	=	mg/kg	7.61E+03		X	NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	ALUMINUM	METS	10,100	=	mg/kg	7.61E+03		X	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	ALUMINUM	METS	9,940	=	mg/kg	7.61E+03		X	NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	ALUMINUM	METS	9,640	=	mg/kg	7.61E+03		X	NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	ALUMINUM	METS	9,300	=	mg/kg	7.61E+03		X	NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	ALUMINUM	METS	9,120	=	mg/kg	7.61E+03		X	NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	ALUMINUM	METS	7,870	=	mg/kg	7.61E+03		X	NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	ALUMINUM	METS	7,570	=	mg/kg	7.61E+03			NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	ALUMINUM	METS	7,470	=	mg/kg	7.61E+03			NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	ALUMINUM	METS	7,330	=	mg/kg	7.61E+03			NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	ALUMINUM	METS	7,190	=	mg/kg	7.61E+03			NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	ALUMINUM	METS	6,080	=	mg/kg	7.61E+03			NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	ALUMINUM	METS	5,800	=	mg/kg	7.61E+03			NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	ALUMINUM	METS	4,300	=	mg/kg	7.61E+03			NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	ANTIMONY	METS	0.73	J	mg/kg	3.13E+00	5.00E+00		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	ANTIMONY	METS	0.70	J	mg/kg	3.13E+00	5.00E+00		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	ANTIMONY	METS	0.58	J	mg/kg	3.13E+00	5.00E+00		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	ANTIMONY	METS	0.58	J	mg/kg	3.13E+00	5.00E+00		
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	ANTIMONY	METS	0.53	J	mg/kg	3.13E+00	5.00E+00		
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	ANTIMONY	METS	0.48	J	mg/kg	3.13E+00	5.00E+00		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	ANTIMONY	METS	0.47	J	mg/kg	3.13E+00	5.00E+00		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	ANTIMONY	METS	0.38	J	mg/kg	3.13E+00	5.00E+00		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	ANTIMONY	METS	0.37	J	mg/kg	3.13E+00	5.00E+00		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	ANTIMONY	METS	0.36	J	mg/kg	3.13E+00	5.00E+00		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	ANTIMONY	METS	0.35	J	mg/kg	3.13E+00	5.00E+00		
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	ARSENIC	METS	1.1	J	mg/kg	3.90E-01	2.90E+01	X	
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	ARSENIC	METS	0.86	J	mg/kg	3.90E-01	2.90E+01	X	
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	ARSENIC	METS	0.66	J	mg/kg	3.90E-01	2.90E+01	X	
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	BARIUM	METS	114	=	mg/kg	5.37E+02	1.60E+03		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	BARIUM	METS	95	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	BARIUM	METS	76	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	BARIUM	METS	71	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	BARIUM	METS	70	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	BARIUM	METS	66	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	BARIUM	METS	60	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	BARIUM	METS	59	=	mg/kg	5.37E+02	1.60E+03		
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	BARIUM	METS	54	=	mg/kg	5.37E+02	1.60E+03		
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	BARIUM	METS	53	=	mg/kg	5.37E+02	1.60E+03		
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	BARIUM	METS	52	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	BARIUM	METS	51	=	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	BARIUM	METS	50	J	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	BARIUM	METS	44	J	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	BARIUM	METS	40	J	mg/kg	5.37E+02	1.60E+03		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	BARIUM	METS	40	J	mg/kg	5.37E+02	1.80E+03		
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	BENZO(g,h,i)PERYLENE	SVOC	0.037	J	mg/kg	6.21E-01	5.00E+00		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.28	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.28	J	mg/kg	1.54E+01	8.30E+01		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	BERYLLIUM	METS	0.26	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.27	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.26	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.25	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.24	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.23	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.22	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.22	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.17	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.15	J	mg/kg	1.54E+01	6.30E+01		
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	BERYLLIUM	METS	0.13	J	mg/kg	1.54E+01	6.30E+01		
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	BERYLLIUM	METS	0.11	J	mg/kg	1.54E+01	6.30E+01		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.16	J	mg/kg	3.47E+01			NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.17	J	mg/kg	3.47E+01			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.11	J	mg/kg	3.47E+01			NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	CADMIUM	METS	0.46	J	mg/kg	3.70E+00	8.00E+00		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	CADMIUM	METS	0.040	J	mg/kg	3.70E+00	8.00E+00		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	CADMIUM	METS	0.039	J	mg/kg	3.70E+00	8.00E+00		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	CALCIUM	METS	8,060	=	mg/kg			NA	NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	CALCIUM	METS	6,800	=	mg/kg			NA	NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	CALCIUM	METS	4,770	=	mg/kg			NA	NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	CALCIUM	METS	2,790	=	mg/kg			NA	NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	CALCIUM	METS	2,710	=	mg/kg			NA	NA
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	CALCIUM	METS	2,600	=	mg/kg			NA	NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	CALCIUM	METS	2,400	=	mg/kg			NA	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	CALCIUM	METS	2,370	=	mg/kg			NA	NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	CALCIUM	METS	2,300	=	mg/kg			NA	NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	CALCIUM	METS	2,170	=	mg/kg			NA	NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	CALCIUM	METS	2,150	=	mg/kg			NA	NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	CALCIUM	METS	1,990	=	mg/kg			NA	NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	CALCIUM	METS	1,920	=	mg/kg			NA	NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	CALCIUM	METS	1,360	J	mg/kg			NA	NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	CALCIUM	METS	1,300	=	mg/kg			NA	NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	CALCIUM	METS	1,200	J	mg/kg			NA	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	22	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	16	=	mg/kg	3.01E+01	3.80E+01		
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	15	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	15	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	13	=	mg/kg	3.01E+01	3.80E+01		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	13	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	9.2	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	9.2	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	8.8	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	8.3	=	mg/kg	3.01E+01	3.80E+01		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	CHROMIUM, TOTAL	METS	8.2	=	mg/kg	3.01E+01	3.80E+01		
AOC S	WWTPSB001	NDE188	12/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	7.3	=	mg/kg	3.01E+01	3.80E+01		
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	CHROMIUM, TOTAL	METS	6.4	=	mg/kg	3.01E+01	3.80E+01		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	COBALT	METS	11	J	mg/kg	9.03E+02			NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	COBALT	METS	9.9	J	mg/kg	9.03E+02			NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	COBALT	METS	9.5	J	mg/kg	9.03E+02			NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	COBALT	METS	8.0	J	mg/kg	9.03E+02			NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	COBALT	METS	7.6	J	mg/kg	9.03E+02			NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	COBALT	METS	6.9	J	mg/kg	9.03E+02			NA
AOC S	WWTPSB001	NDE188	12/04/00	0	0.5	SS	COBALT	METS	6.7	J	mg/kg	9.03E+02			NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	COBALT	METS	6.4	J	mg/kg	9.03E+02			NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	COBALT	METS	6.3	J	mg/kg	9.03E+02			NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	COBALT	METS	5.7	J	mg/kg	9.03E+02			NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	COBALT	METS	5.7	J	mg/kg	9.03E+02			NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	COBALT	METS	5.3	J	mg/kg	9.03E+02			NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	COBALT	METS	5.1	J	mg/kg	9.03E+02			NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	COBALT	METS	5.1	J	mg/kg	9.03E+02			NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	COBALT	METS	3.8	J	mg/kg	9.03E+02			NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	COBALT	METS	2.8	J	mg/kg	9.03E+02			NA
AOC B	AB-SB06	NDE245	04/13/01	0	0.5	SS	COPPER	METS	86	=	mg/kg	3.13E+02			NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	COPPER	METS	52	=	mg/kg	3.13E+02			NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	COPPER	METS	48	=	mg/kg	3.13E+02			NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	COPPER	METS	41	=	mg/kg	3.13E+02			NA
AOC S	AB-SB07	NDE243	04/13/01	0	0.5	SS	COPPER	METS	41	=	mg/kg	3.13E+02			NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	COPPER	METS	40	=	mg/kg	3.13E+02			NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	COPPER	METS	35	=	mg/kg	3.13E+02			NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	COPPER	METS	33	=	mg/kg	3.13E+02			NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	COPPER	METS	32	=	mg/kg	3.13E+02			NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	COPPER	METS	32	=	mg/kg	3.13E+02			NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	COPPER	METS	26	=	mg/kg	3.13E+02			NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	COPPER	METS	26	=	mg/kg	3.13E+02			NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	COPPER	METS	24	=	mg/kg	3.13E+02			NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	COPPER	METS	21	=	mg/kg	3.13E+02			NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	COPPER	METS	19	=	mg/kg	3.13E+02			NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	COPPER	METS	16	=	mg/kg	3.13E+02			NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	DIELDRIN	PEST/PCB	0.0039	=	mg/kg	3.04E-02			NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	DIELDRIN	PEST/PCB	0.0018	J	mg/kg	3.04E-02			NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	DIELDRIN	PEST/PCB	7.70E-04	J	mg/kg	3.04E-02			NA
AOC B	WWTPSB002	NOE190	12/04/00	0	0.5	SS	IRON	METS	26,000	=	mg/kg	2.35E+03		X	NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	IRON	METS	22,000	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	IRON	METS	18,400	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	IRON	METS	17,800	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	IRON	METS	16,700	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	IRON	METS	16,100	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	IRON	METS	15,900	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	IRON	METS	14,200	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	IRON	METS	14,100	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	IRON	METS	14,100	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	IRON	METS	14,100	=	mg/kg	2.35E+03		X	NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	IRON	METS	14,000	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	IRON	METS	13,500	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	IRON	METS	12,800	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	IRON	METS	11,700	=	mg/kg	2.35E+03		X	NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	IRON	METS	11,000	=	mg/kg	2.35E+03		X	NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	LEAD	METS	15	=	mg/kg	4.00E+02			NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	LEAD	METS	13	=	mg/kg	4.00E+02			NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	LEAD	METS	9.6	=	mg/kg	4.00E+02			NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	LEAD	METS	9.6	=	mg/kg	4.00E+02			NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	LEAD	METS	9.4	=	mg/kg	4.00E+02			NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	LEAD	METS	8.6	=	mg/kg	4.00E+02			NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	LEAD	METS	7.5	=	mg/kg	4.00E+02			NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	LEAD	METS	7.3	=	mg/kg	4.00E+02			NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	LEAD	METS	7.0	=	mg/kg	4.00E+02			NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	LEAD	METS	7.0	=	mg/kg	4.00E+02			NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	LEAD	METS	4.7	=	mg/kg	4.00E+02			NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	LEAD	METS	4.1	=	mg/kg	4.00E+02			NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	LEAD	METS	3.7	=	mg/kg	4.00E+02			NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	LEAD	METS	3.0	J	mg/kg	4.00E+02			NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	LEAD	METS	2.8	=	mg/kg	4.00E+02			NA
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	LEAD	METS	2.3	=	mg/kg	4.00E+02			NA
AOC B	AB-SB05	NDE239re1	04/13/01	0	0.5	SS	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0014	J	mg/kg	4.00E+02			NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	MAGNESIUM	METS	4,300	=	mg/kg			NA	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	MAGNESIUM	METS	3,540	=	mg/kg			NA	NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	MAGNESIUM	METS	3,370	=	mg/kg			NA	NA
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	MAGNESIUM	METS	3,300	=	mg/kg			NA	NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	MAGNESIUM	METS	2,630	=	mg/kg			NA	NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	MAGNESIUM	METS	2,570	=	mg/kg			NA	NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	MAGNESIUM	METS	2,350	=	mg/kg			NA	NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	MAGNESIUM	METS	2,280	=	mg/kg			NA	NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	MAGNESIUM	METS	2,080	=	mg/kg			NA	NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	MAGNESIUM	METS	1,880	=	mg/kg			NA	NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	MAGNESIUM	METS	1,840	=	mg/kg			NA	NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	MAGNESIUM	METS	1,880	=	mg/kg			NA	NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	MAGNESIUM	METS	1,610	=	mg/kg			NA	NA

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	MAGNESIUM	METS	1,400	=	mg/kg			NA	NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	MAGNESIUM	METS	1,140	J	mg/kg			NA	NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	MAGNESIUM	METS	1,100	J	mg/kg			NA	NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	MANGANESE	METS	818	=	mg/kg	1.76E+02		X	NA
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	MANGANESE	METS	640	J	mg/kg	1.76E+02		X	NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	MANGANESE	METS	470	J	mg/kg	1.76E+02		X	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	MANGANESE	METS	248	=	mg/kg	1.76E+02		X	NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	MANGANESE	METS	242	=	mg/kg	1.76E+02		X	NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	MANGANESE	METS	202	=	mg/kg	1.76E+02		X	NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	MANGANESE	METS	200	=	mg/kg	1.76E+02		X	NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	MANGANESE	METS	180	J	mg/kg	1.76E+02		X	NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	MANGANESE	METS	177	=	mg/kg	1.76E+02		X	NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	MANGANESE	METS	150	J	mg/kg	1.76E+02			NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	MANGANESE	METS	135	=	mg/kg	1.76E+02			NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	MANGANESE	METS	132	=	mg/kg	1.76E+02			NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	MANGANESE	METS	127	=	mg/kg	1.76E+02			NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	MANGANESE	METS	111	=	mg/kg	1.76E+02			NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	MANGANESE	METS	71	=	mg/kg	1.76E+02			NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	MANGANESE	METS	54	=	mg/kg	1.76E+02			NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	MERCURY	METS	0.15	=	mg/kg	2.35E+00			NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	MERCURY	METS	0.14	=	mg/kg	2.35E+00			NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	MERCURY	METS	0.11	=	mg/kg	2.35E+00			NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	MERCURY	METS	0.10	=	mg/kg	2.35E+00			NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	MERCURY	METS	0.094	=	mg/kg	2.35E+00			NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	MERCURY	METS	0.071	=	mg/kg	2.35E+00			NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	MERCURY	METS	0.063	=	mg/kg	2.35E+00			NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	MERCURY	METS	0.063	=	mg/kg	2.35E+00			NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	MERCURY	METS	0.060	=	mg/kg	2.35E+00			NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	MERCURY	METS	0.044	J	mg/kg	2.35E+00			NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	MERCURY	METS	0.033	J	mg/kg	2.35E+00			NA
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	MERCURY	METS	0.030	J	mg/kg	2.35E+00			NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	MERCURY	METS	0.028	J	mg/kg	2.35E+00			NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	MERCURY	METS	0.023	J	mg/kg	2.35E+00			NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	MERCURY	METS	0.018	J	mg/kg	2.35E+00			NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	MERCURY	METS	0.0099	J	mg/kg	2.35E+00			NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.010	J	mg/kg	7.33E+02			NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0045	J	mg/kg	7.33E+02			NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0028	J	mg/kg	7.33E+02			NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	VOC	0.0046	J	mg/kg	7.87E+01			NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	NICKEL	METS	8.5	J	mg/kg	1.56E+02	1.30E+02		
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	NICKEL	METS	8.5	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	NICKEL	METS	8.4	J	mg/kg	1.56E+02	1.30E+02		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	NICKEL	METS	6.9	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	NICKEL	METS	6.7	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	NICKEL	METS	6.0	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	NICKEL	METS	5.6	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	NICKEL	METS	5.1	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	NICKEL	METS	4.9	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	NICKEL	METS	4.7	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	NICKEL	METS	3.8	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	NICKEL	METS	3.8	J	mg/kg	1.56E+02	1.30E+02		
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	NICKEL	METS	3.4	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB18	NDE263	04/13/01	0	0.5	SS	NICKEL	METS	3.2	J	mg/kg	1.56E+02	1.30E+02		
AOC B	WWTPS0004	NDE194	12/04/00	0	0.5	SS	NICKEL	METS	2.7	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	NICKEL	METS	2.7	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB05	NDE239re1	04/13/01	0	0.5	SS	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	5.10E-04	J	mg/kg	1.56E+02	1.30E+02		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0018	J	mg/kg	1.72E+00	5.40E+01		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	p,p'-DDE	PEST/PCB	0.0012	J	mg/kg	1.72E+00	5.40E+01		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	p,p'-DDE	PEST/PCB	9.00E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	p,p'-DDE	PEST/PCB	6.80E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	p,p'-DDE	PEST/PCB	5.70E-04	J	mg/kg	1.72E+00	5.40E+01		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	PCB-1260 (AROCHLOR 1260)	PEST/PCB	0.019	J	mg/kg	2.22E-01			NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	PCB-1260 (AROCHLOR 1260)	PEST/PCB	0.014	J	mg/kg	2.22E-01			NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	PCB-1260 (AROCHLOR 1260)	PEST/PCB	0.012	J	mg/kg	2.22E-01			NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	PCB-1260 (AROCHLOR 1260)	PEST/PCB	0.010	J	mg/kg	2.22E-01			NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	POTASSIUM	METS	1,870	=	mg/kg			NA	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	POTASSIUM	METS	1,580	=	mg/kg			NA	NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	POTASSIUM	METS	1,500	=	mg/kg			NA	NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	POTASSIUM	METS	1,450	=	mg/kg			NA	NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	POTASSIUM	METS	1,380	=	mg/kg			NA	NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	POTASSIUM	METS	1,280	J	mg/kg			NA	NA
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	POTASSIUM	METS	1,200	=	mg/kg			NA	NA
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	POTASSIUM	METS	1,050	J	mg/kg			NA	NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	POTASSIUM	METS	1,050	J	mg/kg			NA	NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	POTASSIUM	METS	1,040	J	mg/kg			NA	NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	POTASSIUM	METS	968	J	mg/kg			NA	NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	POTASSIUM	METS	908	J	mg/kg			NA	NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	POTASSIUM	METS	880	J	mg/kg			NA	NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	POTASSIUM	METS	870	J	mg/kg			NA	NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	POTASSIUM	METS	736	J	mg/kg			NA	NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	POTASSIUM	METS	680	J	mg/kg			NA	NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	SELENIUM	METS	1.2	=	mg/kg	3.91E+01	5.00E+00		
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	SELENIUM	METS	1.0	J	mg/kg	3.91E+01	5.00E+00		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	SELENIUM	METS	1.0	J	mg/kg	3.91E+01	5.00E+00		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	SELENIUM	METS	0.95	J	mg/kg	3.91E+01	5.00E+00		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	SELENIUM	METS	0.90	J	mg/kg	3.91E+01	5.00E+00		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	SELENIUM	METS	0.87	J	mg/kg	3.91E+01	5.00E+00		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	SELENIUM	METS	0.76	J	mg/kg	3.91E+01	5.00E+00		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	SELENIUM	METS	0.67	J	mg/kg	3.91E+01	5.00E+00		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	SELENIUM	METS	0.65	J	mg/kg	3.91E+01	5.00E+00		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	SILVER	METS	0.29	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	SILVER	METS	0.27	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	SILVER	METS	0.19	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	SILVER	METS	0.15	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	SILVER	METS	0.14	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	SILVER	METS	0.13	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	SILVER	METS	0.092	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	SILVER	METS	0.085	J	mg/kg	3.91E+01	3.40E+01		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	SODIUM	METS	188	J	mg/kg			NA	NA
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	SODIUM	METS	160	J	mg/kg			NA	NA
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	SODIUM	METS	151	J	mg/kg			NA	NA
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	SODIUM	METS	149	J	mg/kg			NA	NA
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	SODIUM	METS	149	J	mg/kg			NA	NA
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	SODIUM	METS	126	J	mg/kg			NA	NA
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	SODIUM	METS	123	J	mg/kg			NA	NA
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	SODIUM	METS	120	J	mg/kg			NA	NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	SODIUM	METS	119	J	mg/kg			NA	NA
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	SODIUM	METS	111	J	mg/kg			NA	NA
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	SODIUM	METS	101	J	mg/kg			NA	NA
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	SODIUM	METS	100	J	mg/kg			NA	NA
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	SODIUM	METS	97	J	mg/kg			NA	NA
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	SODIUM	METS	75	J	mg/kg			NA	NA
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	SODIUM	METS	69	J	mg/kg			NA	NA
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	SODIUM	METS	52	J	mg/kg			NA	NA
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	TETRACHLOROETHYLENE(PCE)	VOC	3.70E-04	J	mg/kg	1.51E+00	6.00E-02		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	TETRACHLOROETHYLENE(PCE)	VOC	2.50E-04	J	mg/kg	1.51E+00	6.00E-02		

APPENDIX B-3
Data Screening for Surface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	Residential PRG (HI = 0.1)[1]	SSL (DAF = 20)[2]	Exceed Residential PRG	Exceeds SSL
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	THALLIUM	METS	0.68	J	mg/kg	5.16E-01	7.00E-01	X	
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	THALLIUM	METS	0.51	J	mg/kg	5.16E-01	7.00E-01		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	TOLUENE	VOC	3.00E-04	J	mg/kg	5.20E+01	1.20E+01		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	TOLUENE	VOC	3.00E-04	J	mg/kg	5.20E+01	1.20E+01		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	VANADIUM	METS	73	=	mg/kg	5.47E+01	6.00E+03	X	
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	VANADIUM	METS	61	=	mg/kg	5.47E+01	6.00E+03	X	
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	VANADIUM	METS	55	=	mg/kg	5.47E+01	6.00E+03	X	
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	VANADIUM	METS	53	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	VANADIUM	METS	49	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	VANADIUM	METS	47	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	VANADIUM	METS	47	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	VANADIUM	METS	46	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	VANADIUM	METS	44	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	VANADIUM	METS	44	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	VANADIUM	METS	43	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	VANADIUM	METS	43	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	VANADIUM	METS	42	=	mg/kg	5.47E+01	6.00E+03		
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	VANADIUM	METS	40	=	mg/kg	5.47E+01	6.00E+03		
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	VANADIUM	METS	35	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	VANADIUM	METS	34	=	mg/kg	5.47E+01	6.00E+03		
AOC B	AB-SB05	NDE239re1	04/13/01	0	0.5	SS	XYLENES, TOTAL	VOC	0.0019	J	mg/kg	2.75E+01	2.10E+02		
AOC B	AB-SB08	NDE245	04/13/01	0	0.5	SS	ZINC	METS	164	=	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB13	NDE256	04/13/01	0	0.5	SS	ZINC	METS	120	J	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB07	NDE243	04/13/01	0	0.5	SS	ZINC	METS	117	=	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB10	NDE249	04/13/01	0	0.5	SS	ZINC	METS	110	=	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB06	NDE241	04/13/01	0	0.5	SS	ZINC	METS	102	=	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB11	NDE252	04/13/01	0	0.5	SS	ZINC	METS	83	=	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB09	NDE247	04/13/01	0	0.5	SS	ZINC	METS	82	=	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB15	NDE260	04/13/01	0	0.5	SS	ZINC	METS	67	J	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB14	NDE258	04/13/01	0	0.5	SS	ZINC	METS	63	J	mg/kg	2.35E+03	1.20E+04		
AOC B	WWTPSB003	NDE192	12/04/00	0	0.5	SS	ZINC	METS	58	=	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB16	NDE263	04/13/01	0	0.5	SS	ZINC	METS	56	J	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB12	NDE254	04/13/01	0	0.5	SS	ZINC	METS	49	J	mg/kg	2.35E+03	1.20E+04		
AOC B	AB-SB05	NDE239	04/13/01	0	0.5	SS	ZINC	METS	44	=	mg/kg	2.35E+03	1.20E+04		
AOC B	WWTPSB002	NDE190	12/04/00	0	0.5	SS	ZINC	METS	40	=	mg/kg	2.35E+03	1.20E+04		
AOC B	WWTPSB001	NDE188	12/04/00	0	0.5	SS	ZINC	METS	30	=	mg/kg	2.35E+03	1.20E+04		
AOC B	WWTPSB004	NDE194	12/04/00	0	0.5	SS	ZINC	METS	29	=	mg/kg	2.35E+03	1.20E+04		

Notes:
[1] Region 9 Preliminary Remediation Goals (PRG, EPA, 2002), http://www.epa.gov/region09/waste/sfund/prg/index.htm
[2] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
X indicates that detected concentration exceeds screening criteria.
Bold and boxed concentrations exceed screening criteria (PRG and/or SSL).

Appendix B-4
Data Screening for Subsurface Soils

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	1,2-DICHLOROETHANE	VOC	4.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	ALUMINUM	METS	14,300	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	ALUMINUM	METS	13,400	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	ALUMINUM	METS	13,000	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	ALUMINUM	METS	11,200	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	ALUMINUM	METS	9,930	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	ALUMINUM	METS	9,580	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	ALUMINUM	METS	8,490	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	ALUMINUM	METS	8,370	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	ALUMINUM	METS	7,720	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB16	NDA218	04/07/00	24	28	SB	ALUMINUM	METS	7,140	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	ALUMINUM	METS	7,120	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	ALUMINUM	METS	6,640	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	ALUMINUM	METS	6,380	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	ALUMINUM	METS	6,370	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	ALUMINUM	METS	5,990	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	ALUMINUM	METS	5,500	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	ALUMINUM	METS	5,450	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	ALUMINUM	METS	4,900	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	ALUMINUM	METS	3,540	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	ALUMINUM	METS	3,140	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	ANTIMONY	METS	0.24	J	mg/kg	5.00E+00	4.09E+01		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	ANTIMONY	METS	0.21	J	mg/kg	5.00E+00	4.09E+01		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	ANTIMONY	METS	0.20	J	mg/kg	5.00E+00	4.09E+01		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	ANTIMONY	METS	0.17	J	mg/kg	5.00E+00	4.09E+01		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	ARSENIC	METS	0.71	J	mg/kg	2.90E+01	1.59E+00		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	ARSENIC	METS	0.68	J	mg/kg	2.90E+01	1.59E+00		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	ARSENIC	METS	0.55	J	mg/kg	2.90E+01	1.59E+00		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	ARSENIC	METS	0.45	J	mg/kg	2.90E+01	1.59E+00		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	ARSENIC	METS	0.44	J	mg/kg	2.90E+01	1.59E+00		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	BARIUM	METS	144	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	BARIUM	METS	143	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	BARIUM	METS	118	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	BARIUM	METS	115	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	BARIUM	METS	105	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	BARIUM	METS	95	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	BARIUM	METS	92	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	BARIUM	METS	88	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	BARIUM	METS	86	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	BARIUM	METS	81	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	BARIUM	METS	79	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	BARIUM	METS	74	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	BARIUM	METS	72	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	BARIUM	METS	72	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	BARIUM	METS	67	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB18	NDA228	04/10/00	14	16	SB	BARIUM	METS	60	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	BARIUM	METS	55	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	BARIUM	METS	48	=	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	BARIUM	METS	45	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	BARIUM	METS	35	J	mg/kg	1.60E+03	6.66E+03		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	BENZENE	VOC	4.00E-04	J	mg/kg	3.00E-02	1.31E+00		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	BENZENE	VOC	2.00E-04	J	mg/kg	3.00E-02	1.31E+00		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	BENZENE	VOC	2.00E-04	J	mg/kg	3.00E-02	1.31E+00		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	BERYLLIUM	METS	0.30	J	mg/kg	6.30E+01	1.94E+03		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	BERYLLIUM	METS	0.28	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	BERYLLIUM	METS	0.27	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	BERYLLIUM	METS	0.27	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	BERYLLIUM	METS	0.25	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	BERYLLIUM	METS	0.21	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	BERYLLIUM	METS	0.21	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	BERYLLIUM	METS	0.20	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	BERYLLIUM	METS	0.16	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	BERYLLIUM	METS	0.17	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	BERYLLIUM	METS	0.16	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB18	NDA217	04/07/00	19	21	SB	BERYLLIUM	METS	0.16	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB18	NDA226	04/10/00	14	18	SB	BERYLLIUM	METS	0.15	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	BERYLLIUM	METS	0.15	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	BERYLLIUM	METS	0.13	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	BERYLLIUM	METS	0.095	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	BERYLLIUM	METS	0.094	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	BERYLLIUM	METS	0.088	J	mg/kg	6.30E+01	1.94E+03		
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	CALCIUM	METS	5,770	=	mg/kg			NA	NA
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	CALCIUM	METS	5,330	=	mg/kg			NA	NA
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	CALCIUM	METS	3,400	=	mg/kg			NA	NA
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	CALCIUM	METS	3,230	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	CALCIUM	METS	3,140	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	CALCIUM	METS	3,070	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	CALCIUM	METS	3,010	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	CALCIUM	METS	2,860	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	CALCIUM	METS	2,630	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	CALCIUM	METS	2,400	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	CALCIUM	METS	2,400	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	CALCIUM	METS	2,320	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	CALCIUM	METS	2,300	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	CALCIUM	METS	2,180	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	CALCIUM	METS	2,140	=	mg/kg			NA	NA
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	CALCIUM	METS	2,030	=	mg/kg			NA	NA
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	CALCIUM	METS	1,740	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	CALCIUM	METS	1,580	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	CALCIUM	METS	1,550	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	CALCIUM	METS	1,310	=	mg/kg			NA	NA
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	CHROMIUM, TOTAL	METS	33	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	CHROMIUM, TOTAL	METS	14	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	CHROMIUM, TOTAL	METS	13	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	CHROMIUM, TOTAL	METS	11	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	CHROMIUM, TOTAL	METS	10	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	CHROMIUM, TOTAL	METS	8.4	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	CHROMIUM, TOTAL	METS	7.8	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	CHROMIUM, TOTAL	METS	7.4	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	CHROMIUM, TOTAL	METS	7.1	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	CHROMIUM, TOTAL	METS	7.0	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	CHROMIUM, TOTAL	METS	6.7	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	CHROMIUM, TOTAL	METS	6.1	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	CHROMIUM, TOTAL	METS	6.0	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	CHROMIUM, TOTAL	METS	6.0	=	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	CHROMIUM, TOTAL	METS	5.7	J	mg/kg	3.80E+01	6.40E+01		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	CHROMIUM, TOTAL	METS	4.8	J	mg/kg	3.80E+01	6.40E+01		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	COBALT	METS	14	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	COBALT	METS	13	=	mg/kg		1.92E+03	NA	
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	COBALT	METS	11	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	COBALT	METS	11	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	COBALT	METS	10	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	COBALT	METS	9.5	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	COBALT	METS	9.0	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	COBALT	METS	8.6	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	COBALT	METS	8.6	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB16	NDA216	04/07/00	24	26	SB	COBALT	METS	7.8	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	COBALT	METS	7.7	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	COBALT	METS	7.3	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB18	NDA226	04/10/00	14	18	SB	COBALT	METS	7.2	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	COBALT	METS	7.0	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	COBALT	METS	6.3	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	COBALT	METS	5.8	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	COBALT	METS	5.1	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	COBALT	METS	4.6	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	COBALT	METS	4.0	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	COBALT	METS	3.4	J	mg/kg		1.92E+03	NA	
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	COPPER	METS	47	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	COPPER	METS	43	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	COPPER	METS	34	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	COPPER	METS	34	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	COPPER	METS	32	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	COPPER	METS	30	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	COPPER	METS	29	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	COPPER	METS	29	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB16	NDA216	04/07/00	24	26	SB	COPPER	METS	26	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	COPPER	METS	25	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	COPPER	METS	25	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	COPPER	METS	24	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	COPPER	METS	22	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	COPPER	METS	21	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	COPPER	METS	20	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	COPPER	METS	18	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	COPPER	METS	17	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	COPPER	METS	16	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	COPPER	METS	10	=	mg/kg		4.09E+03	NA	
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	COPPER	METS	10	J	mg/kg		4.09E+03	NA	
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	DI-n-BUTYL PHTHALATE	SVOC	0.036	J	mg/kg	2.30E+03	6.16E+03		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	ETHYLBENZENE	VOC	0.0050	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	ETHYLBENZENE	VOC	0.0030	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	ETHYLBENZENE	VOC	0.0030	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	ETHYLBENZENE	VOC	0.0020	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	ETHYLBENZENE	VOC	0.0010	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	ETHYLBENZENE	VOC	9.00E-04	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	ETHYLBENZENE	VOC	9.00E-04	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	ETHYLBENZENE	VOC	9.00E-04	J	mg/kg	1.30E+01	1.95E+01		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	IRON	METS	26,500	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	IRON	METS	25,500	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	IRON	METS	22,600	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	IRON	METS	22,200	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	IRON	METS	21,000	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	IRON	METS	19,900	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	IRON	METS	18,900	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	IRON	METS	16,600	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	IRON	METS	16,400	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	IRON	METS	15,600	=	mg/kg		1.00E+04	NA	X

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (Hi = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	IRON	METS	15,600	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	IRON	METS	15,300	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	IRON	METS	14,700	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	IRON	METS	14,600	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	IRON	METS	14,100	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	IRON	METS	13,400	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	IRON	METS	12,700	=	mg/kg		1.00E+04	NA	X
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	IRON	METS	11,100	J	mg/kg		1.00E+04	NA	X
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	IRON	METS	8,880	=	mg/kg		1.00E+04	NA	
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	IRON	METS	8,670	J	mg/kg		1.00E+04	NA	
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	LEAD	METS	7.0	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	LEAD	METS	6.8	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	LEAD	METS	2.1	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	LEAD	METS	1.9	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	LEAD	METS	1.9	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	LEAD	METS	1.6	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	LEAD	METS	1.6	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	LEAD	METS	1.5	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	LEAD	METS	1.5	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	LEAD	METS	1.3	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	LEAD	METS	1.2	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	LEAD	METS	1.1	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA216	04/07/00	14	18	SB	LEAD	METS	1.1	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	LEAD	METS	1.1	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	LEAD	METS	1.1	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	LEAD	METS	0.95	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	LEAD	METS	0.78	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	LEAD	METS	0.76	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	LEAD	METS	0.69	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	LEAD	METS	0.58	J	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.028	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.018	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.017	=	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.010	J	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0080	J	mg/kg		7.50E+02	NA	
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0080	J	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0070	J	mg/kg		7.50E+02	NA	
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0080	J	mg/kg		7.50E+02	NA	
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	5.00E-04	J	mg/kg		7.50E+02	NA	
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	MAGNESIUM	METS	4,890	=	mg/kg			NA	NA
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	MAGNESIUM	METS	4,510	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	MAGNESIUM	METS	3,940	=	mg/kg			NA	NA
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	MAGNESIUM	METS	3,730	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	MAGNESIUM	METS	3,710	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	MAGNESIUM	METS	3,600	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	MAGNESIUM	METS	3,230	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	MAGNESIUM	METS	2,960	=	mg/kg			NA	NA
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	MAGNESIUM	METS	2,860	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	MAGNESIUM	METS	2,680	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	MAGNESIUM	METS	2,610	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	MAGNESIUM	METS	2,470	=	mg/kg			NA	NA
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	MAGNESIUM	METS	2,450	=	mg/kg			NA	NA
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	MAGNESIUM	METS	2,330	=	mg/kg			NA	NA
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	MAGNESIUM	METS	2,290	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	MAGNESIUM	METS	2,080	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	MAGNESIUM	METS	1,970	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	MAGNESIUM	METS	1,720	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	MAGNESIUM	METS	1,300	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	MAGNESIUM	METS	1,210	=	mg/kg			NA	NA

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	MANGANESE	METS	956	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	MANGANESE	METS	708	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	MANGANESE	METS	698	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	MANGANESE	METS	669	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	MANGANESE	METS	587	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	MANGANESE	METS	512	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	MANGANESE	METS	482	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	MANGANESE	METS	472	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	MANGANESE	METS	472	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	MANGANESE	METS	468	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	MANGANESE	METS	464	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	MANGANESE	METS	424	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	MANGANESE	METS	409	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	MANGANESE	METS	408	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	MANGANESE	METS	370	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	MANGANESE	METS	329	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	MANGANESE	METS	292	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	MANGANESE	METS	234	J	mg/kg		1.95E+03	NA	
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	MANGANESE	METS	193	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	MANGANESE	METS	164	=	mg/kg		1.95E+03	NA	
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	MERCURY	METS	0.016	J	mg/kg		3.07E+01	NA	
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	NICKEL	METS	12	=	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	NICKEL	METS	7.5	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	NICKEL	METS	5.9	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	NICKEL	METS	5.1	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	NICKEL	METS	4.9	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	NICKEL	METS	4.6	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	NICKEL	METS	4.4	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	NICKEL	METS	4.2	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	NICKEL	METS	4.2	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	NICKEL	METS	3.8	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	NICKEL	METS	3.5	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	NICKEL	METS	3.4	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	NICKEL	METS	3.3	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	NICKEL	METS	3.0	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	NICKEL	METS	2.9	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	NICKEL	METS	2.7	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	NICKEL	METS	2.7	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	NICKEL	METS	2.2	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	NICKEL	METS	2.0	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	NICKEL	METS	1.5	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0070	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0060	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0050	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0030	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0020	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB18	NDA213	04/07/00	4	6	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0020	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0020	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0010	J	mg/kg	1.30E+02	2.04E+03		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	POTASSIUM	METS	2,340	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	POTASSIUM	METS	1,700	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	POTASSIUM	METS	1,600	=	mg/kg			NA	NA
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	POTASSIUM	METS	1,380	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	POTASSIUM	METS	1,240	=	mg/kg			NA	NA
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	POTASSIUM	METS	1,240	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	POTASSIUM	METS	1,130	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	POTASSIUM	METS	1,110	=	mg/kg			NA	NA
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	POTASSIUM	METS	1,080	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	POTASSIUM	METS	1,060	J	mg/kg			NA	NA

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	POTASSIUM	METS	981	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	POTASSIUM	METS	940	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	POTASSIUM	METS	934	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	POTASSIUM	METS	889	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	POTASSIUM	METS	810	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	POTASSIUM	METS	806	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	POTASSIUM	METS	788	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	POTASSIUM	METS	699	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA229	04/10/00	24	28	SB	POTASSIUM	METS	657	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	POTASSIUM	METS	633	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	SELENIUM	METS	0.94	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	SELENIUM	METS	0.89	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	SELENIUM	METS	0.76	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	SELENIUM	METS	0.77	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	SELENIUM	METS	0.77	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	SELENIUM	METS	0.75	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	SELENIUM	METS	0.72	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	SELENIUM	METS	0.72	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	SELENIUM	METS	0.69	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	SELENIUM	METS	0.66	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	SELENIUM	METS	0.46	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	SELENIUM	METS	0.44	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	SELENIUM	METS	0.44	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	SELENIUM	METS	0.43	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	SELENIUM	METS	0.42	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	SELENIUM	METS	0.41	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	SELENIUM	METS	0.40	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	SELENIUM	METS	0.33	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	SELENIUM	METS	0.25	J	mg/kg	5.00E+00	5.11E+02		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	SODIUM	METS	436	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	SODIUM	METS	180	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	SODIUM	METS	174	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	SODIUM	METS	174	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	SODIUM	METS	173	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	SODIUM	METS	172	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA213	04/07/00	4	8	SB	SODIUM	METS	159	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	SODIUM	METS	111	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	SODIUM	METS	108	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	SODIUM	METS	106	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	SODIUM	METS	105	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	SODIUM	METS	104	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	SODIUM	METS	104	J	mg/kg			NA	NA
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	SODIUM	METS	103	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	SODIUM	METS	98	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	SODIUM	METS	93	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	SODIUM	METS	85	J	mg/kg			NA	NA
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	SODIUM	METS	78	J	mg/kg			NA	NA
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	SODIUM	METS	65	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	SODIUM	METS	63	J	mg/kg			NA	NA
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	TETRACHLOROETHYLENE(PCE)	VOC	0.0010	J	mg/kg	6.00E-02	3.42E+00		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	THALLIUM	METS	1.9	J	mg/kg	7.00E-01	6.75E+00	X	
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	THALLIUM	METS	1.7	J	mg/kg	7.00E-01	6.75E+00	X	
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	THALLIUM	METS	1.3	J	mg/kg	7.00E-01	6.75E+00	X	
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	THALLIUM	METS	1.1	J	mg/kg	7.00E-01	6.75E+00	X	
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	THALLIUM	METS	0.75	J	mg/kg	7.00E-01	6.75E+00	X	
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	THALLIUM	METS	0.73	J	mg/kg	7.00E-01	6.75E+00	X	
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	THALLIUM	METS	0.62	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB17	NDA219	04/07/00	4	8	SB	THALLIUM	METS	0.55	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	THALLIUM	METS	0.54	J	mg/kg	7.00E-01	6.75E+00		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB18	NDA226	04/10/00	19	21	SB	THALLIUM	METS	0.50	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	THALLIUM	METS	0.49	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	THALLIUM	METS	0.48	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	THALLIUM	METS	0.45	J	mg/kg	7.00E-01	6.75E+00		
ADC C	AC-SB17	NDA222	04/07/00	19	21	SB	THALLIUM	METS	0.43	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	THALLIUM	METS	0.37	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	THALLIUM	METS	0.36	J	mg/kg	7.00E-01	6.75E+00		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	TOLUENE	VOC	0.0080	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	TOLUENE	VOC	0.0040	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	TOLUENE	VOC	0.0030	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	TOLUENE	VOC	0.0020	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	TOLUENE	VOC	0.0010	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	TOLUENE	VOC	0.0010	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB18	NDA216	04/07/00	14	16	SB	TOLUENE	VOC	0.0010	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	TOLUENE	VOC	9.00E-04	J	mg/kg	1.20E+01	5.20E+01		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	VANADIUM	METS	77	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	VANADIUM	METS	76	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	VANADIUM	METS	69	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	VANADIUM	METS	65	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	VANADIUM	METS	63	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	VANADIUM	METS	60	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	VANADIUM	METS	59	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB16	NDA218	04/07/00	24	26	SB	VANADIUM	METS	53	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	VANADIUM	METS	52	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	VANADIUM	METS	50	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	VANADIUM	METS	47	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	VANADIUM	METS	45	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	VANADIUM	METS	44	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	VANADIUM	METS	42	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	VANADIUM	METS	40	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	VANADIUM	METS	38	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	VANADIUM	METS	35	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	VANADIUM	METS	34	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	VANADIUM	METS	27	=	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	VANADIUM	METS	26	J	mg/kg	6.00E+03	7.15E+02		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	XYLENES, TOTAL	VOC	0.035	=	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	XYLENES, TOTAL	VOC	0.023	=	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	XYLENES, TOTAL	VOC	0.022	=	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	XYLENES, TOTAL	VOC	0.013	=	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	XYLENES, TOTAL	VOC	0.010	J	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	XYLENES, TOTAL	VOC	0.010	J	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	XYLENES, TOTAL	VOC	0.0090	J	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	XYLENES, TOTAL	VOC	0.0070	J	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	XYLENES, TOTAL	VOC	5.00E-04	J	mg/kg	2.10E+02	4.20E+01		
AOC C	AC-SB18	NDA225	04/10/00	9	11	SB	ZINC	METS	40	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB19	NDA230	04/10/00	4	6	SB	ZINC	METS	38	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB16	NDA215	04/07/00	9	11	SB	ZINC	METS	37	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB17	NDA219	04/07/00	4	6	SB	ZINC	METS	37	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB16	NDA213	04/07/00	4	6	SB	ZINC	METS	34	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB17	NDA220	04/07/00	9	11	SB	ZINC	METS	33	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB19	NDA234	04/10/00	24	26	SB	ZINC	METS	29	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB18	NDA228	04/10/00	19	21	SB	ZINC	METS	29	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB17	NDA223	04/07/00	24	26	SB	ZINC	METS	29	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB18	NDA229	04/10/00	24	26	SB	ZINC	METS	23	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB16	NDA216	04/07/00	14	16	SB	ZINC	METS	23	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB18	NDA218	04/07/00	24	26	SB	ZINC	METS	22	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB18	NDA224	04/10/00	4	6	SB	ZINC	METS	21	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB16	NDA217	04/07/00	19	21	SB	ZINC	METS	21	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB19	NDA232	04/10/00	14	16	SB	ZINC	METS	21	=	mg/kg	1.20E+04	1.00E+04		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC C	AC-SB19	NDA231	04/10/00	9	11	SB	ZINC	METS	20	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB18	NDA226	04/10/00	14	16	SB	ZINC	METS	19	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB17	NDA221	04/07/00	14	16	SB	ZINC	METS	16	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB17	NDA222	04/07/00	19	21	SB	ZINC	METS	12	=	mg/kg	1.20E+04	1.00E+04		
AOC C	AC-SB19	NDA233	04/10/00	19	21	SB	ZINC	METS	11	=	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	ALUMINUM	METS	25,900	J	mg/kg		1.00E+04	NA	X
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	ALUMINUM	METS	24,600	J	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	ALUMINUM	METS	23,500	J	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	ALUMINUM	METS	23,000	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	ALUMINUM	METS	20,100	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	ALUMINUM	METS	17,600	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	ALUMINUM	METS	17,000	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	ALUMINUM	METS	15,200	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	ALUMINUM	METS	10,700	J	mg/kg		1.00E+04	NA	X
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	ALUMINUM	METS	10,600	J	mg/kg		1.00E+04	NA	X
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	ALUMINUM	METS	9,570	J	mg/kg		1.00E+04	NA	
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	ALUMINUM	METS	9,260	=	mg/kg		1.00E+04	NA	
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	ALUMINUM	METS	8,940	J	mg/kg		1.00E+04	NA	
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	ALUMINUM	METS	8,080	=	mg/kg		1.00E+04	NA	
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	ALUMINUM	METS	8,030	=	mg/kg		1.00E+04	NA	
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	ALUMINUM	METS	6,900	=	mg/kg		1.00E+04	NA	
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	ALUMINUM	METS	6,790	J	mg/kg		1.00E+04	NA	
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	ANTIMONY	METS	0.87	J	mg/kg	5.00E+00	4.09E+01		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	ANTIMONY	METS	0.73	J	mg/kg	5.00E+00	4.09E+01		
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	ANTIMONY	METS	0.40	J	mg/kg	5.00E+00	4.09E+01		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	ANTIMONY	METS	0.21	J	mg/kg	5.00E+00	4.09E+01		
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	ANTIMONY	METS	0.16	J	mg/kg	5.00E+00	4.09E+01		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	ARSENIC	METS	0.82	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	ARSENIC	METS	0.57	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	ARSENIC	METS	0.55	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	ARSENIC	METS	0.55	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	ARSENIC	METS	0.51	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	ARSENIC	METS	0.51	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	ARSENIC	METS	0.49	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	ARSENIC	METS	0.46	J	mg/kg	2.90E+01	1.59E+00		
AOC F	AF-SB03	NDA249DL1	04/12/00	14	16	SB	BARIUM	METS	682	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	BARIUM	METS	478	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	BARIUM	METS	230	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	BARIUM	METS	222	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	BARIUM	METS	199	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	BARIUM	METS	168	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	BARIUM	METS	156	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	BARIUM	METS	145	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	BARIUM	METS	137	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	BARIUM	METS	106	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	BARIUM	METS	102	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	BARIUM	METS	94	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	BARIUM	METS	88	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	BARIUM	METS	75	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	BARIUM	METS	72	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	BARIUM	METS	71	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	BARIUM	METS	64	=	mg/kg	1.60E+03	6.66E+03		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	BENZENE	VOC	2.00E-04	J	mg/kg	3.00E-02	1.31E+00		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	BERYLLIUM	METS	0.57	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	BERYLLIUM	METS	0.47	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	BERYLLIUM	METS	0.45	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	BERYLLIUM	METS	0.42	J	mg/kg	6.30E+01	1.94E+03		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	BERYLLIUM	METS	0.37	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	BERYLLIUM	METS	0.28	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	BERYLLIUM	METS	0.28	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	BERYLLIUM	METS	0.28	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	BERYLLIUM	METS	0.27	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	BERYLLIUM	METS	0.21	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	BERYLLIUM	METS	0.20	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	BERYLLIUM	METS	0.19	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	BERYLLIUM	METS	0.16	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	BERYLLIUM	METS	0.12	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	BERYLLIUM	METS	0.11	J	mg/kg	6.30E+01	1.94E+03		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	CALCIUM	METS	11,200	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	CALCIUM	METS	7,940	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	CALCIUM	METS	6,160	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	CALCIUM	METS	5,710	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	CALCIUM	METS	5,670	=	mg/kg			NA	NA
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	CALCIUM	METS	5,600	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	CALCIUM	METS	5,120	=	mg/kg			NA	NA
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	CALCIUM	METS	5,010	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	CALCIUM	METS	4,890	=	mg/kg			NA	NA
AOC F	AF-SB03	NDA246	04/12/00	4	8	SB	CALCIUM	METS	3,280	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	CALCIUM	METS	3,030	=	mg/kg			NA	NA
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	CALCIUM	METS	2,850	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	CALCIUM	METS	2,650	=	mg/kg			NA	NA
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	CALCIUM	METS	2,320	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	CALCIUM	METS	2,290	=	mg/kg			NA	NA
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	CALCIUM	METS	2,120	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	CALCIUM	METS	1,790	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	CARBON DISULFIDE	VOC	4.00E-04	J	mg/kg	3.20E+01	7.20E+01		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	CARBON DISULFIDE	VOC	3.00E-04	J	mg/kg	3.20E+01	7.20E+01		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	CHLOROBENZENE	VOC	7.00E-04	J	mg/kg	1.00E+00	5.30E+01		
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	**CHROMIUM, TOTAL**	METS	**129**	=	mg/kg	3.80E+01	6.40E+01	X	X
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	**CHROMIUM, TOTAL**	METS	**118**	=	mg/kg	3.80E+01	6.40E+01	X	X
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	**CHROMIUM, TOTAL**	METS	**75**	J	mg/kg	3.80E+01	6.40E+01	X	X
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	**CHROMIUM, TOTAL**	METS	**59**	=	mg/kg	3.80E+01	6.40E+01	X	
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	CHROMIUM, TOTAL	METS	26	J	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	CHROMIUM, TOTAL	METS	28	=	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	CHROMIUM, TOTAL	METS	25	J	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	CHROMIUM, TOTAL	METS	23	J	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	CHROMIUM, TOTAL	METS	19	=	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	CHROMIUM, TOTAL	METS	15	=	mg/kg	3.60E+01	6.40E+01		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	CHROMIUM, TOTAL	METS	13	J	mg/kg	3.60E+01	6.40E+01		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	CHROMIUM, TOTAL	METS	9.9	J	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	CHROMIUM, TOTAL	METS	8.8	=	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	CHROMIUM, TOTAL	METS	8.2	=	mg/kg	3.60E+01	6.40E+01		
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	CHROMIUM, TOTAL	METS	7.7	J	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	CHROMIUM, TOTAL	METS	7.3	J	mg/kg	3.80E+01	6.40E+01		
AOC F	AF-SB01	NDA236	04/11/00	14	16	SB	COBALT	METS	63	=	mg/kg		1.92E+03	NA	
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	COBALT	METS	42	=	mg/kg		1.92E+03	NA	
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	COBALT	METS	36	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	COBALT	METS	31	=	mg/kg		1.92E+03	NA	
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	COBALT	METS	27	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	COBALT	METS	23	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	COBALT	METS	22	=	mg/kg		1.92E+03	NA	
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	COBALT	METS	19	=	mg/kg		1.92E+03	NA	
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	COBALT	METS	18	=	mg/kg		1.92E+03	NA	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	COBALT	METS	17	=	mg/kg		1.92E+03	NA	
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	COBALT	METS	14	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	COBALT	METS	11	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	COBALT	METS	10	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	COBALT	METS	9.1	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	COBALT	METS	8.4	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	COBALT	METS	7.4	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	COBALT	METS	6.6	J	mg/kg		1.92E+03	NA	
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	COPPER	METS	120	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	COPPER	METS	91	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	COPPER	METS	67	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	COPPER	METS	60	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	COPPER	METS	60	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	COPPER	METS	55	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	COPPER	METS	55	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	COPPER	METS	53	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	COPPER	METS	32	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	COPPER	METS	30	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	COPPER	METS	29	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	COPPER	METS	29	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	COPPER	METS	28	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	COPPER	METS	28	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	COPPER	METS	28	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	COPPER	METS	26	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	COPPER	METS	20	J	mg/kg		4.09E+03	NA	
AOC F	AF-SB03	NDA249DL1	04/12/00	14	16	SB	IRON	METS	52,100	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	IRON	METS	45,300	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA243	04/11/00	14	18	SB	IRON	METS	43,300	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	IRON	METS	42,700	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	IRON	METS	37,200	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	IRON	METS	34,000	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	IRON	METS	33,700	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	IRON	METS	33,100	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	IRON	METS	23,700	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	IRON	METS	23,000	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	IRON	METS	19,700	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	IRON	METS	19,500	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	IRON	METS	19,300	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	IRON	METS	18,700	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	IRON	METS	17,300	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	IRON	METS	16,200	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	IRON	METS	12,500	=	mg/kg		1.00E+04	NA	X
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	LEAD	METS	2.6	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	LEAD	METS	2.3	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	LEAD	METS	2.3	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	LEAD	METS	2.1	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	LEAD	METS	1.8	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	LEAD	METS	1.8	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	LEAD	METS	1.6	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	LEAD	METS	1.5	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	LEAD	METS	1.5	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	LEAD	METS	1.4	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	LEAD	METS	1.1	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	LEAD	METS	0.80	=	mg/kg		7.50E+02	NA	
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	LEAD	METS	0.67	J	mg/kg		7.50E+02	NA	
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	LEAD	METS	0.54	J	mg/kg		7.50E+02	NA	
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	9.00E-04	J	mg/kg		7.50E+02	NA	
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	7.00E-04	J	mg/kg		7.50E+02	NA	
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	4.00E-04	J	mg/kg		7.50E+02	NA	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg		7.50E+02	NA	
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	MAGNESIUM	METS	22,700	=	mg/kg			NA	NA
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	MAGNESIUM	METS	20,400	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	MAGNESIUM	METS	17,700	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	MAGNESIUM	METS	17,400	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	MAGNESIUM	METS	17,300	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	MAGNESIUM	METS	14,100	=	mg/kg			NA	NA
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	MAGNESIUM	METS	13,100	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	MAGNESIUM	METS	12,100	=	mg/kg			NA	NA
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	MAGNESIUM	METS	3,930	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	MAGNESIUM	METS	3,690	=	mg/kg			NA	NA
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	MAGNESIUM	METS	3,360	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	MAGNESIUM	METS	3,030	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	MAGNESIUM	METS	2,960	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	MAGNESIUM	METS	2,830	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	MAGNESIUM	METS	2,760	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	MAGNESIUM	METS	2,650	=	mg/kg			NA	NA
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	MAGNESIUM	METS	1,740	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA238DL1	04/11/00	14	16	SB	MANGANESE	METS	3,490	=	mg/kg		1.95E+03	NA	X
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	MANGANESE	METS	1,550	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	MANGANESE	METS	1,390	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	MANGANESE	METS	1,300	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	MANGANESE	METS	1,230	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	MANGANESE	METS	1,090	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	MANGANESE	METS	965	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	MANGANESE	METS	923	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	MANGANESE	METS	921	J	mg/kg		1.95E+03	NA	
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	MANGANESE	METS	809	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	MANGANESE	METS	723	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	MANGANESE	METS	544	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	MANGANESE	METS	516	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	MANGANESE	METS	510	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	MANGANESE	METS	483	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	MANGANESE	METS	424	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	MANGANESE	METS	372	=	mg/kg		1.95E+03	NA	
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	MERCURY	METS	0.015	J	mg/kg		3.07E+01	NA	
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0070	J	mg/kg		2.71E+03	NA	
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0040	J	mg/kg		2.71E+03	NA	
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0020	J	mg/kg		2.71E+03	NA	
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0020	J	mg/kg		2.71E+03	NA	
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	NICKEL	METS	44	=	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	NICKEL	METS	43	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	NICKEL	METS	37	=	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	NICKEL	METS	37	=	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	NICKEL	METS	26	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	NICKEL	METS	18	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	NICKEL	METS	15	=	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	NICKEL	METS	13	=	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	NICKEL	METS	9.7	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	NICKEL	METS	9.7	=	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	NICKEL	METS	7.1	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	NICKEL	METS	7.0	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	NICKEL	METS	6.7	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	NICKEL	METS	4.9	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	NICKEL	METS	4.4	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	NICKEL	METS	4.1	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	NICKEL	METS	3.7	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	4.00E-04	J	mg/kg	1.30E+02	2.04E+03		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	p,p'-DDE	PEST/PCB	4.70E-04	J	mg/kg	5.40E+01	7.02E+00		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	POTASSIUM	METS	1,710	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	POTASSIUM	METS	1,360	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	POTASSIUM	METS	1,320	=	mg/kg			NA	NA
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	POTASSIUM	METS	1,290	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	POTASSIUM	METS	1,160	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	POTASSIUM	METS	985	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	POTASSIUM	METS	902	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	POTASSIUM	METS	890	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	POTASSIUM	METS	853	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	POTASSIUM	METS	811	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	POTASSIUM	METS	755	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	POTASSIUM	METS	598	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	POTASSIUM	METS	543	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	POTASSIUM	METS	512	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	POTASSIUM	METS	345	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	POTASSIUM	METS	213	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	POTASSIUM	METS	160	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	SELENIUM	METS	0.54	J	mg/kg	5.00E+00	5.11E+02		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	SELENIUM	METS	0.46	J	mg/kg	5.00E+00	5.11E+02		
AOC F	AF-SB03	NDA246	04/12/00	9	11	SB	SELENIUM	METS	0.42	J	mg/kg	5.00E+00	5.11E+02		
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	SELENIUM	METS	0.41	J	mg/kg	5.00E+00	5.11E+02		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	SELENIUM	METS	0.28	J	mg/kg	5.00E+00	5.11E+02		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	SILVER	METS	0.31	J	mg/kg	3.40E+01	5.11E+02		
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	SILVER	METS	0.097	J	mg/kg	3.40E+01	5.11E+02		
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	SODIUM	METS	2,470	=	mg/kg			NA	NA
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	SODIUM	METS	2,120	=	mg/kg			NA	NA
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	SODIUM	METS	1,800	=	mg/kg			NA	NA
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	SODIUM	METS	1,140	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	SODIUM	METS	1,130	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	SODIUM	METS	932	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	SODIUM	METS	349	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	SODIUM	METS	303	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	SODIUM	METS	164	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	SODIUM	METS	132	J	mg/kg			NA	NA
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	SODIUM	METS	128	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	SODIUM	METS	113	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	SODIUM	METS	105	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA241	04/11/00	4	8	SB	SODIUM	METS	63	J	mg/kg			NA	NA
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	SODIUM	METS	64	J	mg/kg			NA	NA
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	SODIUM	METS	63	J	mg/kg			NA	NA
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	THALLIUM	METS	1.7	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	THALLIUM	METS	1.4	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	THALLIUM	METS	1.4	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	THALLIUM	METS	1.4	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	THALLIUM	METS	1.2	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	THALLIUM	METS	1.2	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	THALLIUM	METS	1.0	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	THALLIUM	METS	0.99	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	THALLIUM	METS	0.94	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	THALLIUM	METS	0.92	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	THALLIUM	METS	0.85	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	THALLIUM	METS	0.83	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	THALLIUM	METS	0.77	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	THALLIUM	METS	0.76	J	mg/kg	7.00E-01	6.75E+00	X	
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	TOLUENE	VOC	4.00E-04	J	mg/kg	1.20E+01	5.20E+01		
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	VANADIUM	METS	163	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	VANADIUM	METS	160	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	VANADIUM	METS	148	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	VANADIUM	METS	135	=	mg/kg	6.00E+03	7.15E+02		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	VANADIUM	METS	129	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	VANADIUM	METS	129	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	VANADIUM	METS	96	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	VANADIUM	METS	84	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	VANADIUM	METS	82	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	VANADIUM	METS	61	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	VANADIUM	METS	75	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	VANADIUM	METS	66	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	VANADIUM	METS	57	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	VANADIUM	METS	55	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	VANADIUM	METS	54	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	VANADIUM	METS	49	=	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	VANADIUM	METS	37	J	mg/kg	6.00E+03	7.15E+02		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	XYLENES, TOTAL	VOC	0.0013	J	mg/kg	2.10E+02	4.20E+01		
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	XYLENES, TOTAL	VOC	7.00E-04	J	mg/kg	2.10E+02	4.20E+01		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	XYLENES, TOTAL	VOC	4.00E-04	J	mg/kg	2.10E+02	4.20E+01		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.10E+02	4.20E+01		
AOC F	AF-SB03	NDA249	04/12/00	14	16	SB	ZINC	METS	72	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB02	NDA245	04/12/00	24	26	SB	ZINC	METS	64	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB04	NDA255	04/12/00	19	21	SB	ZINC	METS	60	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB01	NDA239	04/11/00	19	21	SB	ZINC	METS	56	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB02	NDA243	04/11/00	14	16	SB	ZINC	METS	56	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB01	NDA240	04/11/00	24	26	SB	ZINC	METS	49	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB02	NDA244	04/11/00	19	21	SB	ZINC	METS	47	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB01	NDA238	04/11/00	14	16	SB	ZINC	METS	41	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB01	NDA235	04/11/00	4	6	SB	ZINC	METS	32	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB04	NDA254	04/12/00	14	16	SB	ZINC	METS	30	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB03	NDA246	04/12/00	4	6	SB	ZINC	METS	30	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB03	NDA248	04/12/00	9	11	SB	ZINC	METS	30	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB04	NDA253	04/12/00	9	11	SB	ZINC	METS	29	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB04	NDA252	04/12/00	4	6	SB	ZINC	METS	28	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB02	NDA241	04/11/00	4	6	SB	ZINC	METS	26	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB02	NDA242	04/11/00	9	11	SB	ZINC	METS	26	J	mg/kg	1.20E+04	1.00E+04		
AOC F	AF-SB01	NDA236	04/11/00	9	11	SB	ZINC	METS	24	J	mg/kg	1.20E+04	1.00E+04		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	ALUMINUM	METS	6,980	=	mg/kg		1.00E+04	NA	
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	ALUMINUM	METS	5,900	=	mg/kg		1.00E+04	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	ALUMINUM	METS	4,560	=	mg/kg		1.00E+04	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	ALUMINUM	METS	1,970	=	mg/kg		1.00E+04	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	ANTIMONY	METS	0.71	J	mg/kg	5.00E+00	4.09E+01		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	ANTIMONY	METS	0.68	J	mg/kg	5.00E+00	4.09E+01		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	ANTIMONY	METS	0.46	J	mg/kg	5.00E+00	4.09E+01		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	ANTIMONY	METS	0.30	J	mg/kg	5.00E+00	4.09E+01		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	ARSENIC	METS	1.7	J	mg/kg	2.90E+01	1.59E+00		X
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	ARSENIC	METS	1.5	J	mg/kg	2.90E+01	1.59E+00		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	ARSENIC	METS	1.4	J	mg/kg	2.90E+01	1.59E+00		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	BARIUM	METS	57	=	mg/kg	1.60E+03	6.66E+03		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	BARIUM	METS	48	=	mg/kg	1.60E+03	6.66E+03		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	BARIUM	METS	43	J	mg/kg	1.60E+03	6.66E+03		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	BARIUM	METS	27	J	mg/kg	1.60E+03	6.66E+03		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	BERYLLIUM	METS	0.31	J	mg/kg	6.30E+01	1.94E+03		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	BERYLLIUM	METS	0.27	J	mg/kg	6.30E+01	1.94E+03		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	BERYLLIUM	METS	0.22	J	mg/kg	6.30E+01	1.94E+03		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	BERYLLIUM	METS	0.13	J	mg/kg	6.30E+01	1.94E+03		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	CADMIUM	METS	0.13	J	mg/kg	8.00E+00	4.51E+01		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	CADMIUM	METS	0.049	J	mg/kg	6.00E+00	4.51E+01		
AOC-L	AOCLSB001	NDE122DL1	11/29/00	5	6	SB	CALCIUM	METS	185,000	=	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE124DL1	11/29/00	5	6	SB	CALCIUM	METS	177,000	=	mg/kg			NA	NA
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	CALCIUM	METS	100,000	=	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	CALCIUM	METS	2,230	=	mg/kg			NA	NA

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	CHROMIUM, TOTAL	METS	9.0	=	mg/kg	3.80E+01	6.40E+01		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	CHROMIUM, TOTAL	METS	8.2	=	mg/kg	3.80E+01	6.40E+01		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	CHROMIUM, TOTAL	METS	8.2	=	mg/kg	3.80E+01	6.40E+01		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	CHROMIUM, TOTAL	METS	6.4	=	mg/kg	3.80E+01	6.40E+01		
AOC-L	AOCLSB003	NDE126	11/29/00	5	8	SB	COBALT	METS	5.2	J	mg/kg		1.92E+03	NA	
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	COBALT	METS	3.5	J	mg/kg		1.92E+03	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	COBALT	METS	2.7	J	mg/kg		1.92E+03	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	COBALT	METS	1.5	J	mg/kg		1.92E+03	NA	
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	COPPER	METS	18	=	mg/kg		4.09E+03	NA	
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	COPPER	METS	11	=	mg/kg		4.09E+03	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	COPPER	METS	7.5	=	mg/kg		4.09E+03	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	COPPER	METS	3.7	J	mg/kg		4.09E+03	NA	
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	ETHYLBENZENE	VOC	0.0020	J	mg/kg	1.30E+01	1.95E+01		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	IRON	METS	12,500	=	mg/kg		1.00E+04	NA	X
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	IRON	METS	9,600	=	mg/kg		1.00E+04	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	IRON	METS	7,370	=	mg/kg		1.00E+04	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	IRON	METS	5,100	=	mg/kg		1.00E+04	NA	
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	LEAD	METS	5.2	=	mg/kg		7.50E+02	NA	
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	LEAD	METS	1.3	=	mg/kg		7.50E+02	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	LEAD	METS	1.1	=	mg/kg		7.50E+02	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	LEAD	METS	0.90	=	mg/kg		7.50E+02	NA	
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0090	J	mg/kg		7.50E+02	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	MAGNESIUM	METS	9,460	=	mg/kg			NA	NA
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	MAGNESIUM	METS	8,980	=	mg/kg			NA	NA
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	MAGNESIUM	METS	6,800	=	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	MAGNESIUM	METS	1,940	=	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	MANGANESE	METS	324	=	mg/kg		1.95E+03	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	MANGANESE	METS	216	=	mg/kg		1.95E+03	NA	
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	MANGANESE	METS	200	=	mg/kg		1.95E+03	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	MANGANESE	METS	87	=	mg/kg		1.95E+03	NA	
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	MERCURY	METS	0.10	=	mg/kg		3.07E+01	NA	
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	MERCURY	METS	0.014	J	mg/kg		3.07E+01	NA	
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	MERCURY	METS	0.0080	J	mg/kg		3.07E+01	NA	
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	MERCURY	METS	0.0060	J	mg/kg		3.07E+01	NA	
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	NICKEL	METS	3.5	J	mg/kg	1.30E+02	2.04E+03		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	NICKEL	METS	2.2	J	mg/kg	1.30E+02	2.04E+03		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	NICKEL	METS	1.6	J	mg/kg	1.30E+02	2.04E+03		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	NICKEL	METS	1.2	J	mg/kg	1.30E+02	2.04E+03		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0031	J	mg/kg	1.30E+02	2.04E+03		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	POTASSIUM	METS	920	J	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	POTASSIUM	METS	898	J	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	POTASSIUM	METS	813	J	mg/kg			NA	NA
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	POTASSIUM	METS	328	J	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	SELENIUM	METS	0.79	J	mg/kg	5.00E+00	5.11E+02		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	SODIUM	METS	1,480	=	mg/kg			NA	NA
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	SODIUM	METS	1,400	=	mg/kg			NA	NA
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	SODIUM	METS	1,390	=	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	SODIUM	METS	130	J	mg/kg			NA	NA
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	VANADIUM	METS	35	=	mg/kg	6.00E+03	7.15E+02		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	VANADIUM	METS	30	=	mg/kg	6.00E+03	7.15E+02		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	VANADIUM	METS	25	=	mg/kg	6.00E+03	7.15E+02		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	VANADIUM	METS	21	=	mg/kg	6.00E+03	7.15E+02		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	XYLENES, TOTAL	VOC	0.012	=	mg/kg	2.10E+02	4.20E+01		
AOC-L	AOCLSB004	NDE129	11/29/00	5	6	SB	ZINC	METS	39	=	mg/kg	1.20E+04	1.00E+04		
AOC-L	AOCLSB003	NDE126	11/29/00	5	6	SB	ZINC	METS	22	=	mg/kg	1.20E+04	1.00E+04		
AOC-L	AOCLSB002	NDE124	11/29/00	5	6	SB	ZINC	METS	12	=	mg/kg	1.20E+04	1.00E+04		
AOC-L	AOCLSB001	NDE122	11/29/00	5	6	SB	ZINC	METS	6.8	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	8.03E-01		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	8.03E-01		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	ALUMINUM	METS	8,560	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	ALUMINUM	METS	7,050	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	ALUMINUM	METS	6,540	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	ALUMINUM	METS	6,420	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	ALUMINUM	METS	5,860	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	ALUMINUM	METS	5,720	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	ALUMINUM	METS	5,490	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	ALUMINUM	METS	5,030	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	ALUMINUM	METS	5,000	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	ALUMINUM	METS	4,640	=	mg/kg		1.00E+04	NA	
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	ANTIMONY	METS	0.31	J	mg/kg	5.00E+00	4.09E+01		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	ANTIMONY	METS	0.27	J	mg/kg	5.00E+00	4.09E+01		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	ANTIMONY	METS	0.21	J	mg/kg	5.00E+00	4.09E+01		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	ANTIMONY	METS	0.20	J	mg/kg	5.00E+00	4.09E+01		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	ARSENIC	METS	0.91	J	mg/kg	2.90E+01	1.59E+00		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	ARSENIC	METS	0.57	J	mg/kg	2.90E+01	1.59E+00		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	ARSENIC	METS	0.44	J	mg/kg	2.90E+01	1.59E+00		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	BARIUM	METS	139	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	BARIUM	METS	107	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	BARIUM	METS	105	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB02	NDA129	04/04/00	4	8	SB	BARIUM	METS	101	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	BARIUM	METS	101	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	BARIUM	METS	92	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	BARIUM	METS	81	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	BARIUM	METS	74	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	BARIUM	METS	73	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	BARIUM	METS	72	=	mg/kg	1.60E+03	6.66E+03		
SWM10	W10-SB03	NDA132	04/04/00	4	8	SB	BERYLLIUM	METS	0.30	J	mg/kg	8.30E+01	1.94E+03		
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	BERYLLIUM	METS	0.26	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	BERYLLIUM	METS	0.21	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	BERYLLIUM	METS	0.21	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	BERYLLIUM	METS	0.19	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	CALCIUM	METS	3,100	=	mg/kg			NA	NA
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	CALCIUM	METS	2,340	=	mg/kg			NA	NA
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	CALCIUM	METS	2,020	=	mg/kg			NA	NA
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	CALCIUM	METS	2,020	=	mg/kg			NA	NA
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	CALCIUM	METS	1,990	=	mg/kg			NA	NA
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	CALCIUM	METS	1,780	=	mg/kg			NA	NA
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	CALCIUM	METS	1,640	=	mg/kg			NA	NA
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	CALCIUM	METS	1,500	=	mg/kg			NA	NA
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	CALCIUM	METS	1,250	=	mg/kg			NA	NA
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	CALCIUM	METS	1,060	=	mg/kg			NA	NA
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	8.2	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	7.5	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	7.4	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	7.0	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	6.9	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	6.6	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	6.0	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	5.6	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	5.6	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	CHROMIUM, TOTAL	METS	4.9	=	mg/kg	3.80E+01	6.40E+01		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	COBALT	METS	11	=	mg/kg		1.92E+03	NA	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	COBALT	METS	9.6	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	COBALT	METS	9.5	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	COBALT	METS	9.5	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB05	NDA136	04/04/00	4	8	SB	COBALT	METS	8.8	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	COBALT	METS	8.2	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	COBALT	METS	7.5	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB10	NDA148	04/04/00	4	6	SB	COBALT	METS	7.3	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	COBALT	METS	6.5	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	COBALT	METS	5.3	J	mg/kg		1.92E+03	NA	
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	COPPER	METS	33	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	COPPER	METS	32	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	COPPER	METS	31	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	COPPER	METS	28	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	COPPER	METS	26	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	COPPER	METS	26	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	COPPER	METS	25	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	COPPER	METS	20	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	COPPER	METS	20	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	COPPER	METS	19	=	mg/kg		4.09E+03	NA	
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	DIETHYL PHTHALATE	SVOC	0.21	J	mg/kg		1.00E+04	NA	
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	DIETHYL PHTHALATE	SVOC	0.16	J	mg/kg		1.00E+04	NA	
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	DIETHYL PHTHALATE	SVOC	0.15	J	mg/kg		1.00E+04	NA	
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	DIETHYL PHTHALATE	SVOC	0.057	J	mg/kg		1.00E+04	NA	
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	DIETHYL PHTHALATE	SVOC	0.051	J	mg/kg		1.00E+04	NA	
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	IRON	METS	17,700	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	IRON	METS	15,200	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	IRON	METS	14,400	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	IRON	METS	13,200	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	IRON	METS	12,200	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	IRON	METS	12,100	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	IRON	METS	11,000	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	IRON	METS	10,800	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	IRON	METS	10,300	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	IRON	METS	10,300	=	mg/kg		1.00E+04	NA	X
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	LEAD	METS	16	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	LEAD	METS	5.1	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	LEAD	METS	4.3	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	LEAD	METS	3.3	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	LEAD	METS	2.6	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	LEAD	METS	2.4	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	LEAD	METS	1.5	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	LEAD	METS	1.3	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	LEAD	METS	1.2	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	LEAD	METS	0.94	=	mg/kg		7.50E+02	NA	
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	MAGNESIUM	METS	4,020	=	mg/kg			NA	NA
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	MAGNESIUM	METS	3,940	=	mg/kg			NA	NA
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	MAGNESIUM	METS	3,440	=	mg/kg			NA	NA
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	MAGNESIUM	METS	2,950	=	mg/kg			NA	NA
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	MAGNESIUM	METS	2,900	=	mg/kg			NA	NA
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	MAGNESIUM	METS	2,410	=	mg/kg			NA	NA
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	MAGNESIUM	METS	2,350	=	mg/kg			NA	NA
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	MAGNESIUM	METS	2,330	=	mg/kg			NA	NA
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	MAGNESIUM	METS	2,190	=	mg/kg			NA	NA
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	MAGNESIUM	METS	2,170	=	mg/kg			NA	NA
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	MANGANESE	METS	597	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	MANGANESE	METS	590	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	MANGANESE	METS	551	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	MANGANESE	METS	516	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	MANGANESE	METS	515	=	mg/kg		1.95E+03	NA	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	MANGANESE	METS	510	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	MANGANESE	METS	447	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB01	NDA126	04/04/00	4	8	SB	MANGANESE	METS	407	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB08	NDA142	04/04/00	4	8	SB	MANGANESE	METS	395	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	MANGANESE	METS	298	=	mg/kg		1.95E+03	NA	
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	MERCURY	METS	0.024	J	mg/kg		3.07E+01	NA	
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	NICKEL	METS	4.5	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	NICKEL	METS	4.4	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	NICKEL	METS	3.9	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	NICKEL	METS	3.9	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	NICKEL	METS	3.6	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	NICKEL	METS	3.5	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB02	NDA129	04/04/00	4	8	SB	NICKEL	METS	3.3	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	NICKEL	METS	3.2	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB06	NDA142	04/04/00	4	6	SB	NICKEL	METS	2.8	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	NICKEL	METS	2.7	J	mg/kg	1.30E+02	2.04E+03		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	p,p'-DDD	PEST/PCB	6.70E-04	J	mg/kg	1.60E+01	9.95E+00		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	p,p'-DDE	PEST/PCB	0.021	=	mg/kg	5.40E+01	7.02E+00		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	p,p'-DDE	PEST/PCB	0.015	=	mg/kg	5.40E+01	7.02E+00		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	p,p'-DDE	PEST/PCB	0.0013	J	mg/kg	5.40E+01	7.02E+00		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	p,p'-DDE	PEST/PCB	0.0012	J	mg/kg	5.40E+01	7.02E+00		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	p,p'-DDE	PEST/PCB	8.00E-04	J	mg/kg	5.40E+01	7.02E+00		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	p,p'-DDT	PEST/PCB	0.011	=	mg/kg	3.20E+01	7.02E+00		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	p,p'-DDT	PEST/PCB	0.0076	J	mg/kg	3.20E+01	7.02E+00		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	p,p'-DDT	PEST/PCB	0.0010	J	mg/kg	3.20E+01	7.02E+00		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	p,p'-DDT	PEST/PCB	0.0010	J	mg/kg	3.20E+01	7.02E+00		
SWM10	W10-SB03	NDA132	04/04/00	4	8	SB	POTASSIUM	METS	1,190	=	mg/kg			NA	NA
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	POTASSIUM	METS	1,160	=	mg/kg			NA	NA
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	POTASSIUM	METS	1,110	=	mg/kg			NA	NA
SWM10	W10-SB05	NDA136	04/04/00	4	8	SB	POTASSIUM	METS	1,040	=	mg/kg			NA	NA
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	POTASSIUM	METS	861	J	mg/kg			NA	NA
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	POTASSIUM	METS	818	J	mg/kg			NA	NA
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	POTASSIUM	METS	809	J	mg/kg			NA	NA
SWM10	W10-SB06	NDA136	04/04/00	4	6	SB	POTASSIUM	METS	803	J	mg/kg			NA	NA
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	POTASSIUM	METS	772	J	mg/kg			NA	NA
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	POTASSIUM	METS	710	J	mg/kg			NA	NA
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	SELENIUM	METS	0.60	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	SELENIUM	METS	0.58	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	SELENIUM	METS	0.53	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	SELENIUM	METS	0.53	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	SELENIUM	METS	0.53	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	SELENIUM	METS	0.53	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB06	NDA136	04/04/00	4	6	SB	SELENIUM	METS	0.50	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	SELENIUM	METS	0.48	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	SELENIUM	METS	0.43	J	mg/kg	5.00E+00	5.11E+02		
SWM10	W10-SB10	NDA148	04/04/00	4	6	SB	SODIUM	METS	157	J	mg/kg			NA	NA
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	SODIUM	METS	135	J	mg/kg			NA	NA
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	SODIUM	METS	97	J	mg/kg			NA	NA
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	SODIUM	METS	96	J	mg/kg			NA	NA
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	SODIUM	METS	90	J	mg/kg			NA	NA
SWM10	W10-SB06	NDA136	04/04/00	4	6	SB	SODIUM	METS	76	J	mg/kg			NA	NA
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	SODIUM	METS	67	J	mg/kg			NA	NA
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	SODIUM	METS	60	J	mg/kg			NA	NA
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	SODIUM	METS	56	J	mg/kg			NA	NA
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	SODIUM	METS	49	J	mg/kg			NA	NA
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	THALLIUM	METS	1.3	J	mg/kg	7.00E-01	6.75E+00	X	
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	THALLIUM	METS	0.95	J	mg/kg	7.00E-01	6.75E+00	X	
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	THALLIUM	METS	0.93	J	mg/kg	7.00E-01	6.75E+00	X	
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	THALLIUM	METS	0.84	J	mg/kg	7.00E-01	6.75E+00	X	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	THALLIUM	METS	0.75	J	mg/kg	7.00E-01	6.75E+00	X	
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	THALLIUM	METS	0.71	J	mg/kg	7.00E-01	6.75E+00	X	
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	THALLIUM	METS	0.59	J	mg/kg	7.00E-01	6.75E+00		
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	THALLIUM	METS	0.59	J	mg/kg	7.00E-01	6.75E+00		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	THALLIUM	METS	0.54	J	mg/kg	7.00E-01	6.75E+00		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	THALLIUM	METS	0.50	J	mg/kg	7.00E-01	6.75E+00		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	VANADIUM	METS	57	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	VANADIUM	METS	46	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	VANADIUM	METS	38	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	VANADIUM	METS	37	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	VANADIUM	METS	37	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	VANADIUM	METS	36	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	VANADIUM	METS	35	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	VANADIUM	METS	33	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	VANADIUM	METS	31	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	VANADIUM	METS	29	J	mg/kg	6.00E+03	7.15E+02		
SWM10	W10-SB09	NDA144	04/04/00	4	6	SB	ZINC	METS	57	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB08	NDA142	04/04/00	4	6	SB	ZINC	METS	41	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB06	NDA138	04/04/00	4	6	SB	ZINC	METS	39	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB03	NDA132	04/04/00	4	6	SB	ZINC	METS	34	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB10	NDA146	04/04/00	4	6	SB	ZINC	METS	32	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB01	NDA126	04/04/00	4	6	SB	ZINC	METS	32	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB05	NDA136	04/04/00	4	6	SB	ZINC	METS	30	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB02	NDA129	04/04/00	4	6	SB	ZINC	METS	27	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB07	NDA140	04/04/00	4	6	SB	ZINC	METS	22	=	mg/kg	1.20E+04	1.00E+04		
SWM10	W10-SB04	NDA134	04/04/00	4	6	SB	ZINC	METS	20	=	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	ALUMINUM	METS	13,400	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	ALUMINUM	METS	12,400	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	ALUMINUM	METS	11,600	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	ALUMINUM	METS	10,100	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	ALUMINUM	METS	9,470	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	ALUMINUM	METS	8,810	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	ALUMINUM	METS	8,790	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	ALUMINUM	METS	8,400	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	ALUMINUM	METS	8,380	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	ALUMINUM	METS	8,220	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	ALUMINUM	METS	7,110	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	ALUMINUM	METS	7,070	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	ALUMINUM	METS	6,790	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	ALUMINUM	METS	5,740	=	mg/kg		1.00E+04	NA	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	ANTIMONY	METS	0.26	J	mg/kg	5.00E+00	4.09E+01		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	ANTIMONY	METS	0.24	J	mg/kg	5.00E+00	4.09E+01		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	ARSENIC	METS	0.66	J	mg/kg	2.90E+01	1.59E+00		
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	ARSENIC	METS	0.56	J	mg/kg	2.90E+01	1.59E+00		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	ARSENIC	METS	0.49	J	mg/kg	2.90E+01	1.59E+00		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	ARSENIC	METS	0.39	J	mg/kg	2.90E+01	1.59E+00		
SWM14	W14-SB06	NDA160	04/06/00	4	6	SB	BARIUM	METS	156	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	BARIUM	METS	131	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB01	NDA146	04/05/00	4	6	SB	BARIUM	METS	130	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB05	NDA158	04/05/00	4	8	SB	BARIUM	METS	115	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	BARIUM	METS	113	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	BARIUM	METS	97	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	BARIUM	METS	91	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	BARIUM	METS	82	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	BARIUM	METS	81	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	BARIUM	METS	80	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	BARIUM	METS	70	=	mg/kg	1.60E+03	6.66E+03		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	BARIUM	METS	62	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	BARIUM	METS	57	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	BARIUM	METS	48	=	mg/kg	1.60E+03	6.66E+03		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	BENZENE	VOC	2.00E-04	J	mg/kg	3.00E-02	1.31E+00		
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	BERYLLIUM	METS	0.31	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	BERYLLIUM	METS	0.31	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	BERYLLIUM	METS	0.29	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	BERYLLIUM	METS	0.28	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	BERYLLIUM	METS	0.27	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	BERYLLIUM	METS	0.27	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	BERYLLIUM	METS	0.27	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	BERYLLIUM	METS	0.23	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	BERYLLIUM	METS	0.23	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	BERYLLIUM	METS	0.21	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	BERYLLIUM	METS	0.21	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	BERYLLIUM	METS	0.19	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	BERYLLIUM	METS	0.18	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	BERYLLIUM	METS	0.13	J	mg/kg	6.30E+01	1.94E+03		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	CALCIUM	METS	6,280	=	mg/kg			NA	NA
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	CALCIUM	METS	4,660	=	mg/kg			NA	NA
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	CALCIUM	METS	4,390	=	mg/kg			NA	NA
SWM14	W14-SB10	NDA169	04/06/00	4	8	SB	CALCIUM	METS	3,770	=	mg/kg			NA	NA
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	CALCIUM	METS	3,160	=	mg/kg			NA	NA
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	CALCIUM	METS	3,040	=	mg/kg			NA	NA
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	CALCIUM	METS	2,940	=	mg/kg			NA	NA
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	CALCIUM	METS	2,840	=	mg/kg			NA	NA
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	CALCIUM	METS	2,830	=	mg/kg			NA	NA
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	CALCIUM	METS	2,830	=	mg/kg			NA	NA
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	CALCIUM	METS	2,570	=	mg/kg			NA	NA
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	CALCIUM	METS	2,530	=	mg/kg			NA	NA
SWM14	W14-SB09	NDA167	04/06/00	4	8	SB	CALCIUM	METS	2,410	=	mg/kg			NA	NA
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	CALCIUM	METS	2,030	=	mg/kg			NA	NA
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	CHROMIUM, TOTAL	METS	18	=	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB01	NDA148	04/05/00	4	8	SB	CHROMIUM, TOTAL	METS	14	J	mg/kg	3.60E+01	6.40E+01		
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	CHROMIUM, TOTAL	METS	13	J	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	CHROMIUM, TOTAL	METS	13	=	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	CHROMIUM, TOTAL	METS	11	J	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB02	NDA161	04/05/00	4	6	SB	CHROMIUM, TOTAL	METS	10	J	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	CHROMIUM, TOTAL	METS	9.9	=	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	CHROMIUM, TOTAL	METS	9.2	J	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	CHROMIUM, TOTAL	METS	9.1	J	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	CHROMIUM, TOTAL	METS	7.8	=	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	CHROMIUM, TOTAL	METS	7.3	=	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	CHROMIUM, TOTAL	METS	7.1	=	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	CHROMIUM, TOTAL	METS	5.2	J	mg/kg	3.80E+01	6.40E+01		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	COBALT	METS	13	=	mg/kg		1.92E+03	NA	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	COBALT	METS	12	=	mg/kg		1.92E+03	NA	
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	COBALT	METS	11	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	COBALT	METS	11	=	mg/kg		1.92E+03	NA	
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	COBALT	METS	11	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	COBALT	METS	10	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	COBALT	METS	10	=	mg/kg		1.92E+03	NA	
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	COBALT	METS	9.5	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	COBALT	METS	8.8	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	COBALT	METS	8.2	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	COBALT	METS	8.2	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	COBALT	METS	7.7	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	COBALT	METS	7.5	J	mg/kg		1.92E+03	NA	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	COBALT	METS	5.8	J	mg/kg		1.92E+03	NA	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	COPPER	METS	32	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	COPPER	METS	31	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	COPPER	METS	30	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	COPPER	METS	29	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	COPPER	METS	29	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	COPPER	METS	28	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	COPPER	METS	28	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	COPPER	METS	26	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	COPPER	METS	26	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	COPPER	METS	25	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	COPPER	METS	22	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	COPPER	METS	22	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	COPPER	METS	21	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	COPPER	METS	21	=	mg/kg		4.09E+03	NA	
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	IRON	METS	21,600	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	IRON	METS	21,600	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	IRON	METS	20,600	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	IRON	METS	19,100	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	IRON	METS	18,500	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	IRON	METS	17,800	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	IRON	METS	17,600	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	IRON	METS	17,300	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	IRON	METS	16,300	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	IRON	METS	15,400	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	IRON	METS	15,100	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	IRON	METS	12,700	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	IRON	METS	12,200	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	IRON	METS	10,600	=	mg/kg		1.00E+04	NA	X
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	LEAD	METS	37	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	LEAD	METS	14	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	LEAD	METS	6.7	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	LEAD	METS	4.7	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	LEAD	METS	3.8	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	LEAD	METS	3.4	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	LEAD	METS	3.3	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	LEAD	METS	3.2	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	LEAD	METS	2.8	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	LEAD	METS	2.6	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	LEAD	METS	2.1	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	LEAD	METS	1.7	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	LEAD	METS	1.3	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	LEAD	METS	1.0	=	mg/kg		7.50E+02	NA	
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0010	J	mg/kg		7.50E+02	NA	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	7.00E-04	J	mg/kg		7.50E+02	NA	
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	4.00E-04	J	mg/kg		7.50E+02	NA	
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	4.00E-04	J	mg/kg		7.50E+02	NA	
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg		7.50E+02	NA	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	MAGNESIUM	METS	4,020	=	mg/kg			NA	NA
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	MAGNESIUM	METS	3,540	=	mg/kg			NA	NA
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	MAGNESIUM	METS	3,390	=	mg/kg			NA	NA
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	MAGNESIUM	METS	3,260	=	mg/kg			NA	NA
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	MAGNESIUM	METS	3,150	=	mg/kg			NA	NA
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	MAGNESIUM	METS	3,040	=	mg/kg			NA	NA
SWM14	W14-SB09	NDA187	04/06/00	4	6	SB	MAGNESIUM	METS	3,010	=	mg/kg			NA	NA
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	MAGNESIUM	METS	2,950	=	mg/kg			NA	NA
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	MAGNESIUM	METS	2,930	=	mg/kg			NA	NA
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	MAGNESIUM	METS	2,840	=	mg/kg			NA	NA
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	MAGNESIUM	METS	2,490	=	mg/kg			NA	NA

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	MAGNESIUM	METS	2,460	=	mg/kg			NA	NA
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	MAGNESIUM	METS	2,440	=	mg/kg			NA	NA
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	MAGNESIUM	METS	2,020	=	mg/kg			NA	NA
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	MANGANESE	METS	783	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB08	NDA185	04/06/00	4	6	SB	MANGANESE	METS	769	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	MANGANESE	METS	708	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	MANGANESE	METS	657	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	MANGANESE	METS	654	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	MANGANESE	METS	589	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	MANGANESE	METS	568	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	MANGANESE	METS	520	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	MANGANESE	METS	497	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	MANGANESE	METS	469	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	MANGANESE	METS	436	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	MANGANESE	METS	421	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	MANGANESE	METS	394	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	MANGANESE	METS	299	J	mg/kg		1.95E+03	NA	
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	MERCURY	METS	0.031	J	mg/kg		3.07E+01	NA	
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	MERCURY	METS	0.016	J	mg/kg		3.07E+01	NA	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	MERCURY	METS	0.014	J	mg/kg		3.07E+01	NA	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	NICKEL	METS	7.8	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB01	NDA148	04/05/00	4	8	SB	NICKEL	METS	6.7	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	NICKEL	METS	6.3	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	NICKEL	METS	5.9	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	NICKEL	METS	5.7	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	NICKEL	METS	5.5	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	NICKEL	METS	5.4	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	NICKEL	METS	4.6	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	NICKEL	METS	4.5	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	NICKEL	METS	4.4	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	NICKEL	METS	3.7	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	NICKEL	METS	3.6	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	NICKEL	METS	2.6	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	NICKEL	METS	2.5	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	4.00E-04	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	3.00E-04	J	mg/kg	1.30E+02	2.04E+03		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	p,p'-DDD	PEST/PCB	0.0012	J	mg/kg	1.60E+01	9.95E+00		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	p,p'-DDT	PEST/PCB	0.038	=	mg/kg	3.20E+01	7.02E+00		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	POTASSIUM	METS	1,670	=	mg/kg			NA	NA
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	POTASSIUM	METS	1,650	=	mg/kg			NA	NA
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	POTASSIUM	METS	1,630	=	mg/kg			NA	NA
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	POTASSIUM	METS	1,570	=	mg/kg			NA	NA
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	POTASSIUM	METS	1,480	=	mg/kg			NA	NA
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	POTASSIUM	METS	1,420	=	mg/kg			NA	NA
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	POTASSIUM	METS	1,370	=	mg/kg			NA	NA
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	POTASSIUM	METS	1,330	=	mg/kg			NA	NA
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	POTASSIUM	METS	1,310	=	mg/kg			NA	NA
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	POTASSIUM	METS	1,230	=	mg/kg			NA	NA
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	POTASSIUM	METS	1,170	=	mg/kg			NA	NA
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	POTASSIUM	METS	866	J	mg/kg			NA	NA
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	POTASSIUM	METS	821	J	mg/kg			NA	NA
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	POTASSIUM	METS	785	J	mg/kg			NA	NA
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	SELENIUM	METS	0.81	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	SELENIUM	METS	0.74	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	SELENIUM	METS	0.69	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	SELENIUM	METS	0.64	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	SELENIUM	METS	0.58	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	SELENIUM	METS	0.57	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	SELENIUM	METS	0.56	J	mg/kg	5.00E+00	5.11E+02		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	SELENIUM	METS	0.56	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	SELENIUM	METS	0.46	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	SELENIUM	METS	0.46	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	SELENIUM	METS	0.44	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	SELENIUM	METS	0.42	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	SELENIUM	METS	0.32	J	mg/kg	5.00E+00	5.11E+02		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	SODIUM	METS	188	J	mg/kg			NA	NA
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	SODIUM	METS	165	J	mg/kg			NA	NA
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	SODIUM	METS	152	J	mg/kg			NA	NA
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	SODIUM	METS	149	J	mg/kg			NA	NA
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	SODIUM	METS	147	J	mg/kg			NA	NA
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	SODIUM	METS	146	J	mg/kg			NA	NA
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	SODIUM	METS	101	J	mg/kg			NA	NA
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	SODIUM	METS	56	J	mg/kg			NA	NA
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	SODIUM	METS	53	J	mg/kg			NA	NA
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	SODIUM	METS	52	J	mg/kg			NA	NA
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	SODIUM	METS	49	J	mg/kg			NA	NA
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	SODIUM	METS	47	J	mg/kg			NA	NA
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	SODIUM	METS	27	J	mg/kg			NA	NA
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	THALLIUM	METS	1.4	J	mg/kg	7.00E-01	6.75E+00	X	
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	THALLIUM	METS	1.3	J	mg/kg	7.00E-01	6.75E+00	X	
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	THALLIUM	METS	0.88	J	mg/kg	7.00E-01	6.75E+00	X	
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	THALLIUM	METS	0.87	J	mg/kg	7.00E-01	6.75E+00	X	
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	THALLIUM	METS	0.87	J	mg/kg	7.00E-01	6.75E+00	X	
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	THALLIUM	METS	0.83	J	mg/kg	7.00E-01	6.75E+00	X	
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	THALLIUM	METS	0.61	J	mg/kg	7.00E-01	6.75E+00	X	
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	THALLIUM	METS	0.66	J	mg/kg	7.00E-01	6.75E+00		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	THALLIUM	METS	0.65	J	mg/kg	7.00E-01	6.75E+00		
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	THALLIUM	METS	0.55	J	mg/kg	7.00E-01	6.75E+00		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	THALLIUM	METS	0.54	J	mg/kg	7.00E-01	6.75E+00		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	THALLIUM	METS	0.47	J	mg/kg	7.00E-01	6.75E+00		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	THALLIUM	METS	0.41	J	mg/kg	7.00E-01	6.75E+00		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	TOLUENE	VOC	0.0010	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	TOLUENE	VOC	6.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	TOLUENE	VOC	4.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	TOLUENE	VOC	4.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	TOLUENE	VOC	3.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	TOLUENE	VOC	3.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	TOLUENE	VOC	3.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	TOLUENE	VOC	3.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	VANADIUM	METS	63	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	VANADIUM	METS	62	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	VANADIUM	METS	61	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	VANADIUM	METS	59	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	VANADIUM	METS	58	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	VANADIUM	METS	56	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	VANADIUM	METS	50	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	VANADIUM	METS	50	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	VANADIUM	METS	48	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	VANADIUM	METS	46	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	VANADIUM	METS	43	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	VANADIUM	METS	37	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	VANADIUM	METS	35	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	VANADIUM	METS	30	=	mg/kg	6.00E+03	7.15E+02		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	XYLENES, TOTAL	VOC	0.0010	J	mg/kg	2.10E+02	4.20E+01		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	XYLENES, TOTAL	VOC	0.0010	J	mg/kg	2.10E+02	4.20E+01		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	XYLENES, TOTAL	VOC	4.00E-04	J	mg/kg	2.10E+02	4.20E+01		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	XYLENES, TOTAL	VOC	4.00E-04	J	mg/kg	2.10E+02	4.20E+01		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.10E+02	4.20E+01		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWM14	W14-SB10	NDA169	04/06/00	4	6	SB	ZINC	METS	45	J	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB14	NDA177	04/06/00	4	6	SB	ZINC	METS	40	J	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB08	NDA165	04/06/00	4	6	SB	ZINC	METS	40	J	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB01	NDA148	04/05/00	4	6	SB	ZINC	METS	38	=	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB13	NDA175	04/06/00	4	6	SB	ZINC	METS	37	J	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB04	NDA156	04/05/00	4	6	SB	ZINC	METS	36	=	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB03	NDA154	04/05/00	4	6	SB	ZINC	METS	32	=	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB11	NDA171	04/06/00	4	6	SB	ZINC	METS	31	J	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB02	NDA151	04/05/00	4	6	SB	ZINC	METS	30	=	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB06	NDA160	04/05/00	4	6	SB	ZINC	METS	30	=	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB09	NDA167	04/06/00	4	6	SB	ZINC	METS	30	J	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB12	NDA173	04/06/00	4	6	SB	ZINC	METS	29	J	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB07	NDA162	04/05/00	4	6	SB	ZINC	METS	24	=	mg/kg	1.20E+04	1.00E+04		
SWM14	W14-SB05	NDA158	04/05/00	4	6	SB	ZINC	METS	23	=	mg/kg	1.20E+04	1.00E+04		
SWMU5	W5-SB03	NDA089	04/14/00	2	4	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
SWMU5	W5-SB03	NDA099	04/14/00	4	6	SB	1,2-DICHLOROETHANE	VOC	3.00E-04	J	mg/kg	2.00E-02	6.03E-01		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	ACENAPHTHYLENE	SVOC	0.098	J	mg/kg	5.70E+02	2.92E+03		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	ANTHRACENE	SVOC	0.020	J	mg/kg	1.20E+04	1.00E+04		
SWMU5	W5-SB01	NDA085	04/13/00	4	6	SB	BENZENE	VOC	2.00E-04	J	mg/kg	3.00E-02	1.31E+00		
SWMU5	W5-SB01	NDA092	04/13/00	9	11	SB	BENZENE	VOC	2.00E-04	J	mg/kg	3.00E-02	1.31E+00		
SWMU5	W5-SB04	NDA296	04/17/00	8	10	SB	BENZENE	VOC	2.00E-04	J	mg/kg	3.00E-02	1.31E+00		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	BENZO(a)ANTHRACENE	SVOC	0.075	J	mg/kg	2.00E+00	2.11E+00		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	BENZO(a)ANTHRACENE	SVOC	0.018	J	mg/kg	2.00E+00	2.11E+00		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	BENZO(a)PYRENE	SVOC	0.16	J	mg/kg	8.00E+00	2.11E-01		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	BENZO(a)PYRENE	SVOC	0.031	J	mg/kg	8.00E+00	2.11E-01		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	BENZO(b)FLUORANTHENE	SVOC	0.12	J	mg/kg	5.00E+00	2.11E+00		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	BENZO(b)FLUORANTHENE	SVOC	0.025	J	mg/kg	5.00E+00	2.11E+00		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	BENZO(g,h,i)PERYLENE	SVOC	0.18	J	mg/kg	5.00E+00	2.11E+00		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	BENZO(g,h,i)PERYLENE	SVOC	0.040	J	mg/kg	5.00E+00	2.11E+00		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	BENZO(k)FLUORANTHENE	SVOC	0.10	J	mg/kg	4.90E+01	2.11E+01		
SWMU5	W5-SB04	NDA298	04/17/00	4	8	SB	BENZO(k)FLUORANTHENE	SVOC	0.028	J	mg/kg	4.90E+01	2.11E+01		
SWMU5	W5-SB01	NDA092	04/13/00	9	11	SB	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.032	J	mg/kg		1.23E+02	NA	
SWMU5	W5-SB02	NDA087	04/14/00	2	4	SB	CARBON DISULFIDE	VOC	0.010	J	mg/kg	3.20E+01	7.20E+01		
SWMU5	W5-SB04	NDA299	04/17/00	6	8	SB	CARBON DISULFIDE	VOC	9.00E-04	J	mg/kg	3.20E+01	7.20E+01		
SWMU5	W5-SB02	NDA096	04/14/00	4	5	SB	CARBON DISULFIDE	VOC	6.00E-04	J	mg/kg	3.20E+01	7.20E+01		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	CARBON DISULFIDE	VOC	6.00E-04	J	mg/kg	3.20E+01	7.20E+01		
SWMU5	W5-SB04	NDA296	04/17/00	8	10	SB	CARBON DISULFIDE	VOC	6.00E-04	J	mg/kg	3.20E+01	7.20E+01		
SWMU5	W5-SB02	NDA097	04/14/00	5	6	SB	CARBON DISULFIDE	VOC	4.00E-04	J	mg/kg	3.20E+01	7.20E+01		
SWMU5	W5-SB03	NDA089	04/14/00	2	4	SB	CARBON DISULFIDE	VOC	3.00E-04	J	mg/kg	3.20E+01	7.20E+01		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	CHRYSENE	SVOC	0.13	J	mg/kg	1.60E+02	2.11E+02		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	CHRYSENE	SVOC	0.021	J	mg/kg	1.60E+02	2.11E+02		
SWMU5	W5-SB02	NDA096	04/14/00	4	5	SB	DI-n-BUTYL PHTHALATE	SVOC	0.042	J	mg/kg	2.30E+03	6.18E+03		
SWMU5	W5-SB02	NDA087	04/14/00	2	4	SB	DI-n-BUTYL PHTHALATE	SVOC	0.040	J	mg/kg	2.30E+03	8.16E+03		
SWMU5	W5-SB02	NDA097	04/14/00	5	6	SB	DI-n-BUTYL PHTHALATE	SVOC	0.031	J	mg/kg	2.30E+03	6.16E+03		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	DIBENZ(a,h)ANTHRACENE	SVOC	0.035	J	mg/kg	2.00E+00	2.11E-01		
SWMU5	W5-SB01	NDA094	04/13/00	19	21	SB	DIETHYL PHTHALATE	SVOC	0.068	J	mg/kg		1.00E+04	NA	
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	ETHYLBENZENE	VOC	0.0010	J	mg/kg	1.30E+01	1.95E+01		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	FLUORANTHENE	SVOC	0.10	J	mg/kg	4.30E+03	2.20E+03		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	FLUORANTHENE	SVOC	0.021	J	mg/kg	4.30E+03	2.20E+03		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	INDENO(1,2,3-c,d)PYRENE	SVOC	0.14	J	mg/kg	1.40E+01	2.11E+00		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	INDENO(1,2,3-c,d)PYRENE	SVOC	0.028	J	mg/kg	1.40E+01	2.11E+00		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0090	J	mg/kg		7.50E+02	NA	
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	9.00E-04	J	mg/kg		7.50E+02	NA	
SWMU5	W5-SB02	NDA096	04/14/00	4	5	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	5.00E-04	J	mg/kg		7.50E+02	NA	
SWMU5	W5-SB02	NDA087	04/14/00	2	4	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	4.00E-04	J	mg/kg		7.50E+02	NA	
SWMU5	W5-SB03	NDA089	04/14/00	2	4	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.00E-04	J	mg/kg		7.50E+02	NA	
SWMU5	W5-SB02	NDA097	04/14/00	5	6	SB	M,P-XYLENE (SUM OF ISOMERS)	VOC	2.00E-04	J	mg/kg		7.50E+02	NA	
SWMU5	W5-SB01	NDA094	04/13/00	19	21	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0030	J	mg/kg		2.71E+03	NA	
SWMU5	W5-SB01	NDA092	04/13/00	9	11	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0030	J	mg/kg		2.71E+03	NA	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
SWMU5	W5-SB02	NDA097	04/14/00	5	6	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0030	J	mg/kg		2.71E+03	NA	
SWMU5	W5-SB02	NDA096	04/14/00	4	5	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0020	J	mg/kg		2.71E+03	NA	
SWMU5	W5-SB01	NDA093	04/13/00	14	16	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0020	J	mg/kg		2.71E+03	NA	
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0020	J	mg/kg		2.71E+03	NA	
SWMU5	W5-SB01	NDA085	04/13/00	4	6	SB	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.0020	J	mg/kg		2.71E+03	NA	
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0030	J	mg/kg	1.30E+02	2.04E+03		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	3.00E-04	J	mg/kg	1.30E+02	2.04E+03		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	PHENANTHRENE	SVOC	0.042	J	mg/kg		7.44E-01	NA	
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	PYRENE	SVOC	0.17	J	mg/kg	4.20E+03	2.91E+03		
SWMU5	W5-SB04	NDA296	04/17/00	4	6	SB	PYRENE	SVOC	0.023	J	mg/kg	4.20E+03	2.91E+03		
SWMU5	W5-SB04	NDA298	04/17/00	4	6	SB	STYRENE	VOC	6.00E-04	J	mg/kg	4.00E+00	1.70E+02		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	TOLUENE	VOC	0.0010	J	mg/kg	1.20E+01	5.20E+01		
SWMU5	W5-SB01	NDA085	04/13/00	4	6	SB	TOLUENE	VOC	6.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWMU5	W5-SB01	NDA092	04/13/00	9	11	SB	TOLUENE	VOC	5.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWMU5	W5-SB02	NDA096	04/14/00	4	5	SB	TOLUENE	VOC	4.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWMU5	W5-SB04	NDA296	04/17/00	8	10	SB	TOLUENE	VOC	3.00E-04	J	mg/kg	1.20E+01	5.20E+01		
SWMU5	W5-SB04	NDA297	04/17/00	2	4	SB	XYLENES, TOTAL	VOC	0.012	=	mg/kg	2.10E+02	4.20E+01		
SWMU5	W5-SB04	NDA296	04/17/00	4	6	SB	XYLENES, TOTAL	VOC	0.0010	J	mg/kg	2.10E+02	4.20E+01		
SWMU5	W5-SB02	NDA096	04/14/00	4	5	SB	XYLENES, TOTAL	VOC	5.00E-04	J	mg/kg	2.10E+02	4.20E+01		
SWMU5	W5-SB02	NDA087	04/14/00	2	4	SB	XYLENES, TOTAL	VOC	4.00E-04	J	mg/kg	2.10E+02	4.20E+01		
SWMU5	W5-SB03	NDA089	04/14/00	2	4	SB	XYLENES, TOTAL	VOC	3.00E-04	J	mg/kg	2.10E+02	4.20E+01		
SWMU5	W5-SB02	NDA097	04/14/00	5	6	SB	XYLENES, TOTAL	VOC	2.00E-04	J	mg/kg	2.10E+02	4.20E+01		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	1,1-DICHLOROETHENE	VOC	0.0011	J	mg/kg	6.00E-02	4.13E+01		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	1,1-DICHLOROETHENE	VOC	8.50E-04	J	mg/kg	6.00E-02	4.13E+01		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	ALDRIN	PEST/PCB	5.50E-04	J	mg/kg	5.00E-01	1.01E-01		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	ALUMINUM	METS	17,600	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	ALUMINUM	METS	17,200	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	ALUMINUM	METS	17,000	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	ALUMINUM	METS	16,800	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	ALUMINUM	METS	12,400	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	ALUMINUM	METS	11,800	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	ALUMINUM	METS	11,000	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	ALUMINUM	METS	10,300	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB18	NDE264	04/13/01	4	6	SB	ALUMINUM	METS	9,470	=	mg/kg		1.00E+04	NA	
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	ALUMINUM	METS	7,530	=	mg/kg		1.00E+04	NA	
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	ALUMINUM	METS	6,710	=	mg/kg		1.00E+04	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	ALUMINUM	METS	5,900	=	mg/kg		1.00E+04	NA	
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	ALUMINUM	METS	5,370	=	mg/kg		1.00E+04	NA	
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.8	SB	ALUMINUM	METS	5,300	=	mg/kg		1.00E+04	NA	
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	ALUMINUM	METS	5,100	=	mg/kg		1.00E+04	NA	
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	ALUMINUM	METS	4,700	=	mg/kg		1.00E+04	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	ANTIMONY	METS	0.43	J	mg/kg	5.00E+00	4.09E+01		
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	ANTIMONY	METS	0.38	J	mg/kg	5.00E+00	4.09E+01		
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	ANTIMONY	METS	0.33	J	mg/kg	5.00E+00	4.09E+01		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	ANTIMONY	METS	0.31	J	mg/kg	5.00E+00	4.09E+01		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	ARSENIC	METS	0.74	J	mg/kg	2.90E+01	1.59E+00		
AOC B	AB-SB10	NDE251	04/13/01	4	8	SB	ARSENIC	METS	0.72	J	mg/kg	2.90E+01	1.59E+00		
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	ARSENIC	METS	0.62	J	mg/kg	2.90E+01	1.59E+00		
AOC B	WWTPSB002	NDC013	06/06/00	0	5	SB	ARSENIC	METS	0.60	J	mg/kg	2.90E+01	1.59E+00		
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	ARSENIC	METS	0.52	J	mg/kg	2.90E+01	1.59E+00		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	BARIUM	METS	118	=	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB002	NDC013	06/06/00	0	5	SB	BARIUM	METS	115	=	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB003	NDC014	06/06/00	0	5	SB	BARIUM	METS	108	=	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB001	NDC011	06/06/00	0	5	SB	BARIUM	METS	102	=	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB004	NDC015	06/06/00	0	5	SB	BARIUM	METS	102	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB06	NDE246	04/13/01	4	6	SB	BARIUM	METS	98	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB10	NDE251	04/13/01	4	8	SB	BARIUM	METS	78	=	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	BARIUM	METS	76	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	BARIUM	METS	72	=	mg/kg	1.60E+03	6.66E+03		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	BARIUM	METS	70	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	BARIUM	METS	68	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	BARIUM	METS	64	=	mg/kg	1.80E+03	6.66E+03		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	BARIUM	METS	62	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	BARIUM	METS	55	=	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	BARIUM	METS	52	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	BARIUM	METS	48	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	BARIUM	METS	47	=	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	BARIUM	METS	44	=	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	BARIUM	METS	36	J	mg/kg	1.60E+03	6.66E+03		
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	BARIUM	METS	31	J	mg/kg	1.60E+03	6.66E+03		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	BERYLLIUM	METS	0.50	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	BERYLLIUM	METS	0.42	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	BERYLLIUM	METS	0.39	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	BERYLLIUM	METS	0.39	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	BERYLLIUM	METS	0.37	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	BERYLLIUM	METS	0.35	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	BERYLLIUM	METS	0.35	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	BERYLLIUM	METS	0.33	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	BERYLLIUM	METS	0.31	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	BERYLLIUM	METS	0.26	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	BERYLLIUM	METS	0.23	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	BERYLLIUM	METS	0.19	J	mg/kg	6.30E+01	1.94E+03		
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	BERYLLIUM	METS	0.13	J	mg/kg	6.30E+01	1.94E+03		
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	bis(2-ETHYLHEXYL) PHTHALATE	SVOC	0.093	J	mg/kg		1.23E+02	NA	
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	CALCIUM	METS	6,790	=	mg/kg			NA	NA
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	CALCIUM	METS	5,730	=	mg/kg			NA	NA
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	CALCIUM	METS	4,700	=	mg/kg			NA	NA
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	CALCIUM	METS	3,470	=	mg/kg			NA	NA
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	CALCIUM	METS	2,740	=	mg/kg			NA	NA
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	CALCIUM	METS	2,570	=	mg/kg			NA	NA
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	CALCIUM	METS	2,190	=	mg/kg			NA	NA
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	CALCIUM	METS	2,100	=	mg/kg			NA	NA
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	CALCIUM	METS	1,890	=	mg/kg			NA	NA
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	CALCIUM	METS	1,870	=	mg/kg			NA	NA
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	CALCIUM	METS	1,730	=	mg/kg			NA	NA
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	CALCIUM	METS	1,720	=	mg/kg			NA	NA
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	CALCIUM	METS	1,600	=	mg/kg			NA	NA
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	CALCIUM	METS	1,600	=	mg/kg			NA	NA
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	CALCIUM	METS	1,500	=	mg/kg			NA	NA
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	CALCIUM	METS	1,200	=	mg/kg			NA	NA
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	14	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	14	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	13	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	CHROMIUM, TOTAL	METS	12	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	11	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	10	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	CHROMIUM, TOTAL	METS	9.7	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB001	NDC011	06/08/00	0	5	SB	CHROMIUM, TOTAL	METS	9.6	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	9.1	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	CHROMIUM, TOTAL	METS	8.9	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB09	NDE246	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	8.9	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	7.7	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB002	NDC013	06/08/00	0	5	SB	CHROMIUM, TOTAL	METS	7.2	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB004	NDC015	06/08/00	0	5	SB	CHROMIUM, TOTAL	METS	7.0	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	CHROMIUM, TOTAL	METS	7.0	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	6.0	=	mg/kg	3.80E+01	6.40E+01		
AOC B	WWTPSB003	NDC014	06/08/00	0	5	SB	CHROMIUM, TOTAL	METS	5.8	=	mg/kg	3.80E+01	6.40E+01		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	5.7	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	CHROMIUM, TOTAL	METS	5.4	=	mg/kg	3.80E+01	6.40E+01		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	COBALT	METS	13	=	mg/kg		1.92E+03	NA	
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	COBALT	METS	12	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	COBALT	METS	9.5	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	COBALT	METS	9.0	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	COBALT	METS	8.3	J	mg/kg		1.92E+03	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	COBALT	METS	7.8	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	COBALT	METS	7.8	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	COBALT	METS	7.0	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	COBALT	METS	6.9	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	COBALT	METS	6.8	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	COBALT	METS	6.2	J	mg/kg		1.92E+03	NA	
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	COBALT	METS	5.9	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	COBALT	METS	5.7	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	COBALT	METS	5.7	J	mg/kg		1.92E+03	NA	
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	COBALT	METS	4.9	J	mg/kg		1.92E+03	NA	
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	COBALT	METS	3.6	J	mg/kg		1.92E+03	NA	
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	COPPER	METS	38	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	COPPER	METS	38	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	COPPER	METS	35	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	COPPER	METS	33	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	COPPER	METS	30	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	COPPER	METS	28	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	COPPER	METS	26	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	COPPER	METS	25	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB004	NDC015	06/08/00	0	5	SB	COPPER	METS	23	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	COPPER	METS	23	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB002	NDC013	06/08/00	0	5	SB	COPPER	METS	22	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	COPPER	METS	22	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB003	NDC014	06/08/00	0	5	SB	COPPER	METS	21	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	COPPER	METS	21	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	COPPER	METS	21	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB001	NDC011	06/08/00	0	5	SB	COPPER	METS	20	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	COPPER	METS	18	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	COPPER	METS	18	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	COPPER	METS	17	=	mg/kg		4.09E+03	NA	
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	COPPER	METS	16	=	mg/kg		4.09E+03	NA	
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	IRON	METS	30,300	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	IRON	METS	29,800	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	IRON	METS	25,900	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	IRON	METS	25,000	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	IRON	METS	24,800	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	IRON	METS	23,700	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	IRON	METS	19,900	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB15	NDE262	04/13/01	4	8	SB	IRON	METS	19,100	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	IRON	METS	19,000	=	mg/kg		1.00E+04	NA	X
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	IRON	METS	16,000	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	IRON	METS	15,200	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	IRON	METS	15,000	=	mg/kg		1.00E+04	NA	X
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	IRON	METS	14,000	=	mg/kg		1.00E+04	NA	X
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	IRON	METS	14,000	=	mg/kg		1.00E+04	NA	X
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	IRON	METS	12,500	=	mg/kg		1.00E+04	NA	X
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	IRON	METS	12,000	=	mg/kg		1.00E+04	NA	X
AOC B	WWTPSB002	NDC013	06/08/00	0	5	SB	LEAD	METS	3.5	=	mg/kg		7.50E+02	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	LEAD	METS	1.8	=	mg/kg		7.50E+02	NA	
AOC B	WWTPSB003	NDC014	06/08/00	0	5	SB	LEAD	METS	1.2	=	mg/kg		7.50E+02	NA	
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	LEAD	METS	1.2	=	mg/kg		7.50E+02	NA	
AOC B	WWTPSB001	NDC011	06/08/00	0	5	SB	LEAD	METS	0.95	=	mg/kg		7.50E+02	NA	

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	LEAD	METS	0.93	=	mg/kg		7.50E+02	NA	
AOC B	WWTPSB004	NDC015	06/08/00	0	5	SB	LEAD	METS	0.67	=	mg/kg		7.50E+02	NA	
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	LEAD	METS	0.65	=	mg/kg		7.50E+02	NA	
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	MAGNESIUM	METS	4,210	=	mg/kg			NA	NA
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	MAGNESIUM	METS	4,040	=	mg/kg			NA	NA
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	MAGNESIUM	METS	3,990	=	mg/kg			NA	NA
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	MAGNESIUM	METS	3,460	=	mg/kg			NA	NA
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	MAGNESIUM	METS	3,210	=	mg/kg			NA	NA
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	MAGNESIUM	METS	2,830	=	mg/kg			NA	NA
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	MAGNESIUM	METS	2,800	=	mg/kg			NA	NA
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	MAGNESIUM	METS	2,680	=	mg/kg			NA	NA
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	MAGNESIUM	METS	2,440	=	mg/kg			NA	NA
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	MAGNESIUM	METS	2,330	=	mg/kg			NA	NA
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	MAGNESIUM	METS	2,300	=	mg/kg			NA	NA
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	MAGNESIUM	METS	2,040	=	mg/kg			NA	NA
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	MAGNESIUM	METS	2,020	=	mg/kg			NA	NA
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	MAGNESIUM	METS	2,000	=	mg/kg			NA	NA
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	MAGNESIUM	METS	1,960	=	mg/kg			NA	NA
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	MAGNESIUM	METS	1,800	=	mg/kg			NA	NA
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	MANGANESE	METS	735	=	mg/kg		1.95E+03	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	MANGANESE	METS	670	J	mg/kg		1.95E+03	NA	
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	MANGANESE	METS	616	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	MANGANESE	METS	595	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	MANGANESE	METS	551	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	MANGANESE	METS	475	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	MANGANESE	METS	395	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	MANGANESE	METS	325	=	mg/kg		1.95E+03	NA	
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	MANGANESE	METS	320	J	mg/kg		1.95E+03	NA	
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	MANGANESE	METS	290	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	MANGANESE	METS	289	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	MANGANESE	METS	278	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	MANGANESE	METS	260	=	mg/kg		1.95E+03	NA	
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	MANGANESE	METS	259	=	mg/kg		1.95E+03	NA	
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	MANGANESE	METS	210	J	mg/kg		1.95E+03	NA	
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	MANGANESE	METS	95	J	mg/kg		1.95E+03	NA	
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	MERCURY	METS	0.021	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	MERCURY	METS	0.017	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	MERCURY	METS	0.014	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	MERCURY	METS	0.012	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	MERCURY	METS	0.011	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	MERCURY	METS	0.0099	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	MERCURY	METS	0.0089	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	MERCURY	METS	0.0074	J	mg/kg		3.07E+01	NA	
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	MERCURY	METS	0.0071	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	MERCURY	METS	0.0070	J	mg/kg		3.07E+01	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	MERCURY	METS	0.0065	J	mg/kg		3.07E+01	NA	
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	MERCURY	METS	0.0050	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	MERCURY	METS	0.0044	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	MERCURY	METS	0.0043	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	MERCURY	METS	0.0036	J	mg/kg		3.07E+01	NA	
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	MERCURY	METS	0.0033	J	mg/kg		3.07E+01	NA	
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	'HYL ISOBUTYL KETONE (4-METHYL-2-PENTANC	VOC	0.0042	J	mg/kg		2.84E+02	NA	
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	'HYL ISOBUTYL KETONE (4-METHYL-2-PENTANC	VOC	0.0033	J	mg/kg		2.84E+02	NA	
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	'HYL ISOBUTYL KETONE (4-METHYL-2-PENTANC	VOC	0.0010	J	mg/kg		2.84E+02	NA	
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	NICKEL	METS	6.9	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	NICKEL	METS	6.5	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	NICKEL	METS	6.5	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	NICKEL	METS	6.4	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	NICKEL	METS	5.8	J	mg/kg	1.30E+02	2.04E+03		

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	NICKEL	METS	5.7	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	NICKEL	METS	5.0	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	NICKEL	METS	4.9	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	NICKEL	METS	4.3	J	mg/kg	1.30E+02	2.04E+03		
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	NICKEL	METS	4.1	J	mg/kg	1.30E+02	2.04E+03		
AOC B	WWTPSB001	NDC011	06/08/00	0	5	SB	NICKEL	METS	3.5	J	mg/kg	1.30E+02	2.04E+03		
AOC B	WWTPSB002	NDC013	06/08/00	0	5	SB	NICKEL	METS	3.5	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	NICKEL	METS	3.3	J	mg/kg	1.30E+02	2.04E+03		
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	NICKEL	METS	3.1	J	mg/kg	1.30E+02	2.04E+03		
AOC B	WWTPSB004	NDC015	06/08/00	0	5	SB	NICKEL	METS	3.1	J	mg/kg	1.30E+02	2.04E+03		
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	NICKEL	METS	3.0	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	NICKEL	METS	3.0	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	NICKEL	METS	2.8	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	NICKEL	METS	2.5	J	mg/kg	1.30E+02	2.04E+03		
AOC B	WWTPSB003	NDC014	06/08/00	0	5	SB	NICKEL	METS	2.5	J	mg/kg	1.30E+02	2.04E+03		
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	POTASSIUM	METS	1,870	=	mg/kg			NA	NA
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	POTASSIUM	METS	1,740	=	mg/kg			NA	NA
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	POTASSIUM	METS	1,740	=	mg/kg			NA	NA
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	POTASSIUM	METS	1,720	=	mg/kg			NA	NA
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	POTASSIUM	METS	1,510	=	mg/kg			NA	NA
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	POTASSIUM	METS	1,400	=	mg/kg			NA	NA
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	POTASSIUM	METS	1,400	=	mg/kg			NA	NA
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	POTASSIUM	METS	1,290	=	mg/kg			NA	NA
AOC B	AB-SB16	NDE264	04/13/01	4	8	SB	POTASSIUM	METS	1,160	=	mg/kg			NA	NA
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	POTASSIUM	METS	1,060	J	mg/kg			NA	NA
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	POTASSIUM	METS	1,000	J	mg/kg			NA	NA
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	POTASSIUM	METS	950	J	mg/kg			NA	NA
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	POTASSIUM	METS	900	J	mg/kg			NA	NA
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	POTASSIUM	METS	830	J	mg/kg			NA	NA
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	POTASSIUM	METS	827	J	mg/kg			NA	NA
AOC B	WWTPSB004	NDE196	12/04/00	4.8	5.6	SB	POTASSIUM	METS	810	J	mg/kg			NA	NA
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	SELENIUM	METS	0.93	J	mg/kg	5.00E+00	5.11E+02		
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	SELENIUM	METS	0.92	J	mg/kg	5.00E+00	5.11E+02		
AOC B	WWTPSB001	NDC011	06/08/00	0	5	SB	SELENIUM	METS	0.83	J	mg/kg	5.00E+00	5.11E+02		
AOC B	WWTPSB002	NDC013	06/08/00	0	5	SB	SELENIUM	METS	0.79	J	mg/kg	5.00E+00	5.11E+02		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	SELENIUM	METS	0.77	J	mg/kg	5.00E+00	5.11E+02		
AOC B	WWTPSB004	NDC015	06/08/00	0	5	SB	SELENIUM	METS	0.75	J	mg/kg	5.00E+00	5.11E+02		
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	SELENIUM	METS	0.87	J	mg/kg	5.00E+00	5.11E+02		
AOC B	WWTPSB003	NDC014	06/08/00	0	5	SB	SELENIUM	METS	0.66	J	mg/kg	5.00E+00	5.11E+02		
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	SELENIUM	METS	0.63	J	mg/kg	5.00E+00	5.11E+02		
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	SELENIUM	METS	0.62	J	mg/kg	5.00E+00	5.11E+02		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	SELENIUM	METS	0.58	J	mg/kg	5.00E+00	5.11E+02		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	SELENIUM	METS	0.57	J	mg/kg	5.00E+00	5.11E+02		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	SILVER	METS	0.13	J	mg/kg	3.40E+01	5.11E+02		
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	SILVER	METS	0.13	J	mg/kg	3.40E+01	5.11E+02		
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	SILVER	METS	0.11	J	mg/kg	3.40E+01	5.11E+02		
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	SILVER	METS	0.097	J	mg/kg	3.40E+01	5.11E+02		
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	SILVER	METS	0.090	J	mg/kg	3.40E+01	5.11E+02		
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	SODIUM	METS	160	J	mg/kg			NA	NA
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	SODIUM	METS	159	J	mg/kg			NA	NA
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	SODIUM	METS	152	J	mg/kg			NA	NA
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	SODIUM	METS	146	J	mg/kg			NA	NA
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	SODIUM	METS	145	J	mg/kg			NA	NA
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	SODIUM	METS	104	J	mg/kg			NA	NA
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	SODIUM	METS	101	J	mg/kg			NA	NA
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	SODIUM	METS	97	J	mg/kg			NA	NA
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	SODIUM	METS	81	J	mg/kg			NA	NA
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	SODIUM	METS	79	J	mg/kg			NA	NA
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	SODIUM	METS	78	J	mg/kg			NA	NA

APPENDIX B-4
Data Screening for Subsurface Soils
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

SiteID	StationID	SampleID	DateCollected	Upper Depth (feet)	Lower Depth (feet)	Matrix	Chemical	Class	Result	Qualifier	Units	SSL (DAF = 20)[1]	Industrial PRG (HI = 0.1)[2]	Exceeds SSL	Exceeds Industrial PRG
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	SODIUM	METS	72	J	mg/kg			NA	NA
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	SODIUM	METS	66	J	mg/kg			NA	NA
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	SODIUM	METS	65	J	mg/kg			NA	NA
AOC B	WWTPSB004	NDE196	12/04/00	4.6	5.6	SB	SODIUM	METS	63	J	mg/kg			NA	NA
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	SODIUM	METS	40	J	mg/kg			NA	NA
AOC B	WWTPSB004	NDE196	12/04/00	4.6	5.6	SB	THALLIUM	METS	0.40	J	mg/kg	7.00E-01	6.75E+00		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	TOLUENE	VOC	3.50E-04	J	mg/kg	1.20E+01	5.20E+01		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	TOLUENE	VOC	3.50E-04	J	mg/kg	1.20E+01	5.20E+01		
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	TOLUENE	VOC	2.80E-04	J	mg/kg	1.20E+01	5.20E+01		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	TOLUENE	VOC	2.10E-04	J	mg/kg	1.20E+01	5.20E+01		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	VANADIUM	METS	82	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	VANADIUM	METS	82	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	VANADIUM	METS	75	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	VANADIUM	METS	69	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB09	NDE248	04/13/01	4	6	SB	VANADIUM	METS	69	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	VANADIUM	METS	65	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	VANADIUM	METS	57	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	VANADIUM	METS	52	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	VANADIUM	METS	50	=	mg/kg	6.00E+03	7.15E+02		
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	VANADIUM	METS	47	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	VANADIUM	METS	44	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	VANADIUM	METS	42	=	mg/kg	6.00E+03	7.15E+02		
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	VANADIUM	METS	41	=	mg/kg	6.00E+03	7.15E+02		
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	VANADIUM	METS	40	=	mg/kg	6.00E+03	7.15E+02		
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	VANADIUM	METS	36	=	mg/kg	6.00E+03	7.15E+02		
AOC B	WWTPSB004	NDE196	12/04/00	4.6	5.6	SB	VANADIUM	METS	35	=	mg/kg	6.00E+03	7.15E+02		
AOC B	WWTPSB002	NDC013	06/08/00	0	5	SB	ZINC	METS	99	J	mg/kg	1.20E+04	1.00E+04		
AOC B	WWTPSB003	NDC014	06/08/00	0	5	SB	ZINC	METS	93	J	mg/kg	1.20E+04	1.00E+04		
AOC B	WWTPSB004	NDC015	06/08/00	0	5	SB	ZINC	METS	89	J	mg/kg	1.20E+04	1.00E+04		
AOC B	WWTPSB001	NDC011	06/08/00	0	5	SB	ZINC	METS	73	J	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB11	NDE253	04/13/01	4	6	SB	ZINC	METS	49	J	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB07	NDE244	04/13/01	4	6	SB	ZINC	METS	42	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB10	NDE251	04/13/01	4	6	SB	ZINC	METS	36	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB08	NDE246	04/13/01	4	6	SB	ZINC	METS	36	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB13	NDE257	04/13/01	4	6	SB	ZINC	METS	34	J	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB06	NDE242	04/13/01	4	6	SB	ZINC	METS	32	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB09	NDE246	04/13/01	4	6	SB	ZINC	METS	31	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB15	NDE262	04/13/01	4	6	SB	ZINC	METS	31	J	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB16	NDE264	04/13/01	4	6	SB	ZINC	METS	26	J	mg/kg	1.20E+04	1.00E+04		
AOC B	WWTPSB004	NDE196	12/04/00	4.6	5.6	SB	ZINC	METS	26	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB14	NDE259	04/13/01	4	6	SB	ZINC	METS	25	J	mg/kg	1.20E+04	1.00E+04		
AOC B	WWTPSB001	NDE189	12/04/00	4.5	5.5	SB	ZINC	METS	23	=	mg/kg	1.20E+04	1.00E+04		
AOC B	WWTPSB003	NDE193	12/04/00	4.5	5.5	SB	ZINC	METS	21	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB12	NDE255	04/13/01	4	6	SB	ZINC	METS	21	J	mg/kg	1.20E+04	1.00E+04		
AOC B	WWTPSB002	NDE191	12/04/00	5	6	SB	ZINC	METS	20	=	mg/kg	1.20E+04	1.00E+04		
AOC B	AB-SB05	NDE240	04/13/01	4	6	SB	ZINC	METS	16	=	mg/kg	1.20E+04	1.00E+04		

Notes:
[1]EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
[2] Region 9 Preliminary Remediation Goals (PRG, EPA, 2002), http://www.epa.gov/region09/waste/sfund/prg/index.htm
X indicades that detected concentration exceeds screening criteria.
Bold and boxed concentrations exceed screening criteria (PRG and/or SSL).
Only chemical concentrations that exceed screening criteria and were collected less than 10 feet below land surface were used in the Risk Assessment.

Appendix B-5
Data Screening for Sediments

APPENDIX B-5
Data Screening for Sediments
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	SiteID	StationID	SampleID	DateCollected	Matrix	Chemical	Class	Result	Qualifier	Units	Ecological Criteria	Exceeds Eco Criteria
1	AOC C	AC-SD01	NDA054	04/07/00	SD	ALUMINUM	METS	9,050	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	ALUMINUM	METS	4,380	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	ANTIMONY	METS	0.22	J	mg/kg	12	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	ARSENIC	METS	0.75	J	mg/kg	7.2	
1	AOC C	AC-SD02	NDA055	04/07/00	SD	BARIUM	METS	75	J	mg/kg	200	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	BARIUM	METS	46	J	mg/kg	200	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	BERYLLIUM	METS	0.14	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	BERYLLIUM	METS	0.088	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	CALCIUM	METS	8,980	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	CALCIUM	METS	4,570	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	CHROMIUM, TOTAL	METS	13	J	mg/kg	52	
1	AOC C	AC-SD02	NDA055	04/07/00	SD	CHROMIUM, TOTAL	METS	7.7	J	mg/kg	52	
1	AOC C	AC-SD02	NDA055	04/07/00	SD	COBALT	METS	9.5	J	mg/kg	20	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	COBALT	METS	7.6	J	mg/kg	20	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	**COPPER**	METS	**24**	J	mg/kg	19	X
1	AOC C	AC-SD02	NDA055	04/07/00	SD	COPPER	METS	16	J	mg/kg	19	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	**DIELDRIN**	PEST/PCB	**0.0044**	J	mg/kg	0.0033	X
1	AOC C	AC-SD01	NDA054	04/07/00	SD	ETHYLBENZENE	VOC	0.0020	J	mg/kg	3.6	
1	AOC C	AC-SD02	NDA055	04/07/00	SD	ETHYLBENZENE	VOC	3.00E-04	J	mg/kg	3.6	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	IRON	METS	15,700	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	IRON	METS	9,310	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	LEAD	METS	11	=	mg/kg	30	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	LEAD	METS	8.5	=	mg/kg	30	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0090	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0020	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	MAGNESIUM	METS	4,950	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	MAGNESIUM	METS	2,900	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	MANGANESE	METS	546	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	MANGANESE	METS	387	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	NICKEL	METS	7.7	J	mg/kg	16	
1	AOC C	AC-SD02	NDA055	04/07/00	SD	NICKEL	METS	4.3	J	mg/kg	16	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0020	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	5.00E-04	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	p,p'-DDE	PEST/PCB	8.00E-04	J	mg/kg	0.0033	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	POTASSIUM	METS	1,070	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	POTASSIUM	METS	577	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	SELENIUM	METS	0.51	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	SELENIUM	METS	0.25	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	SODIUM	METS	224	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	SODIUM	METS	81	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	THALLIUM	METS	0.56	J	mg/kg		
1	AOC C	AC-SD02	NDA055	04/07/00	SD	THALLIUM	METS	0.32	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	TOLUENE	VOC	0.0020	J	mg/kg	0.67	
1	AOC C	AC-SD02	NDA055	04/07/00	SD	TOLUENE	VOC	5.00E-04	J	mg/kg	0.67	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	VANADIUM	METS	45	J	mg/kg		

APPENDIX B-5
Data Screening for Sediments
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	SiteID	StationID	SampleID	DateCollected	Matrix	Chemical	Class	Result	Qualifier	Units	Ecological Criteria	Exceeds Eco Criteria
1	AOC C	AC-SD02	NDA055	04/07/00	SD	VANADIUM	METS	28	J	mg/kg		
1	AOC C	AC-SD01	NDA054	04/07/00	SD	XYLENES, TOTAL	VOC	0.012	J	mg/kg	0.050	
1	AOC C	AC-SD02	NDA055	04/07/00	SD	XYLENES, TOTAL	VOC	0.0020	J	mg/kg	0.050	
1	AOC C	AC-SD01	NDA054	04/07/00	SD	**ZINC**	METS	**287**	=	mg/kg	124	X
1	AOC C	AC-SD02	NDA055	04/07/00	SD	ZINC	METS	75	=	mg/kg	124	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**2-METHYLNAPHTHALENE**	SVOC	**4.5**	J	mg/kg	0.33	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**2-METHYLNAPHTHALENE**	SVOC	**2.5**	J	mg/kg	0.33	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**2-METHYLNAPHTHALENE**	SVOC	**0.52**	J	mg/kg	0.33	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	ALUMINUM	METS	22,300	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	ALUMINUM	METS	18,600	=	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	ALUMINUM	METS	13,500	=	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	ANTIMONY	METS	2.1	J	mg/kg	12	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	ANTIMONY	METS	1.6	J	mg/kg	12	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	ANTIMONY	METS	0.49	J	mg/kg	12	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	ARSENIC	METS	3.9	J	mg/kg	7.2	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	ARSENIC	METS	3.1	=	mg/kg	7.2	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	ARSENIC	METS	2.9	J	mg/kg	7.2	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	BARIUM	METS	144	=	mg/kg	200	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	BARIUM	METS	132	=	mg/kg	200	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	BARIUM	METS	85	=	mg/kg	200	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	BENZENE	VOC	0.0050	J	mg/kg	0.057	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	BENZENE	VOC	0.0030	J	mg/kg	0.057	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	BERYLLIUM	METS	0.40	J	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	BERYLLIUM	METS	0.33	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	BERYLLIUM	METS	0.21	J	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**bis(2-ETHYLHEXYL) PHTHALATE**	SVOC	**9.4**	=	mg/kg	0.18	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**bis(2-ETHYLHEXYL) PHTHALATE**	SVOC	**8.9**	J	mg/kg	0.18	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**bis(2-ETHYLHEXYL) PHTHALATE**	SVOC	**3.9**	=	mg/kg	0.18	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**CADMIUM**	METS	**6.5**	=	mg/kg	1.0	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**CADMIUM**	METS	**5.9**	=	mg/kg	1.0	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**CADMIUM**	METS	**2.5**	=	mg/kg	1.0	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	CALCIUM	METS	41,000	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	CALCIUM	METS	26,000	=	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	CALCIUM	METS	25,100	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	CARBON DISULFIDE	VOC	0.0050	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	CARBON DISULFIDE	VOC	0.0030	J	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	CHROMIUM, TOTAL	METS	51	=	mg/kg	52	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	CHROMIUM, TOTAL	METS	39	=	mg/kg	52	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	CHROMIUM, TOTAL	METS	33	=	mg/kg	52	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	COBALT	METS	19	J	mg/kg	20	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	COBALT	METS	17	J	mg/kg	20	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	COBALT	METS	14	J	mg/kg	20	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**COPPER**	METS	**158**	=	mg/kg	19	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**COPPER**	METS	**130**	=	mg/kg	19	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**COPPER**	METS	**80**	=	mg/kg	19	X

APPENDIX B-5
Data Screening for Sediments
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	SiteID	StationID	SampleID	DateCollected	Matrix	Chemical	Class	Result	Qualifier	Units	Ecological Criteria	Exceeds Eco Criteria
1	SWM14	W14-SD01	NDA050	04/06/00	SD	ETHYLBENZENE	VOC	0.45	J	mg/kg	3.6	
1	SWM14	W14-SD03	NDA053DL1	04/06/00	SD	ETHYLBENZENE	VOC	0.12	J	mg/kg	3.6	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	ETHYLBENZENE	VOC	0.032	J	mg/kg	3.6	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	IRON	METS	38,100	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	IRON	METS	34,700	=	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	IRON	METS	28,400	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**LEAD**	METS	**111**	=	mg/kg	30	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**LEAD**	METS	**54**	=	mg/kg	30	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**LEAD**	METS	**31**	=	mg/kg	30	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.018	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.0070	J	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	MAGNESIUM	METS	10,500	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	MAGNESIUM	METS	9,020	=	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	MAGNESIUM	METS	8,870	=	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	MANGANESE	METS	607	J	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	MANGANESE	METS	555	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	MANGANESE	METS	478	J	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**MERCURY**	METS	**0.37**	=	mg/kg	0.13	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**MERCURY**	METS	**0.23**	=	mg/kg	0.13	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	MERCURY	METS	0.052	J	mg/kg	0.13	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.029	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	METHYL ETHYL KETONE (2-BUTANONE)	VOC	0.025	J	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	VOC	0.018	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	VOC	0.010	J	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**NAPHTHALENE**	SVOC	**3.0**	J	mg/kg	0.33	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**NAPHTHALENE**	SVOC	**1.1**	J	mg/kg	0.33	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	NAPHTHALENE	SVOC	0.28	J	mg/kg	0.33	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**NICKEL**	METS	**18**	J	mg/kg	16	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**NICKEL**	METS	**17**	J	mg/kg	16	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**NICKEL**	METS	**17**	=	mg/kg	16	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0070	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.0040	J	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**p,p'-DDE**	PEST/PCB	**0.012**	J	mg/kg	0.0033	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**p,p'-DDE**	PEST/PCB	**0.0062**	J	mg/kg	0.0033	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**p,p'-DDT**	PEST/PCB	**0.013**	J	mg/kg	0.0033	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**PHENANTHRENE**	SVOC	**1.2**	J	mg/kg	0.33	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**PHENANTHRENE**	SVOC	**0.91**	J	mg/kg	0.33	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	PHENANTHRENE	SVOC	0.22	J	mg/kg	0.33	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	POTASSIUM	METS	2,650	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	POTASSIUM	METS	2,120	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	POTASSIUM	METS	1,400	J	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**PYRENE**	SVOC	**0.51**	J	mg/kg	0.33	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**PYRENE**	SVOC	**0.40**	J	mg/kg	0.33	X
1	SWM14	W14-SD02	NDA052	04/06/00	SD	SELENIUM	METS	1.2	J	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	SELENIUM	METS	0.92	J	mg/kg		

APPENDIX B-5
Data Screening for Sediments
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	SiteID	StationID	SampleID	DateCollected	Matrix	Chemical	Class	Result	Qualifier	Units	Ecological Criteria	Exceeds Eco Criteria
1	SWM14	W14-SD03	NDA053	04/06/00	SD	SILVER	METS	0.14	J	mg/kg	2.0	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	SODIUM	METS	422	J	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	SODIUM	METS	390	J	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	SODIUM	METS	345	J	mg/kg		
1	SWM14	W14-SD01	NDA050	04/06/00	SD	THALLIUM	METS	0.67	J	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	TOLUENE	VOC	0.0050	J	mg/kg	0.67	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	TOLUENE	VOC	0.0020	J	mg/kg	0.67	
1	SWM14	W14-SD01	NDA050	04/06/00	SD	VANADIUM	METS	100	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	VANADIUM	METS	97	=	mg/kg		
1	SWM14	W14-SD03	NDA053	04/06/00	SD	VANADIUM	METS	79	=	mg/kg		
1	SWM14	W14-SD02	NDA052	04/06/00	SD	XYLENES, TOTAL	VOC	0.024	=	mg/kg	0.050	
1	SWM14	W14-SD03	NDA053	04/06/00	SD	XYLENES, TOTAL	VOC	0.011	J	mg/kg	0.050	
1	SWM14	W14-SD02	NDA052	04/06/00	SD	**ZINC**	METS	**513**	J	mg/kg	124	X
1	SWM14	W14-SD01	NDA050	04/06/00	SD	**ZINC**	METS	**448**	J	mg/kg	124	X
1	SWM14	W14-SD03	NDA053	04/06/00	SD	**ZINC**	METS	**213**	J	mg/kg	124	X
1	WWTP	WWTPSL001	NDC010DL1	06/13/00	SL	1,4-DICHLOROBENZENE	VOC	1.1	=	mg/kg		
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	ARSENIC	METS	3.1	=	mg/kg	7.2	
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	BARIUM	METS	85	J	mg/kg	200	
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	BENZENE	VOC	0.0030	J	mg/kg	0.057	
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	**CADMIUM**	METS	**32**	J	mg/kg	1.0	X
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	**CHROMIUM, TOTAL**	METS	**2,200**	=	mg/kg	52	X
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	**COPPER**	METS	**351**	=	mg/kg	19	X
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	ETHYLBENZENE	VOC	0.022	=	mg/kg	3.6	
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	**LEAD**	METS	**676**	=	mg/kg	30	X
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	M,P-XYLENE (SUM OF ISOMERS)	VOC	0.20	=	mg/kg		
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	NICKEL	METS	14	=	mg/kg	16	
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	0.061	=	mg/kg		
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	PETROLEUM HYDROCARBONS	FL-PRO	8,000	=	mg/kg		
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	SELENIUM	METS	1.0	J	mg/kg		
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	**SILVER**	METS	**2.7**	=	mg/kg	2.0	X
1	WWTP	WWTPSL001	NDC010DL1	06/13/00	SL	**TOLUENE**	VOC	**4.6**	=	mg/kg	0.67	X
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	**XYLENES, TOTAL**	VOC	**0.26**	J	mg/kg	0.050	X
1	WWTP	WWTPSL001	NDC010DL1	06/13/00	SL	**ZINC**	METS	**4,090**	J	mg/kg	124	X
1	WWTP	WWTPSL001	NDC010	06/13/00	SL	**ZINC**	METS	**1,950**	=	mg/kg	124	X

Notes:
X indicades that detected concentration exceeds screening criteria.
Bold and boxed concentrations exceed screening criteria

Appendix B-6
Data Screening for Groundwater

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	**ALUMINUM**	METS	**4,390**	=	µg/L	3.65E+03		X	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	BARIUM	METS	156	J	µg/L	2.55E+02	2.00E+03		
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	BARIUM, DISSOLVED	DISSMETALS	124	J	µg/L	2.55E+02	2.00E+03		
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	CALCIUM	METS	70,900	=	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	CALCIUM, DISSOLVED	DISSMETALS	66,600	=	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	1.2	J	µg/L	1.06E+01			NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	**CHROMIUM, TOTAL**	METS	**17**	=	µg/L	1.09E+01	1.00E+02	X	
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	COBALT	METS	3.3	J	µg/L	7.30E+01			NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	COPPER	METS	11	J	µg/L	1.46E+02	1.30E+03		
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	**IRON**	METS	**5,720**	=	µg/L	1.09E+03		X	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	LEAD, DISSOLVED	DISSMETALS	1.4	J	µg/L		1.50E+01	NA	
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	MAGNESIUM	METS	42,100	=	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	40,000	=	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	**MANGANESE**	METS	**177**	=	µg/L	8.76E+01		X	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	MANGANESE, DISSOLVED	DISSMETALS	23	=	µg/L	8.76E+01			NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	NICKEL	METS	9.1	J	µg/L	7.30E+01			NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	NICKEL, DISSOLVED	DISSMETALS	5.7	J	µg/L	7.30E+01			NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	POTASSIUM	METS	4,980	J	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	4,650	J	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	SELENIUM, DISSOLVED	DISSMETALS	2.7	J	µg/L	1.82E+01	5.00E+01		
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	SODIUM	METS	157,000	=	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	SODIUM, DISSOLVED	DISSMETALS	155,000	=	µg/L			NA	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	**VANADIUM**	METS	**28**	J	µg/L	2.55E+01		X	NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	VANADIUM, DISSOLVED	DISSMETALS	12	J	µg/L	2.55E+01			NA
1	AOC C	AOC-C-MW01	NDA016	05/01/00	WG	ZINC	METS	18	J	µg/L	1.09E+03			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	**ALUMINUM**	METS	**18,800**	=	µg/L	3.65E+03		X	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	ALUMINUM	METS	1,490	=	µg/L	3.65E+03			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	ALUMINUM	METS	886	=	µg/L	3.65E+03			NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	ALUMINUM	METS	291	=	µg/L	3.65E+03			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	ALUMINUM	METS	221	=	µg/L	3.65E+03			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	**ANTIMONY**	METS	**1.6**	J	µg/L	1.46E+00	6.00E+00	X	
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	**ANTIMONY, DISSOLVED**	DISSMETALS	**1.9**	J	µg/L	1.46E+00	6.00E+00	X	
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	BARIUM	METS	141	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	BARIUM	METS	72	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	BARIUM	METS	71	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	BARIUM	METS	64	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	BARIUM	METS	61	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	BARIUM, DISSOLVED	DISSMETALS	71	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	BARIUM, DISSOLVED	DISSMETALS	70	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	BARIUM, DISSOLVED	DISSMETALS	59	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	BARIUM, DISSOLVED	DISSMETALS	58	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	BARIUM, DISSOLVED	DISSMETALS	55	J	µg/L	2.55E+02	2.00E+03		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	CADMIUM, DISSOLVED	DISSMETALS	0.20	J	µg/L	1.82E+00			NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	CADMIUM, DISSOLVED	DISSMETALS	0.20	J	µg/L	1.82E+00			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	CALCIUM	METS	48,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	CALCIUM	METS	46,500	=	µg/L			NA	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	CALCIUM	METS	43,200	=	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	CALCIUM	METS	38,900	=	µg/L			NA	NA

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	CALCIUM	METS	37,500	=	µg/L			NA	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	CALCIUM, DISSOLVED	DISSMETALS	48,600	=	µg/L			NA	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	CALCIUM, DISSOLVED	DISSMETALS	45,100	=	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	CALCIUM, DISSOLVED	DISSMETALS	42,700	=	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	CALCIUM, DISSOLVED	DISSMETALS	40,400	=	µg/L			NA	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	CALCIUM, DISSOLVED	DISSMETALS	38,400	=	µg/L			NA	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	2.3	J	µg/L	1.06E+01			NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	1.0	J	µg/L	1.06E+01			NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	0.93	J	µg/L	1.06E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	0.92	J	µg/L	1.06E+01			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	0.90	J	µg/L	1.06E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	**CHROMIUM, TOTAL**	METS	28	=	µg/L	1.09E+01	1.00E+02	X	
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	CHROMIUM, TOTAL	METS	8.0	J	µg/L	1.09E+01	1.00E+02		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	CHROMIUM, TOTAL	METS	7.3	J	µg/L	1.09E+01	1.00E+02		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	CHROMIUM, TOTAL	METS	2.2	J	µg/L	1.09E+01	1.00E+02		
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	CHROMIUM, TOTAL	METS	1.8	J	µg/L	1.09E+01	1.00E+02		
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	COBALT	METS	15	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	COBALT	METS	1.6	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	COBALT	METS	0.93	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	COPPER	METS	46	=	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	COPPER	METS	5.7	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	COPPER	METS	4.4	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	COPPER	METS	3.8	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	COPPER	METS	2.9	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	COPPER, DISSOLVED	DISSMETALS	3.8	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	COPPER, DISSOLVED	DISSMETALS	2.9	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	COPPER, DISSOLVED	DISSMETALS	2.8	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	COPPER, DISSOLVED	DISSMETALS	2.8	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	COPPER, DISSOLVED	DISSMETALS	2.6	J	µg/L	1.46E+02	1.30E+03		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	DIETHYL PHTHALATE	SVOC	10	=	µg/L	2.92E+03			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	DIETHYL PHTHALATE	SVOC	8.0	=	µg/L	2.92E+03			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	**IRON**	METS	23,900	=	µg/L	1.09E+03		X	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	**IRON**	METS	1,660	=	µg/L	1.09E+03		X	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	**IRON**	METS	1,380	=	µg/L	1.09E+03		X	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	IRON	METS	284	=	µg/L	1.09E+03			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	IRON	METS	257	=	µg/L	1.09E+03			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	LEAD	METS	3.4	=	µg/L		1.50E+01	NA	
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	LEAD	METS	1.2	J	µg/L		1.50E+01	NA	
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	LEAD, DISSOLVED	DISSMETALS	1.7	J	µg/L		1.50E+01	NA	
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	LEAD, DISSOLVED	DISSMETALS	1.3	J	µg/L		1.50E+01	NA	
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	LEAD, DISSOLVED	DISSMETALS	1.1	J	µg/L		1.50E+01	NA	
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	MAGNESIUM	METS	38,600	=	µg/L			NA	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	MAGNESIUM	METS	34,100	=	µg/L			NA	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	MAGNESIUM	METS	27,700	=	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	MAGNESIUM	METS	25,800	=	µg/L			NA	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	MAGNESIUM	METS	25,400	=	µg/L			NA	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	34,900	=	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	28,900	=	µg/L			NA	NA

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	28,300	=	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	26,600	=	µg/L			NA	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	25,300	=	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	**MANGANESE**	METS	**819**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	**MANGANESE**	METS	**196**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	**MANGANESE**	METS	**173**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	**MANGANESE**	METS	**149**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	MANGANESE	METS	29	=	µg/L	8.76E+01			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**155**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**142**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**122**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**107**	=	µg/L	8.76E+01		X	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	MANGANESE, DISSOLVED	DISSMETALS	20	=	µg/L	8.76E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	NICKEL	METS	15	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	NICKEL	METS	3.9	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	NICKEL	METS	2.9	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	NICKEL	METS	2.2	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	NICKEL	METS	2.0	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	NICKEL, DISSOLVED	DISSMETALS	1.8	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	NICKEL, DISSOLVED	DISSMETALS	1.6	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	NICKEL, DISSOLVED	DISSMETALS	1.5	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	NICKEL, DISSOLVED	DISSMETALS	1.0	J	µg/L	7.30E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	POTASSIUM	METS	5,650	J	µg/L			NA	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	POTASSIUM	METS	3,900	J	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	POTASSIUM	METS	3,460	J	µg/L			NA	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	POTASSIUM	METS	3,390	J	µg/L			NA	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	POTASSIUM	METS	3,320	J	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	4,120	J	µg/L			NA	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	3,890	J	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	3,530	J	µg/L			NA	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	3,410	J	µg/L			NA	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	3,380	J	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	SELENIUM	METS	7.2	=	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	SELENIUM	METS	5.8	=	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	SELENIUM	METS	2.7	J	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	SELENIUM	METS	2.6	J	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	SELENIUM, DISSOLVED	DISSMETALS	6.7	=	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	SELENIUM, DISSOLVED	DISSMETALS	6.0	=	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	SELENIUM, DISSOLVED	DISSMETALS	5.9	=	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	SELENIUM, DISSOLVED	DISSMETALS	3.6	J	µg/L	1.82E+01	5.00E+01		
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	SODIUM	METS	251,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	SODIUM	METS	250,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	SODIUM	METS	232,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	SODIUM	METS	232,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	SODIUM	METS	140,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	SODIUM, DISSOLVED	DISSMETALS	250,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	SODIUM, DISSOLVED	DISSMETALS	247,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	SODIUM, DISSOLVED	DISSMETALS	234,000	=	µg/L			NA	NA

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	SODIUM, DISSOLVED	DISSMETALS	226,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	SODIUM, DISSOLVED	DISSMETALS	146,000	=	µg/L			NA	NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	**VANADIUM**	METS	84	=	µg/L	2.55E+01		X	NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	**VANADIUM**	METS	35	J	µg/L	2.55E+01		X	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	VANADIUM	METS	24	J	µg/L	2.55E+01			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	VANADIUM	METS	22	J	µg/L	2.55E+01			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	VANADIUM	METS	19	J	µg/L	2.55E+01			NA
1	AOC F	AOC-F-MW03	NDA020	04/25/00	WG	**VANADIUM, DISSOLVED**	DISSMETALS	29	J	µg/L	2.55E+01		X	NA
1	AOC F	AOC-F-MW02	NDA019	04/25/00	WG	VANADIUM, DISSOLVED	DISSMETALS	24	J	µg/L	2.55E+01			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	VANADIUM, DISSOLVED	DISSMETALS	19	J	µg/L	2.55E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	VANADIUM, DISSOLVED	DISSMETALS	18	J	µg/L	2.55E+01			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	VANADIUM, DISSOLVED	DISSMETALS	17	J	µg/L	2.55E+01			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	ZINC	METS	50	=	µg/L	1.09E+03			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	ZINC	METS	10	J	µg/L	1.09E+03			NA
1	AOC F	AOC-F-MW04	NDA021	04/25/00	WG	ZINC	METS	2.8	J	µg/L	1.09E+03			NA
1	AOC F	AOC-F-MW05	NDA022	04/20/00	WG	ZINC, DISSOLVED	DISSMETALS	118	=	µg/L	1.09E+03			NA
1	AOC F	AOC-F-MW01	NDA017	04/19/00	WG	ZINC, DISSOLVED	DISSMETALS	7.3	J	µg/L	1.09E+03			NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	**ALUMINUM**	METS	9,100	=	µg/L	3.65E+03		X	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	ALUMINUM	METS	2,000	=	µg/L	3.65E+03			NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	ALUMINUM	METS	910	=	µg/L	3.65E+03			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	ALUMINUM	METS	680	=	µg/L	3.65E+03			NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	**BARIUM**	METS	390	=	µg/L	2.55E+02	2.00E+03	X	
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	BARIUM	METS	250	=	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	BARIUM	METS	180	J	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	BARIUM	METS	110	J	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	BARIUM	METS	94	J	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	BARIUM, DISSOLVED	DISSMETALS	200	=	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	BARIUM, DISSOLVED	DISSMETALS	160	J	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	BARIUM, DISSOLVED	DISSMETALS	150	J	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	BARIUM, DISSOLVED	DISSMETALS	110	J	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	BARIUM, DISSOLVED	DISSMETALS	92	J	µg/L	2.55E+02	2.00E+03		
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	**bis(2-ETHYLHEXYL) PHTHALATE**	SVOC	19	=	µg/L	4.80E+00	6.00E+00	X	X
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	CALCIUM	METS	120,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	CALCIUM	METS	120,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	CALCIUM	METS	82,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	CALCIUM	METS	79,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	CALCIUM	METS	76,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	CALCIUM, DISSOLVED	DISSMETALS	110,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	CALCIUM, DISSOLVED	DISSMETALS	110,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	CALCIUM, DISSOLVED	DISSMETALS	82,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	CALCIUM, DISSOLVED	DISSMETALS	71,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	CALCIUM, DISSOLVED	DISSMETALS	64,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	**CHROMIUM, TOTAL**	METS	19	=	µg/L	1.09E+01	1.00E+02	X	
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	CHROMIUM, TOTAL	METS	4.9	J	µg/L	1.09E+01	1.00E+02		
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	CHROMIUM, TOTAL	METS	4.8	J	µg/L	1.09E+01	1.00E+02		
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	COBALT	METS	23	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	COBALT	METS	5.4	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	COBALT, DISSOLVED	DISSMETALS	1.1	J	µg/L	7.30E+01			NA

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	COPPER	METS	26	=	µg/L	1.46E+02	1.30E+03		
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	COPPER	METS	12	J	µg/L	1.46E+02	1.30E+03		
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	COPPER	METS	6.3	J	µg/L	1.46E+02	1.30E+03		
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	COPPER	METS	5.1	J	µg/L	1.46E+02	1.30E+03		
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	COPPER, DISSOLVED	DISSMETALS	4.0	J	µg/L	1.46E+02	1.30E+03		
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	COPPER, DISSOLVED	DISSMETALS	3.2	J	µg/L	1.46E+02	1.30E+03		
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	COPPER, DISSOLVED	DISSMETALS	2.8	J	µg/L	1.46E+02	1.30E+03		
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	**IRON**	METS	**9,600**	=	µg/L	1.09E+03		X	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	**IRON**	METS	**3,800**	=	µg/L	1.09E+03		X	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	**IRON**	METS	**1,100**	=	µg/L	1.09E+03		X	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	IRON	METS	790	=	µg/L	1.09E+03			NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	IRON	METS	86	J	µg/L	1.09E+03			NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	MAGNESIUM	METS	76,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	MAGNESIUM	METS	59,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	MAGNESIUM	METS	51,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	MAGNESIUM	METS	51,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	MAGNESIUM	METS	49,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	71,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	58,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	51,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	48,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	42,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	**MANGANESE**	METS	**1,300**	J	µg/L	8.76E+01		X	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	**MANGANESE**	METS	**400**	=	µg/L	8.76E+01		X	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	**MANGANESE**	METS	**230**	J	µg/L	8.76E+01		X	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	MANGANESE	METS	22	J	µg/L	8.76E+01			NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	MANGANESE	METS	18	=	µg/L	8.76E+01			NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**370**	=	µg/L	8.76E+01		X	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**210**	=	µg/L	8.76E+01		X	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**190**	=	µg/L	8.76E+01		X	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	MANGANESE, DISSOLVED	DISSMETALS	7.4	J	µg/L	8.76E+01			NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	NICKEL	METS	30	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	NICKEL	METS	12	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	NICKEL	METS	9.2	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	NICKEL, DISSOLVED	DISSMETALS	7.0	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	NICKEL, DISSOLVED	DISSMETALS	3.9	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	NICKEL, DISSOLVED	DISSMETALS	2.8	J	µg/L	7.30E+01			NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	POTASSIUM	METS	8,500	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	POTASSIUM	METS	6,200	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	POTASSIUM	METS	6,000	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	POTASSIUM	METS	5,900	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	POTASSIUM	METS	5,100	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	8,800	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	6,100	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	5,800	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	5,600	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	4,700	J	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	SELENIUM, DISSOLVED	DISSMETALS	6.4	=	µg/L	1.82E+01	5.00E+01		

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	SODIUM	METS	210,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	SODIUM	METS	160,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	SODIUM	METS	170,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	SODIUM	METS	170,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	SODIUM	METS	160,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	SODIUM, DISSOLVED	DISSMETALS	200,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	SODIUM, DISSOLVED	DISSMETALS	180,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	SODIUM, DISSOLVED	DISSMETALS	170,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	SODIUM, DISSOLVED	DISSMETALS	170,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	SODIUM, DISSOLVED	DISSMETALS	160,000	=	µg/L			NA	NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	**THALLIUM**	METS	**9.3**	J	µg/L	2.41E-01	2.00E+00	X	X
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	**THALLIUM**	METS	**8.0**	J	µg/L	2.41E-01	2.00E+00	X	X
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	**THALLIUM, DISSOLVED**	DISSMETALS	**6.4**	J	µg/L	2.41E-01	2.00E+00	X	X
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	**THALLIUM, DISSOLVED**	DISSMETALS	**5.3**	J	µg/L	2.41E-01	2.00E+00	X	X
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	TOLUENE	VOC	0.75	J	µg/L	7.23E+01	1.00E+03		
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	TOLUENE	VOC	0.62	J	µg/L	7.23E+01	1.00E+03		
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	TOLUENE	VOC	0.43	J	µg/L	7.23E+01	1.00E+03		
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	**VANADIUM**	METS	**64**	=	µg/L	2.55E+01		X	NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	VANADIUM	METS	20	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	VANADIUM	METS	13	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	VANADIUM	METS	12	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	VANADIUM	METS	6.9	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	VANADIUM, DISSOLVED	DISSMETALS	8.2	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	VANADIUM, DISSOLVED	DISSMETALS	8.2	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW02	NDE219	12/19/00	WG	VANADIUM, DISSOLVED	DISSMETALS	8.0	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW01	NDE218	12/19/00	WG	VANADIUM, DISSOLVED	DISSMETALS	6.2	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW03	NDE220	12/19/00	WG	VANADIUM, DISSOLVED	DISSMETALS	4.9	J	µg/L	2.55E+01			NA
2	AOC-K	AOC-K-MW04	NDE221	12/19/00	WG	ZINC	METS	28	=	µg/L	1.09E+03			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	ZINC	METS	22	=	µg/L	1.09E+03			NA
2	AOC-K	AOC-K-MW05	NDE223	12/19/00	WG	ZINC, DISSOLVED	DISSMETALS	9.7	J	µg/L	1.09E+03			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**ALUMINUM**	METS	**26,100**	=	µg/L	3.65E+03		X	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	ALUMINUM	METS	152	J	µg/L	3.65E+03			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	ALUMINUM, DISSOLVED	DISSMETALS	28	J	µg/L	3.65E+03			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**ANTIMONY**	METS	**2.3**	J	µg/L	1.46E+00	6.00E+00	X	
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**ANTIMONY, DISSOLVED**	DISSMETALS	**2.1**	J	µg/L	1.46E+00	6.00E+00	X	
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	BARIUM	METS	250	=	µg/L	2.55E+02	2.00E+03		
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	BARIUM	METS	92	J	µg/L	2.55E+02	2.00E+03		
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	BARIUM, DISSOLVED	DISSMETALS	90	J	µg/L	2.55E+02	2.00E+03		
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	BARIUM, DISSOLVED	DISSMETALS	69	J	µg/L	2.55E+02	2.00E+03		
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	CALCIUM	METS	86,300	=	µg/L			NA	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	CALCIUM	METS	49,600	=	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	CALCIUM, DISSOLVED	DISSMETALS	58,700	=	µg/L			NA	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	CALCIUM, DISSOLVED	DISSMETALS	51,600	=	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	1.8	J	µg/L	1.06E+01			NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	1.6	J	µg/L	1.06E+01			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**CHROMIUM, TOTAL**	METS	**68**	=	µg/L	1.09E+01	1.00E+02	X	
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	CHROMIUM, TOTAL	METS	3.3	J	µg/L	1.09E+01	1.00E+02		
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	COBALT	METS	22	J	µg/L	7.30E+01			NA

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	COBALT, DISSOLVED	DISSMETALS	0.94	J	µg/L	7.30E+01			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	COPPER	METS	70	=	µg/L	1.46E+02	1.30E+03		
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	COPPER, DISSOLVED	DISSMETALS	3.5	J	µg/L	1.46E+02	1.30E+03		
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	**DIELDRIN**	PEST/PCB	0.010	J	µg/L	4.20E-03		X	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**IRON**	METS	32,100	J	µg/L	1.09E+03		X	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	IRON	METS	147	J	µg/L	1.09E+03			NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	IRON, DISSOLVED	DISSMETALS	12	=	µg/L	1.09E+03			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	IRON, DISSOLVED	DISSMETALS	12	=	µg/L	1.09E+03			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	LEAD	METS	5.1	=	µg/L		1.50E+01	NA	
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	LEAD, DISSOLVED	DISSMETALS	1.2	J	µg/L		1.50E+01	NA	
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	MAGNESIUM	METS	35,700	=	µg/L			NA	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	MAGNESIUM	METS	24,800	=	µg/L			NA	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	25,700	=	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	23,200	=	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**MANGANESE**	METS	1,820	=	µg/L	8.76E+01		X	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	**MANGANESE**	METS	97	=	µg/L	8.76E+01		X	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	1,160	=	µg/L	8.76E+01		X	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	MANGANESE, DISSOLVED	DISSMETALS	84	=	µg/L	8.76E+01			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	NICKEL	METS	40	J	µg/L	7.30E+01			NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	NICKEL	METS	1.5	J	µg/L	7.30E+01			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	NICKEL, DISSOLVED	DISSMETALS	12	J	µg/L	7.30E+01			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	POTASSIUM	METS	5,680	J	µg/L			NA	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	POTASSIUM	METS	3,120	J	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	3,250	J	µg/L			NA	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	3,060	J	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	SELENIUM	METS	5.2	=	µg/L	1.82E+01	5.00E+01		
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	SODIUM	METS	116,000	J	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	SODIUM	METS	108,000	J	µg/L			NA	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	SODIUM, DISSOLVED	DISSMETALS	118,000	J	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	SODIUM, DISSOLVED	DISSMETALS	96,100	J	µg/L			NA	NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	**VANADIUM**	METS	108	=	µg/L	2.55E+01		X	NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	VANADIUM	METS	20	J	µg/L	2.55E+01			NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	VANADIUM, DISSOLVED	DISSMETALS	20	J	µg/L	2.55E+01			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	VANADIUM, DISSOLVED	DISSMETALS	15	J	µg/L	2.55E+01			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	ZINC	METS	92	=	µg/L	1.09E+03			NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	ZINC	METS	3.8	J	µg/L	1.09E+03			NA
1	SWM14	SWMU14-MW01	NDA014	04/28/00	WG	ZINC, DISSOLVED	DISSMETALS	3.4	J	µg/L	1.09E+03			NA
1	SWM14	SWMU14-MW02	NDA013	04/28/00	WG	ZINC, DISSOLVED	DISSMETALS	3.0	J	µg/L	1.09E+03			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	**ALUMINUM**	METS	8,700	=	µg/L	3.65E+03		X	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	**ANTIMONY**	METS	1.5	J	µg/L	1.46E+00	6.00E+00	X	
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	BARIUM	METS	174	J	µg/L	2.55E+02	2.00E+03		
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	BARIUM, DISSOLVED	DISSMETALS	108	J	µg/L	2.55E+02	2.00E+03		
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	BERYLLIUM	METS	0.31	J	µg/L	7.30E+00	4.00E+00		
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	CADMIUM, DISSOLVED	DISSMETALS	0.23	J	µg/L	1.82E+00			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	CALCIUM	METS	78,200	=	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	CALCIUM, DISSOLVED	DISSMETALS	72,300	=	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	CHROMIUM, DISSOLVED	DISSMETALS	2.0	J	µg/L	1.06E+01			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	**CHROMIUM, TOTAL**	METS	31	=	µg/L	1.09E+01	1.00E+02	X	

APPENDIX B-6
Data Screening for Groundwater
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase	Site ID	Station ID	Sample ID	Date Collected	Matrix	Chemical	Class	Result	Qualifier	Units	Tap Water PRG[1]	MCL[2]	Exceeds Tap Water PRG	Exceeds MCL
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	COBALT	METS	5.9	J	µg/L	7.30E+01			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	COPPER	METS	15	J	µg/L	1.46E+02	1.30E+03		
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	**IRON**	METS	**10,100**	=	µg/L	1.09E+03		X	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	LEAD	METS	1.7	J	µg/L		1.50E+01	NA	
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	MAGNESIUM	METS	37,800	=	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	MAGNESIUM, DISSOLVED	DISSMETALS	34,700	=	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	**MANGANESE**	METS	**458**	=	µg/L	8.76E+01		X	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	**MANGANESE, DISSOLVED**	DISSMETALS	**117**	=	µg/L	8.76E+01		X	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	NICKEL	METS	17	J	µg/L	7.30E+01			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	NICKEL, DISSOLVED	DISSMETALS	2.8	J	µg/L	7.30E+01			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	POTASSIUM	METS	3,530	J	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	POTASSIUM, DISSOLVED	DISSMETALS	2,300	J	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	SODIUM	METS	92,500	=	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	SODIUM, DISSOLVED	DISSMETALS	89,600	=	µg/L			NA	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	**VANADIUM**	METS	**44**	J	µg/L	2.55E+01		X	NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	VANADIUM, DISSOLVED	DISSMETALS	18	J	µg/L	2.55E+01			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	ZINC	METS	31	=	µg/L	1.09E+03			NA
1	SWM15	SWMU15-MW01	NDA015	05/01/00	WG	ZINC, DISSOLVED	DISSMETALS	8.7	J	µg/L	1.09E+03			NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	1,4-DICHLOROBENZENE	VOC	36	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	BARIUM	METS	20	J	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	BENZENE	VOC	0.20	J	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	CHROMIUM, TOTAL	METS	5.3	J	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	COPPER	METS	57	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	CRESOLS, m & p	SVOC	798	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	ETHYLBENZENE	VOC	0.80	J	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	LEAD	METS	3.1	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	M,P-XYLENE (SUM OF ISOMERS)	VOC	3.0	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	MERCURY	METS	0.45	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	NITROGEN, NITRATE-NITRITE	GENCHEM	250	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	O-XYLENE (1,2-DIMETHYLBENZENE)	VOC	2.0	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	PETROLEUM HYDROCARBONS	FL-PRO	34,000	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	PHENOL	SVOC	80	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	SULFATE (AS SO4)	MISC	27,400	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	SULFIDE, TOTAL	GENCHEM	6,950	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009DL1	06/13/00	WW	TOLUENE	VOC	370	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	XYLENES, TOTAL	VOC	4.0	=	µg/L	NA	NA	NA	NA
1	WWTP	WWTPWW001	NDC009	06/13/00	WW	ZINC	METS	193	=	µg/L	NA	NA	NA	NA

Notes:
[1] Region 9 Preliminary Remediation Goals (PRG, EPA, 2002), http://www.epa.gov/region09/waste/sfund/prg/index.htm
[2] Maximum Contaminant Levels. EPA Office of Water. http://www.epa.gov/safewater/mcl.html
NA - not available or not applicable.
X indicates that detected concentration exceeds screening criteria.
Bold and boxed concentrations exceed screening criteria (PRG and/or MCL).

Appendix C
Statistical Evaluations Summary

Appendix C-1
Surface Soils Statistical Data Summary

APPENDIX C-1
Surface Soils Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Residential PRG (HI = 0.1)[3]	SSL (DAF = 20)[4]	Exceeds Residential PRG	Exceeds SSL
1	AOC C	ALUMINUM	15	15	9,600	4,130	7,516	7,516	7,614		X	
1	AOC C	ANTIMONY	15	1	0.19	0.19	0.19	0.087	3.1	5.0		
1	AOC C	ARSENIC	15	11	2.1	0.36	0.82	0.65	0.39	29	X	
1	AOC C	BARIUM	15	15	264	30	64	64	537	1,600		
1	AOC C	BENZENE	15	2	3.00E-04	1.00E-04	2.00E-04	0.0055	0.60	0.030		
1	AOC C	BERYLLIUM	15	15	0.27	0.095	0.18	0.18	15	63		
1	AOC C	CALCIUM	15	15	12,600	1,410	3,728	3,728				
1	AOC C	CHROMIUM, TOTAL	15	15	14	6.3	9.4	9.4	30.1	38		
1	AOC C	COBALT	15	15	20	5.2	8.7	8.7	903			
1	AOC C	COPPER	15	15	34	13	25	25	313			
1	AOC C	DI-n-BUTYL PHTHALATE	15	1	0.11	0.11	0.11	0.28	611	2,300		
1	AOC C	ETHYLBENZENE	15	3	0.0030	0.0010	0.0017	0.0054	8.9	13		
1	AOC C	IRON	15	15	21,100	9,770	15,011	15,011	2,346		X	
1	AOC C	LEAD	15	15	8.4	1.1	4.0	4.0	400	400		
1	AOC C	M,P-XYLENE (SUM OF ISOMERS)	15	3	0.0080	3.00E-04	0.0029	0.0059	27.5			
1	AOC C	MAGNESIUM	15	15	4,200	1,330	2,651	2,651				
1	AOC C	MANGANESE	15	15	2,190	249	546	546	176		X	
1	AOC C	MERCURY	15	2	0.025	0.021	0.023	0.0091	2.3	2.0		
1	AOC C	NICKEL	15	15	11	2.5	5.1	5.1	156	130		
1	AOC C	O-XYLENE (1,2-DIMETHYLBENZENE)	15	1	0.0020	0.0020	0.0020	0.0055				
1	AOC C	p,p'-DDD	15	1	0.0021	0.0021	0.0021	0.0019	2.4	16		
1	AOC C	p,p'-DDE	15	9	0.0064	4.80E-04	0.0014	0.0016	1.7	54		
1	AOC C	p,p'-DDT	15	5	0.016	4.70E-04	0.0038	0.0025	1.7	32		
1	AOC C	POTASSIUM	15	15	1,340	672	1,046	1,046				
1	AOC C	SELENIUM	15	15	0.90	0.42	0.68	0.68	39	5.0		
1	AOC C	SODIUM	15	15	205	46	118	118				
1	AOC C	THALLIUM	15	9	0.65	0.31	0.47	0.34	0.52	0.70	X	
1	AOC C	TOLUENE	15	3	0.0050	0.0010	0.0023	0.0056	52	12		
1	AOC C	TRICHLOROETHYLENE (TCE)	15	1	3.00E-04	3.00E-04	3.00E-04	0.0060	0.053	0.060		
1	AOC C	VANADIUM	15	15	66	32	46	46	55	6,000	X	
1	AOC C	XYLENES, TOTAL	15	5	0.026	3.00E-04	0.0095	0.0075	27	210		
1	AOC C	ZINC	15	15	57	13	32	32	2,346	12,000		
2	AOC L	2-HEXANONE	4	2	0.0012	8.70E-04	0.0010	0.0030				
2	AOC L	ALUMINUM	4	4	9,150	6,350	7,748	7,748	7,614		X	
2	AOC L	ANTIMONY	4	4	0.71	0.50	0.58	0.58	3.1	5.0		
2	AOC L	ARSENIC	4	3	1.0	0.46	0.66	0.53	0.39	29	X	
2	AOC L	BARIUM	4	4	113	40	70	70	537	1,600		
2	AOC L	BERYLLIUM	4	4	0.14	0.11	0.13	0.13	15	63		
2	AOC L	CALCIUM	4	4	36,500	4,300	13,240	13,240				
2	AOC L	CHROMIUM, TOTAL	4	4	11	7.3	8.6	8.6	30.1	38		
2	AOC L	COBALT	4	4	8.1	5.3	6.5	6.5	903			
2	AOC L	COPPER	4	4	34	18	24	24	313			
2	AOC L	IRON	4	4	17,700	12,600	14,550	14,550	2,346		X	
2	AOC L	LEAD	4	4	9.9	7.8	8.6	8.6	400	400		
2	AOC L	MAGNESIUM	4	4	3,430	1,750	2,560	2,560				
2	AOC L	MANGANESE	4	4	472	332	397	397	176		X	
2	AOC L	MERCURY	4	4	0.071	0.033	0.046	0.046	2.3	2.0		
2	AOC L	NICKEL	4	4	7.2	3.4	4.5	4.5	156	130		
2	AOC L	p,p'-DDE	4	2	0.0023	0.0016	0.0020	0.0019	1.7	54		
2	AOC L	p,p'-DDT	4	2	0.0091	0.0012	0.0052	0.0035	1.7	32		
2	AOC L	POTASSIUM	4	4	1,350	849	1,155	1,155				
2	AOC L	SELENIUM	4	4	1.2	0.78	0.94	0.94	39	5.0		

APPENDIX C-1
Surface Soils Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Residential PRG (HI = 0.1)[3]	SSL (DAF = 20)[4]	Exceeds Residential PRG	Exceeds SSL
2	AOC L	SODIUM	4	4	275	61	128	128				
2	AOC L	VANADIUM	4	4	51	36	41	41	55	6,000		
2	AOC L	ZINC	4	4	82	54	63	63	2,346	12,000		
1	SWMU 10	ALUMINUM	10	10	10,000	3,740	5,575	5,575	7,614		X	
1	SWMU 10	ANTIMONY	10	10	1.3	0.24	0.59	0.59	3.1	5.0		
1	SWMU 10	ARSENIC	10	10	6.4	0.70	2.1	2.1	0.39	29	X	
1	SWMU 10	BARIUM	10	10	299	66	114	114	537	1,600		
1	SWMU 10	BENZO(a)PYRENE	10	1	0.040	0.040	0.040	0.26	0.062	6.0		
1	SWMU 10	BENZO(b)FLUORANTHENE	10	1	0.043	0.043	0.043	0.26	0.62	5.0		
1	SWMU 10	BENZYL BUTYL PHTHALATE	10	1	0.063	0.063	0.063	0.26	1,222	930		
1	SWMU 10	BERYLLIUM	10	10	0.19	0.11	0.14	0.14	15	63		
1	SWMU 10	CALCIUM	10	10	7,330	1,150	3,341	3,341				
1	SWMU 10	CHROMIUM, TOTAL	10	10	35	5.4	15	15	30.1	38	X	
1	SWMU 10	COBALT	10	10	13	4.4	7.5	7.5	903			
1	SWMU 10	COPPER	10	10	87	18	47	47	313			
1	SWMU 10	DIETHYL PHTHALATE	10	3	0.20	0.085	0.14	0.23	4,888			
1	SWMU 10	IRON	10	10	18,200	6,190	11,210	11,210	2,346		X	
1	SWMU 10	LEAD	10	10	98	8.3	36	36	400	400		
1	SWMU 10	M,P-XYLENE (SUM OF ISOMERS)	10	1	5.00E-04	5.00E-04	5.00E-04	0.0058	27.5			
1	SWMU 10	MAGNESIUM	10	10	6,440	994	2,539	2,539				
1	SWMU 10	MANGANESE	10	10	735	534	625	625	176		X	
1	SWMU 10	MERCURY	10	9	0.079	0.018	0.037	0.034	2.3	2.0		
1	SWMU 10	NICKEL	10	10	21	2.9	7.3	7.3	156	130		
1	SWMU 10	p,p'-DDD	10	3	8.00E-04	4.30E-04	6.67E-04	0.0015	2.4	16		
1	SWMU 10	p,p'-DDE	9	9	0.055	0.0012	0.019	0.019	1.7	54		
1	SWMU 10	p,p'-DDT	9	9	0.044	8.20E-04	0.012	0.012	1.7	32		
1	SWMU 10	POTASSIUM	10	10	1,600	621	1,022	1,022				
1	SWMU 10	SELENIUM	10	10	0.70	0.40	0.57	0.57	39	5.0		
1	SWMU 10	SILVER	10	3	0.065	0.054	0.060	0.038	39	34		
1	SWMU 10	SODIUM	10	9	179	55	87	79				
1	SWMU 10	THALLIUM	10	9	1.2	0.35	0.56	0.52	0.52	0.70	X	X
1	SWMU 10	TOLUENE	10	4	0.0010	4.00E-04	7.75E-04	0.0035	52	12		
1	SWMU 10	VANADIUM	10	10	55	22	32	32	55	6,000		
1	SWMU 10	XYLENES, TOTAL	10	1	5.00E-04	5.00E-04	5.00E-04	0.0058	27	210		
1	SWMU 10	ZINC	10	10	1,130	38	202	202	2,346	12,000		
1	SWMU 14	1,2-DICHLOROETHANE	14	2	4.00E-04	3.00E-04	3.50E-04	0.0054	0.28	0.020		
1	SWMU 14	ALUMINUM	14	14	16,300	4,900	8,471	8,471	7,614		X	
1	SWMU 14	ANTIMONY	14	12	0.74	0.17	0.36	0.34	3.1	5.0		
1	SWMU 14	ARSENIC	14	13	3.0	0.40	1.1	1.0	0.39	29	X	
1	SWMU 14	BARIUM	14	14	159	27	69	69	537	1,600		
1	SWMU 14	BENZENE	14	1	2.00E-04	2.00E-04	2.00E-04	0.0046	0.60	0.030		
1	SWMU 14	BENZYL BUTYL PHTHALATE	14	2	0.33	0.076	0.20	0.43	1,222	930		
1	SWMU 14	BERYLLIUM	14	14	0.27	0.072	0.16	0.16	15	63		
1	SWMU 14	bis(2-ETHYLHEXYL) PHTHALATE	14	7	0.16	0.042	0.084	0.34	35	3,600		
1	SWMU 14	CADMIUM	14	10	3.2	0.073	1.0	0.74	3.7	6.0		
1	SWMU 14	CALCIUM	14	14	82,400	1,710	17,204	17,204				
1	SWMU 14	CARBON DISULFIDE	14	1	9.00E-04	9.00E-04	9.00E-04	0.0058	36	32		
1	SWMU 14	CHROMIUM, TOTAL	14	14	32	5.3	15	15	30.1	38	X	
1	SWMU 14	COBALT	14	14	13	6.1	8.6	8.6	903			
1	SWMU 14	COPPER	14	14	97	14	44	44	313			
1	SWMU 14	DI-n-BUTYL PHTHALATE	14	1	0.040	0.040	0.040	0.42	611	2,300		
1	SWMU 14	DIELDRIN	14	1	4.50E-04	4.50E-04	4.50E-04	0.0019	0.030	0.0040		

APPENDIX C-1
Surface Soils Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Residential PRG (HI = 0.1)[3]	SSL (DAF = 20)[4]	Exceeds Residential PRG	Exceeds SSL
1	SWMU 14	DIMETHYL PHTHALATE	14	1	5.8	5.8	5.8	0.83	10,000			
1	SWMU 14	ETHYLBENZENE	14	1	0.0010	0.0010	0.0010	0.0059	8.9	13		
1	SWMU 14	IRON	14	14	28,300	7,490	16,251	16,251	2,346		X	
1	SWMU 14	LEAD	14	14	71	2.5	25	25	400	400		
1	SWMU 14	M,P-XYLENE (SUM OF ISOMERS)	14	8	0.0050	3.00E-04	0.0010	0.0022	27.5			
1	SWMU 14	MAGNESIUM	14	14	6,910	1,320	3,782	3,782				
1	SWMU 14	MANGANESE	14	14	907	263	524	524	176		X	
1	SWMU 14	MERCURY	14	10	2.3	0.025	0.29	0.21	2.3	2.0		X
1	SWMU 14	METHOXYCHLOR	14	1	0.0012	0.0012	0.0012	0.0099	31			
1	SWMU 14	METHYL ETHYL KETONE (2-BUTANONE)	1	1	0.018	0.018	0.018	0.018	733			
1	SWMU 14	NICKEL	14	14	16	3.8	7.1	7.1	156	130		
1	SWMU 14	O-XYLENE (1,2-DIMETHYLBENZENE)	14	3	0.0020	3.00E-04	9.00E-04	0.0052				
1	SWMU 14	p,p'-DDD	14	1	6.80E-04	6.80E-04	6.80E-04	0.0020	2.4	16		
1	SWMU 14	p,p'-DDE	14	6	0.0030	5.00E-04	0.0011	0.0018	1.7	54		
1	SWMU 14	POTASSIUM	14	14	2,740	460	1,128	1,128				
1	SWMU 14	SELENIUM	14	12	0.64	0.30	0.46	0.42	39	5.0		
1	SWMU 14	SILVER	14	2	0.096	0.056	0.076	0.035	39	34		
1	SWMU 14	SODIUM	14	14	475	51	196	196				
1	SWMU 14	THALLIUM	14	11	1.7	0.40	0.70	0.59	0.52	0.70	X	X
1	SWMU 14	TOLUENE	14	6	0.0010	3.00E-04	6.00E-04	0.0032	52	12		
1	SWMU 14	VANADIUM	14	14	74	20	44	44	55	6,000	X	
1	SWMU 14	XYLENES, TOTAL	14	8	0.0070	3.00E-04	0.0014	0.0024	27	210		
1	SWMU 14	ZINC	14	14	229	17	90	90	2,346	12,000		
1	SWMU 15	1,2-DICHLOROETHANE	16	3	3.00E-04	3.00E-04	3.00E-04	0.0043	0.28	0.020		
1	SWMU 15	2-HEXANONE	16	1	0.0020	0.0020	0.0020	0.0053				
1	SWMU 15	ALUMINUM	16	16	21,400	5,030	8,161	8,161	7,614		X	
1	SWMU 15	ANTHRACENE	16	1	0.017	0.017	0.017	0.28	2,190	12,000		
1	SWMU 15	ANTIMONY	16	15	0.84	0.23	0.48	0.45	3.1	5.0		
1	SWMU 15	ARSENIC	16	15	4.8	0.45	1.3	1.2	0.39	29	X	
1	SWMU 15	BARIUM	16	16	80	44	64	64	537	1,600		
1	SWMU 15	BENZENE	16	1	2.00E-04	2.00E-04	2.00E-04	0.0051	0.60	0.030		
1	SWMU 15	BENZO(a)ANTHRACENE	16	2	0.061	0.032	0.047	0.27	0.62	2.0		
1	SWMU 15	BENZO(a)PYRENE	16	2	0.071	0.053	0.062	0.27	0.062	8.0	X	
1	SWMU 15	BENZO(b)FLUORANTHENE	16	3	0.12	0.027	0.067	0.27	0.62	5.0		
1	SWMU 15	BENZO(g,h,i)PERYLENE	16	1	0.041	0.041	0.041	0.28	232	420		
1	SWMU 15	BENZO(k)FLUORANTHENE	16	3	0.098	0.034	0.058	0.26	6.2	49		
1	SWMU 15	BENZYL BUTYL PHTHALATE	16	1	0.18	0.18	0.18	0.29	1,222	930		
1	SWMU 15	BERYLLIUM	18	16	0.18	0.091	0.12	0.12	15	63		
1	SWMU 15	bis(2-ETHYLHEXYL) PHTHALATE	16	1	0.31	0.31	0.31	0.30	35	3,600		
1	SWMU 15	CADMIUM	16	5	2.5	0.10	0.72	0.23	3.7	8.0		
1	SWMU 15	CALCIUM	16	16	22,700	1,920	5,656	5,656				
1	SWMU 15	CHROMIUM, TOTAL	16	16	48	6.6	15	15	30.1	38	X	X
1	SWMU 15	CHRYSENE	16	3	0.17	0.038	0.096	0.27	62	160		
1	SWMU 15	COBALT	18	16	17	6.5	8.9	8.9	903			
1	SWMU 15	COPPER	16	16	75	21	37	37	313			
1	SWMU 15	DIELDRIN	16	1	4.50E-04	4.50E-04	4.50E-04	0.0018	0.030	0.0040		
1	SWMU 15	DIETHYL PHTHALATE	16	1	0.039	0.039	0.039	0.29	4,888			
1	SWMU 15	ETHYLBENZENE	16	3	0.0010	4.00E-04	6.67E-04	0.0046	8.9	13		
1	SWMU 15	FLUORANTHENE	16	4	0.31	0.044	0.12	0.26	229	4,300		
1	SWMU 15	INDENO(1,2,3-c,d)PYRENE	18	1	0.053	0.053	0.053	0.29	0.62	14		
1	SWMU 15	IRON	16	16	30,100	11,900	16,381	16,381	2,346		X	
1	SWMU 15	LEAD	16	16	68	2.4	22	22	400	400		

APPENDIX C-1
Surface Soils Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Residential PRG (Hi = 0.1)[3]	SSL (DAF = 20)[4]	Exceeds Residential PRG	Exceeds SSL
1	SWMU 15	M,P-XYLENE (SUM OF ISOMERS)	16	10	0.0020	4.00E-04	8.90E-04	0.0024	27.5			
1	SWMU 15	MAGNESIUM	16	16	14,200	1,060	3,571	3,571				
1	SWMU 15	MANGANESE	16	16	786	370	632	632	176		X	
1	SWMU 15	MERCURY	16	7	0.11	0.014	0.034	0.019	2.3	2.0		
1	SWMU 15	NICKEL	16	16	28	3.3	7.7	7.7	156	130		
1	SWMU 15	O-XYLENE (1,2-DIMETHYLBENZENE)	16	4	7.00E-04	3.00E-04	5.25E-04	0.0037				
1	SWMU 15	p,p'-DDE	16	3	0.0011	4.20E-04	7.13E-04	0.0017	1.7	54		
1	SWMU 15	p,p'-DDT	16	1	5.50E-04	5.50E-04	5.50E-04	0.0018	1.7	32		
1	SWMU 15	PCB-1260 (AROCHLOR 1260)	16	1	0.021	0.021	0.021	0.019	0.22			
1	SWMU 15	PHENANTHRENE	16	1	0.074	0.074	0.074	0.29	2190	4,200		
1	SWMU 15	POTASSIUM	16	16	1,600	670	977	977				
1	SWMU 15	PYRENE	16	4	0.23	0.036	0.094	0.26	232	4,200		
1	SWMU 15	SELENIUM	16	14	0.97	0.24	0.53	0.48	39	5.0		
1	SWMU 15	SODIUM	16	16	870	49	181	181				
1	SWMU 15	STYRENE	16	1	2.00E-04	2.00E-04	2.00E-04	0.0052	170	4.0		
1	SWMU 15	THALLIUM	16	11	0.85	0.33	0.55	0.42	0.52	0.70	X	X
1	SWMU 15	TOLUENE	16	2	7.00E-04	5.00E-04	6.00E-04	0.0048	52	12		
1	SWMU 15	TRICHLOROETHYLENE (TCE)	16	3	5.00E-04	3.00E-04	4.33E-04	0.0045	0.053	0.060		
1	SWMU 15	VANADIUM	16	16	96	35	48	48	55	6,000	X	
1	SWMU 15	XYLENES, TOTAL	16	11	0.0040	4.00E-04	0.0013	0.0026	27	210		
1	SWMU 15	ZINC	16	16	219	27	69	69	2,348	12,000		
1	SWMU 5	BENZO(a)ANTHRACENE	4	2	0.038	0.023	0.031	0.10	0.62	2.0		
1	SWMU 5	BENZO(a)PYRENE	4	2	0.088	0.075	0.082	0.13	0.062	8.0	X	
1	SWMU 5	BENZO(b)FLUORANTHENE	4	2	0.14	0.050	0.097	0.14	0.62	5.0		
1	SWMU 5	BENZO(g,h,i)PERYLENE	4	2	0.093	0.041	0.067	0.12	232	420		
1	SWMU 5	BENZO(k)FLUORANTHENE	4	2	0.074	0.059	0.067	0.12	6.2	49		
1	SWMU 5	CARBON DISULFIDE	4	3	7.00E-04	5.00E-04	6.00E-04	0.0021	36	32		
1	SWMU 5	CHRYSENE	4	2	0.062	0.060	0.061	0.12	62	160		
1	SWMU 5	FLUORANTHENE	4	2	0.068	0.041	0.055	0.12	229	4,300		
1	SWMU 5	INDENO(1,2,3-c,d)PYRENE	4	2	0.068	0.037	0.053	0.12	0.62	14		
1	SWMU 5	METHYL ETHYL KETONE (2-BUTANONE)	1	1	0.0020	0.0020	0.0020	0.0020	733			
1	SWMU 5	PYRENE	4	2	0.067	0.065	0.066	0.12	232	4,200		
1	SWMU 5	STYRENE	4	1	6.00E-04	6.00E-04	6.00E-04	0.0044	170	4.0		
1	SWMU 5	TOLUENE	4	1	4.00E-04	4.00E-04	4.00E-04	0.0041	52	12		
2	AOC B	1,1-DICHLOROETHENE	16	1	5.80E-04	5.80E-04	5.80E-04	0.0054	12.4	0.060		
2	AOC B	2-HEXANONE	16	2	8.10E-04	6.60E-04	7.35E-04	0.0050				
2	AOC B	4-CHLOROANILINE	16	2	0.14	0.10	0.12	0.24	24	0.70		
2	AOC B	ALUMINUM	16	16	14,000	4,300	8,538	8,538	7,614		X	
2	AOC B	ANTIMONY	16	11	0.73	0.35	0.50	0.38	3.1	5.0		
2	AOC B	ARSENIC	16	3	1.1	0.66	0.87	0.35	0.39	29	X	
2	AOC B	BARIUM	16	16	114	40	62	62	537	1,600		
2	AOC B	BENZO(g,h,i)PERYLENE	16	1	0.037	0.037	0.037	0.26	232	420		
2	AOC B	BERYLLIUM	16	15	0.28	0.11	0.21	0.20	15	63		
2	AOC B	bis(2-ETHYLHEXYL) PHTHALATE	16	3	0.18	0.11	0.15	0.24	35	3,600		
2	AOC B	CADMIUM	16	3	0.46	0.039	0.18	0.13	3.7	8.0		
2	AOC B	CALCIUM	16	16	8,060	1,200	2,931	2,931				
2	AOC B	CHROMIUM, TOTAL	16	16	22	6.4	12	12	30.1	38		
2	AOC B	COBALT	16	18	11	2.8	6.6	6.6	903			
2	AOC B	COPPER	16	16	86	16	36	36	313			
2	AOC B	DIELDRIN	16	3	0.0039	7.70E-04	0.0022	0.0021	0.030	0.0040		
2	AOC B	IRON	16	16	26,000	11,000	15,775	15,775	2,346		X	
2	AOC B	LEAD	16	16	15	2.3	7.2	7.2	400	400		

APPENDIX C-1
Surface Soils Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Residential PRG (HI = 0.1)[3]	SSL (DAF = 20)[4]	Exceeds Residential PRG	Exceeds SSL
2	AOC B	M,P-XYLENE (SUM OF ISOMERS)	16	1	0.0014	0.0014	0.0014	0.0055	27.5			
2	AOC B	MAGNESIUM	18	16	4,300	1,100	2,317	2,317				
2	**AOC B**	**MANGANESE**	**16**	**16**	**818**	**54**	**247**	**247**	**176**		**X**	
2	AOC B	MERCURY	16	16	0.15	0.0099	0.065	0.065	2.3	2.0		
2	AOC B	METHYL ETHYL KETONE (2-BUTANONE)	4	3	0.010	0.0028	0.0058	0.0057	733			
2	AOC B	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANON	16	1	0.0046	0.0046	0.0046	0.0055	79			
2	AOC B	NICKEL	18	16	8.5	2.7	5.3	5.3	156	130		
2	AOC B	O-XYLENE (1,2-DIMETHYLBENZENE)	16	1	5.10E-04	5.10E-04	5.10E-04	0.0054				
2	AOC B	p,p'-DDE	16	5	0.0018	5.70E-04	0.0010	0.0017	1.7	54		
2	AOC B	PCB-1260 (AROCHLOR 1260)	16	4	0.019	0.010	0.014	0.019	0.22			
2	AOC B	POTASSIUM	16	16	1,870	680	1,153	1,153				
2	AOC B	SELENIUM	16	9	1.2	0.65	0.89	0.62	39	5.0		
2	AOC B	SILVER	16	8	0.29	0.085	0.17	0.10	39	34		
2	AOC B	SODIUM	18	16	188	52	118	118				
2	AOC B	TETRACHLOROETHYLENE(PCE)	16	2	3.70E-04	2.50E-04	3.10E-04	0.0049	1.5	0.060		
2	**AOC B**	**THALLIUM**	**16**	**2**	**0.68**	**0.51**	**0.60**	**0.84**	**0.52**	**0.70**	**X**	
2	AOC B	TOLUENE	16	2	3.00E-04	3.00E-04	3.00E-04	0.0050	52	12		
2	**AOC B**	**VANADIUM**	**16**	**16**	**73**	**34**	**47**	**47**	**55**	**6,000**	**X**	
2	AOC B	XYLENES, TOTAL	16	1	0.0019	0.0019	0.0019	0.0055	27	210		
2	AOC B	ZINC	16	16	164	29	76	76	2,346	12,000		

Notes:
Values are presented in units of milligrams per kilogram (mg/kg)
[1]Phase refers to the Phase I PA/SI investigation (October 2000) and the Phase II expanded PA/SI.
[2]Best estimate of the mean is the average of all values using one half of the detection limit for undetected values.
[3]Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/
[4]EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm
X The bold "X" denotes that maximum detected concentration exceeds screening criteria.
N = Number of Samples

Appendix C-2
Subsurface Soils Statistical Data Summary

APPENDIX C-2

Subsurface Soils Statistical Data Summary

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Industrial PRG3	SSL[4] (DAF = 20)	Exceeds PRG	Exceeds SSL
1	AOC C	1,2-DICHLOROETHANE	20	6	4.00E-04	3.00E-04	3.17E-04	0.0036	0.60	0.020		
1	**AOC C**	**ALUMINUM**	**20**	**20**	**14,300**	**3,140**	**7,908**	**7,908**	**10,000**		**X**	
1	AOC C	ANTIMONY	20	4	0.24	0.17	0.21	0.10	41	5.0		
1	AOC C	ARSENIC	20	5	0.71	0.44	0.57	0.29	1.6	29		
1	AOC C	BARIUM	20	20	144	35	84	84	6,658	1,600		
1	AOC C	BENZENE	20	3	4.00E-04	2.00E-04	2.67E-04	0.0040	1.3	0.030		
1	AOC C	BERYLLIUM	20	20	0.30	0.088	0.19	0.19	1,941	63		
1	AOC C	CALCIUM	20	20	5,770	1,310	2,720	2,720				
1	AOC C	CHROMIUM, TOTAL	20	20	33	4.8	10	10	64	38		
1	AOC C	COBALT	20	20	14	3.4	8.1	8.1	1,921			
1	AOC C	COPPER	20	20	47	10	26	26	4,088			
1	AOC C	DI-n-BUTYL PHTHALATE	20	1	0.036	0.036	0.036	0.25	6,156	2,300		
1	AOC C	ETHYLBENZENE	20	8	0.0050	9.00E-04	0.0021	0.0040	19.5	13		
1	**AOC C**	**IRON**	**20**	**20**	**26,500**	**8,670**	**16,713**	**16,713**	**10,000**		**X**	
1	AOC C	LEAD	20	20	7.0	0.58	1.8	1.8	750	400		
1	AOC C	M,P-XYLENE (SUM OF ISOMERS)	20	9	0.028	5.00E-04	0.011	0.0078	42			
1	AOC C	MAGNESIUM	20	20	4,890	1,210	2,827	2,827				
1	AOC C	MANGANESE	20	20	956	164	466	466	1,946			
1	AOC C	MERCURY	20	1	0.016	0.016	0.016	0.0077	31	2.0		
1	AOC C	NICKEL	20	20	12	1.5	4.2	4.2	2,044	130		
1	AOC C	O-XYLENE (1,2-DIMETHYLBENZENE)	20	8	0.0070	0.0010	0.0035	0.0046				
1	AOC C	POTASSIUM	20	20	2,340	633	1,101	1,101				
1	AOC C	SELENIUM	20	19	0.94	0.25	0.59	0.57	511	5.0		
1	AOC C	SODIUM	20	20	438	63	135	135				
1	AOC C	TETRACHLOROETHYLENE(PCE)	20	1	0.0010	0.0010	0.0010	0.0051	3.4	0.060		
1	**AOC C**	**THALLIUM**	**20**	**16**	**1.9**	**0.36**	**0.77**	**0.65**	**6.7**	**0.70**		**X**
1	AOC C	TOLUENE	20	8	0.0080	9.00E-04	0.0026	0.0042	52	12		
1	AOC C	VANADIUM	20	20	77	26	50	50	715	6,000		
1	AOC C	XYLENES, TOTAL	20	9	0.035	5.00E-04	0.014	0.0091	42	210		
1	AOC C	ZINC	20	20	40	11	26	26	10,000	12,000		
1	AOC F	1,2-DICHLOROETHANE	17	2	3.00E-04	3.00E-04	3.00E-04	0.0046	0.60	0.020		
1	**AOC F**	**ALUMINUM**	**17**	**17**	**25,900**	**6,790**	**14,458**	**14,458**	**10,000**		**X**	
1	AOC F	ANTIMONY	17	5	0.87	0.16	0.47	0.20	41	5.0		
1	AOC F	ARSENIC	17	8	0.82	0.46	0.56	0.37	1.6	29		
1	AOC F	BARIUM	17	17	682	64	182	182	6,658	1,600		
1	AOC F	BENZENE	17	1	2.00E-04	2.00E-04	2.00E-04	0.0046	1.3	0.030		
1	AOC F	BERYLLIUM	17	17	0.57	0.11	0.28	0.28	1,941	63		
1	AOC F	CALCIUM	17	17	11,200	1,790	4,566	4,566				
1	AOC F	CARBON DISULFIDE	17	2	4.00E-04	3.00E-04	3.50E-04	0.0048	72	32		
1	AOC F	CHLOROBENZENE	17	1	7.00E-04	7.00E-04	7.00E-04	0.0051	53	1.0		
1	**AOC F**	**CHROMIUM, TOTAL**	**17**	**17**	**129**	**7.3**	**34**	**34**	**64**	**38**	**X**	**X**
1	AOC F	COBALT	17	17	63	6.6	22	22	1,921			
1	AOC F	COPPER	17	17	120	20	48	48	4,088			
1	**AOC F**	**IRON**	**17**	**17**	**52,100**	**12,500**	**28,900**	**28,900**	**10,000**		**X**	
1	AOC F	LEAD	17	14	2.6	0.54	1.6	1.3	750	400		
1	AOC F	M,P-XYLENE (SUM OF ISOMERS)	17	4	9.00E-04	3.00E-04	5.75E-04	0.0039	42			

APPENDIX C-2
Subsurface Soils Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Industrial PRG3	SSL[4] (DAF = 20)	Exceeds PRG	Exceeds SSL
1	AOC F	MAGNESIUM	17	17	22,700	1,740	9,515	9,515				
1	**AOC F**	**MANGANESE**	**17**	**17**	**3,490**	**372**	**1,014**	**1,014**	**1,946**		**X**	
1	AOC F	MERCURY	17	1	0.015	0.015	0.015	0.0071	31	2.0		
1	AOC F	METHYL ETHYL KETONE (2-BUTANONE)	4	4	0.0070	0.0020	0.0038	0.0038	2,710			
1	AOC F	NICKEL	17	17	44	3.7	17	17	2,044	130		
1	AOC F	O-XYLENE (1,2-DIMETHYLBENZENE)	17	1	4.00E-04	4.00E-04	4.00E-04	0.0051				
1	AOC F	p,p'-DDE	17	1	4.70E-04	4.70E-04	4.70E-04	0.0019	7.0	54		
1	AOC F	POTASSIUM	17	17	1,710	180	850	850				
1	AOC F	SELENIUM	17	5	0.54	0.28	0.42	0.21	511	5.0		
1	AOC F	SILVER	17	2	0.31	0.097	0.20	0.050	511	34		
1	AOC F	SODIUM	17	16	2,470	63	693	653				
1	**AOC F**	**THALLIUM**	**17**	**14**	**1.7**	**0.76**	**1.1**	**0.93**	**6.7**	**0.70**		**X**
1	AOC F	TOLUENE	17	1	4.00E-04	4.00E-04	4.00E-04	0.0051	52	12		
1	AOC F	VANADIUM	17	17	163	37	94	94	715	6,000		
1	AOC F	XYLENES, TOTAL	17	4	0.0013	3.00E-04	6.75E-04	0.0039	42	210		
1	AOC F	ZINC	17	17	72	24	41	41	10,000	12,000		
2	AOC L	ALUMINUM	4	4	6,980	1,970	4,853	4,853	10,000			
2	AOC L	ANTIMONY	4	4	0.71	0.30	0.54	0.54	41	5.0		
2	**AOC L**	**ARSENIC**	**4**	**3**	**1.7**	**1.4**	**1.5**	**1.2**	**1.6**	**29**	**X**	
2	AOC L	BARIUM	4	4	57	27	44	44	6,658	1,600		
2	AOC L	BERYLLIUM	4	4	0.31	0.13	0.23	0.23	1,941	63		
2	AOC L	CADMIUM	4	2	0.13	0.049	0.090	0.053	45	8.0		
2	AOC L	CALCIUM	4	4	185,000	2,230	116,058	116,058				
2	AOC L	CHROMIUM, TOTAL	4	4	9.0	6.4	8.0	8.0	64	38		
2	AOC L	COBALT	4	4	5.2	1.5	3.2	3.2	1,921			
2	AOC L	COPPER	4	4	18	3.7	10	10	4,088			
2	AOC L	ETHYLBENZENE	4	1	0.0020	0.0020	0.0020	0.0045	19.5	13		
2	**AOC L**	**IRON**	**4**	**4**	**12,500**	**5,100**	**8,643**	**8,643**	**10,000**		**X**	
2	AOC L	LEAD	4	4	5.2	0.90	2.1	2.1	750	400		
2	AOC L	M,P-XYLENE (SUM OF ISOMERS)	4	1	0.0090	0.0090	0.0090	0.0063	42			
2	AOC L	MAGNESIUM	4	4	9,460	1,940	6,795	6,795				
2	AOC L	MANGANESE	4	4	324	87	207	207	1,946			
2	AOC L	MERCURY	4	4	0.10	0.0060	0.032	0.032	31	2.0		
2	AOC L	NICKEL	4	4	3.5	1.2	2.1	2.1	2,044	130		
2	AOC L	O-XYLENE (1,2-DIMETHYLBENZENE)	4	1	0.0031	0.0031	0.0031	0.0048				
2	AOC L	POTASSIUM	4	4	920	328	740	740				
2	AOC L	SELENIUM	4	1	0.79	0.79	0.79	0.40	511	5.0		
2	AOC L	SODIUM	4	4	1,480	130	1,100	1,100				
2	AOC L	VANADIUM	4	4	35	21	28	28	715	6,000		
2	AOC L	XYLENES, TOTAL	4	1	0.012	0.012	0.012	0.0070	42	210		
2	AOC L	ZINC	4	4	39	6.8	20	20	10,000	12,000		
1	SWMU 10	1,2-DICHLOROETHANE	10	3	3.00E-04	3.00E-04	3.00E-04	0.0039	0.60	0.020		
1	SWMU 10	ALUMINUM	10	10	8,560	4,640	6,031	6,031	10,000			
1	SWMU 10	ANTIMONY	10	4	0.31	0.20	0.25	0.15	41	5.0		
1	SWMU 10	ARSENIC	10	3	0.91	0.44	0.64	0.33	1.6	29		
1	SWMU 10	BARIUM	10	10	139	72	94	94	6,658	1,600		

APPENDIX C-2

Subsurface Soils Statistical Data Summary

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Industrial PRG3	SSL[4] (DAF = 20)	Exceeds PRG	Exceeds SSL
1	SWMU 10	BERYLLIUM	10	10	0.30	0.18	0.21	0.21	1,941	63		
1	SWMU 10	CALCIUM	10	10	3,100	1,060	1,870	1,870				
1	SWMU 10	CHROMIUM, TOTAL	10	10	8.2	4.9	6.6	6.6	64	38		
1	SWMU 10	COBALT	10	10	11	5.3	8.3	8.3	1,921			
1	SWMU 10	COPPER	10	10	33	19	26	26	4,088			
1	SWMU 10	DIETHYL PHTHALATE	10	5	0.21	0.051	0.13	0.19	10,000			
1	**SWMU 10**	**IRON**	**10**	**10**	**17,700**	**10,300**	**12,720**	**12,720**	**10,000**		**X**	
1	SWMU 10	LEAD	10	10	16	0.94	3.9	3.9	750	400		
1	SWMU 10	MAGNESIUM	10	10	4,020	2,170	2,870	2,870				
1	SWMU 10	MANGANESE	10	10	597	298	483	483	1,946			
1	SWMU 10	MERCURY	10	1	0.024	0.024	0.024	0.0081	31	2.0		
1	SWMU 10	NICKEL	10	10	4.5	2.7	3.6	3.6	2,044	130		
1	SWMU 10	p,p'-DDD	10	1	6.70E-04	6.70E-04	6.70E-04	0.0018	10	16		
1	SWMU 10	p,p'-DDE	10	5	0.021	8.00E-04	0.0079	0.0049	7.0	54		
1	SWMU 10	p,p'-DDT	10	4	0.011	0.0010	0.0052	0.0032	7.0	32		
1	SWMU 10	POTASSIUM	10	10	1,190	710	927	927				
1	SWMU 10	SELENIUM	10	9	0.60	0.43	0.52	0.48	511	5.0		
1	SWMU 10	SODIUM	10	10	157	49	88	88				
1	**SWMU 10**	**THALLIUM**	**10**	**10**	**1.3**	**0.50**	**0.77**	**0.77**	**6.7**	**0.70**		**X**
1	SWMU 10	VANADIUM	10	10	57	29	38	38	715	6,000		
1	SWMU 10	ZINC	10	10	57	20	33	33	10,000	12,000		
1	SWMU 14	1,2-DICHLOROETHANE	14	2	3.00E-04	3.00E-04	3.00E-04	0.0041	0.60	0.020		
1	**SWMU 14**	**ALUMINUM**	**14**	**14**	**13,400**	**5,740**	**9,020**	**9,020**	**10,000**		**X**	
1	SWMU 14	ANTIMONY	14	2	0.26	0.24	0.25	0.10	41	5.0		
1	SWMU 14	ARSENIC	14	4	0.66	0.39	0.53	0.29	1.6	29		
1	SWMU 14	BARIUM	14	14	156	48	94	94	6,658	1,600		
1	SWMU 14	BENZENE	14	1	2.00E-04	2.00E-04	2.00E-04	0.0037	1.3	0.030		
1	SWMU 14	BERYLLIUM	14	14	0.31	0.13	0.24	0.24	1,941	63		
1	SWMU 14	CALCIUM	14	14	6,280	2,030	3,306	3,306				
1	SWMU 14	CHROMIUM, TOTAL	14	14	18	5.2	10	10	64	38		
1	SWMU 14	COBALT	14	14	13	5.8	9.6	9.6	1,921			
1	SWMU 14	COPPER	14	14	32	21	26	26	4,088			
1	**SWMU 14**	**IRON**	**14**	**14**	**21,600**	**10,600**	**16,886**	**16,886**	**10,000**		**X**	
1	SWMU 14	LEAD	14	14	37	1.0	6.3	6.3	750	400		
1	SWMU 14	M,P-XYLENE (SUM OF ISOMERS)	14	5	0.0010	3.00E-04	5.60E-04	0.0028	42			
1	SWMU 14	MAGNESIUM	14	14	4,020	2,020	2,967	2,967				
1	SWMU 14	MANGANESE	14	14	783	299	555	555	1,946			
1	SWMU 14	MERCURY	14	3	0.031	0.014	0.020	0.010	31	2.0		
1	SWMU 14	NICKEL	14	14	7.8	2.5	4.9	4.9	2,044	130		
1	SWMU 14	O-XYLENE (1,2-DIMETHYLBENZENE)	14	2	4.00E-04	3.00E-04	3.50E-04	0.0044				
1	SWMU 14	p,p'-DDD	14	1	0.0012	0.0012	0.0012	0.0019	10	16		
1	SWMU 14	p,p'-DDT	14	1	0.038	0.038	0.038	0.0045	7.0	32		
1	SWMU 14	POTASSIUM	14	14	1,670	785	1,307	1,307				
1	SWMU 14	SELENIUM	14	13	0.81	0.32	0.56	0.53	511	5.0		
1	SWMU 14	SODIUM	14	13	188	27	103	96				
1	**SWMU 14**	**THALLIUM**	**14**	**13**	**1.4**	**0.41**	**0.79**	**0.74**	**6.7**	**0.70**		**X**

APPENDIX C-2
Subsurface Soils Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Industrial PRG3	SSL[4] (DAF = 20)	Exceeds PRG	Exceeds SSL
1	SWMU 14	TOLUENE	14	8	0.0010	3.00E-04	4.75E-04	0.0021	52	12		
1	SWMU 14	VANADIUM	14	14	63	30	50	50	715	6,000		
1	SWMU 14	XYLENES, TOTAL	14	5	0.0010	3.00E-04	6.20E-04	0.0028	42	210		
1	SWMU 14	ZINC	14	14	45	23	33	33	10,000	12,000		
1	SWMU 05	1,2-DICHLOROETHANE	13	2	3.00E-04	3.00E-04	3.00E-04	0.0045	0.60	0.020		
1	SWMU 05	ACENAPHTHYLENE	13	1	0.098	0.098	0.098	0.19	2,913			
1	SWMU 05	ANTHRACENE	13	1	0.020	0.020	0.020	0.18	10,000	12,000		
1	SWMU 05	BENZENE	13	3	2.00E-04	2.00E-04	2.00E-04	0.0033	1.3	0.030		
1	SWMU 05	BENZO(a)ANTHRACENE	13	2	0.075	0.018	0.047	0.17	2.1	2.0		
1	SWMU 05	BENZO(a)PYRENE	13	2	0.16	0.031	0.097	0.18	0.21	8.0		
1	SWMU 05	BENZO(b)FLUORANTHENE	13	2	0.12	0.025	0.072	0.18	2.1	5.0		
1	SWMU 05	BENZO(g,h,I)PERYLENE	13	2	0.18	0.040	0.11	0.18	2,913	420		
1	SWMU 05	BENZO(k)FLUORANTHENE	13	2	0.10	0.028	0.066	0.17	21.1	49		
1	SWMU 05	bis(2-ETHYLHEXYL) PHTHALATE	13	1	0.032	0.032	0.032	0.18	123	3,600		
1	SWMU 05	CARBON DISULFIDE	13	7	0.010	3.00E-04	0.0019	0.0036	72	32		
1	SWMU 05	CHRYSENE	13	2	0.13	0.021	0.073	0.18	211	160		
1	SWMU 05	DI-n-BUTYL PHTHALATE	13	3	0.042	0.031	0.038	0.16	6,156	2,300		
1	SWMU 05	DIBENZ(a,h)ANTHRACENE	13	1	0.035	0.035	0.035	0.18	0.21	2.0		
1	SWMU 05	DIETHYL PHTHALATE	13	1	0.068	0.068	0.068	0.18	10,000			
1	SWMU 05	ETHYLBENZENE	13	1	0.0010	0.0010	0.0010	0.0050	19.5	13		
1	SWMU 05	FLUORANTHENE	13	2	0.10	0.021	0.063	0.17	2,200	4,300		
1	SWMU 05	INDENO(1,2,3-c,d)PYRENE	13	2	0.14	0.028	0.086	0.18	2.1	14		
1	SWMU 05	M,P-XYLENE (SUM OF ISOMERS)	13	6	0.0090	2.00E-04	0.0019	0.0038	42			
1	SWMU 05	METHYL ETHYL KETONE (2-BUTANONE)	7	7	0.0030	0.0020	0.0024	0.0024	2,710			
1	SWMU 05	O-XYLENE (1,2-DIMETHYLBENZENE)	13	2	0.0030	3.00E-04	0.0017	0.0047				
1	SWMU 05	PHENANTHRENE	13	1	0.042	0.042	0.042	0.18	10,000	4,200		
1	SWMU 05	PYRENE	13	2	0.17	0.023	0.099	0.18	2,913	4,200		
1	SWMU 05	STYRENE	13	1	6.00E-04	6.00E-04	6.00E-04	0.0049	170	4.0		
1	SWMU 05	TOLUENE	13	5	0.0010	3.00E-04	5.60E-04	0.0030	52	12		
1	SWMU 05	XYLENES, TOTAL	13	6	0.012	2.00E-04	0.0024	0.0040	42	210		
1,2	AOC B	1,1-DICHLOROETHENE	20	2	0.0011	8.50E-04	9.75E-04	0.0038	41.33	0.060		
1	AOC B	ALDRIN	16	1	5.50E-04	5.50E-04	5.50E-04	9.59E-04	0.10	0.50		
1	**AOC B**	**ALUMINUM**	**16**	**16**	**17,600**	**4,700**	**10,261**	**10,261**	**10,000**		**X**	
1	AOC B	ANTIMONY	16	4	0.43	0.31	0.36	0.17	41	5.0		
1,2	AOC B	ARSENIC	20	5	0.74	0.52	0.64	0.33	1.6	29		
1,2	AOC B	BARIUM	20	20	118	31	72	72	6,658	1,600		
1	AOC B	BERYLLIUM	16	13	0.50	0.13	0.32	0.27	1,941	63		
1	AOC B	bis(2-ETHYLHEXYL) PHTHALATE	16	1	0.093	0.093	0.093	0.23	123	3,600		
1	AOC B	CALCIUM	16	16	6,790	1,200	2,713	2,713				
1,2	AOC B	CHROMIUM, TOTAL	20	20	14	5.4	9.2	9.2	64	38		
1	AOC B	COBALT	16	16	13	3.6	7.5	7.5	1,921			
1,2	AOC B	COPPER	20	20	38	16	25	25	4,088			
1	**AOC B**	**IRON**	**16**	**16**	**30,300**	**12,000**	**19,763**	**19,763**	**10,000**		**X**	
1,2	AOC B	LEAD	20	8	3.5	0.65	1.4	4.5	750	400		
1	AOC B	MAGNESIUM	16	16	4,210	1,800	2,757	2,757				
1	AOC B	MANGANESE	16	16	735	95	398	398	1,946			

APPENDIX C-2

Subsurface Soils Statistical Data Summary

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Industrial PRG3	SSL[4] (DAF = 20)	Exceeds PRG	Exceeds SSL
1,2	AOC B	MERCURY	20	16	0.021	0.0033	0.0089	0.0086	31	2.0		
1	AOC B	METHYL ISOBUTYL KETONE (4-METHYL-2-PEN	16	3	0.0042	0.0010	0.0028	0.0047	284			
1,2	AOC B	NICKEL	20	20	6.9	2.5	4.3	4.3	2,044	130		
1	AOC B	POTASSIUM	16	16	1,870	810	1,263	1,263				
1,2	AOC B	SELENIUM	20	12	0.93	0.57	0.73	0.53	511	5.0		
1,2	AOC B	SILVER	20	5	0.13	0.090	0.11	0.055	511	34		
1	AOC B	SODIUM	16	16	160	40	101	101				
1	AOC B	THALLIUM	16	1	0.40	0.40	0.40	0.30	6.7	0.70		
1,2	AOC B	TOLUENE	20	4	3.50E-04	2.10E-04	2.98E-04	0.0033	52	12		
1	AOC B	VANADIUM	16	16	82	35	55	55	715	6,000		
1,2	AOC B	ZINC	20	20	99	18	42	42	10,000	12,000		

Notes:

Values are presented in units of milligrams per kilogram (mg/kg).

[1] Phase refers to the Phase I PA/SI investigation (October 2000) and the Phase II Expanded PA/SI investigation (July 2001).

[2] Best estimate of the mean is the average of all values using one half of the detection limit for undetected values.

3 Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/

[4] EPA Soil Screening Guidance: Technical Background Document. (EPA, 1996). http://www.epa.gov/superfund/resources/soil/toc.htm

N = Number of Samples

Appendix C-3
Sediments Statistical Data Summary

APPENDIX C-3
Sediments Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Ecological Criteria	Exceeds Eco Criteria
1	AOC C	ALUMINUM	2	2	9,050	4,380	6,715	6,715		
1	AOC C	ANTIMONY	2	1	0.22	0.22	0.22	0.15	12	
1	AOC C	ARSENIC	2	1	0.75	0.75	0.75	0.46	7.2	
1	AOC C	BARIUM	2	2	75	46	60	60	200	
1	AOC C	BERYLLIUM	2	2	0.14	0.088	0.11	0.11		
1	AOC C	CALCIUM	2	2	8,980	4,570	6,775	8,775		
1	AOC C	CHROMIUM, TOTAL	2	2	13	7.7	11	11	52	
1	AOC C	COBALT	2	2	9.5	7.6	8.6	8.6	20	
1	**AOC C**	**COPPER**	**2**	**2**	**24**	**16**	**20**	**20**	**19**	**X**
1	**AOC C**	**DIELDRIN**	**2**	**1**	**0.0044**	**0.0044**	**0.0044**	**0.0030**	**0.0033**	**X**
1	AOC C	ETHYLBENZENE	2	2	0.0020	3.00E-04	0.0012	0.0012	3.6	
1	AOC C	IRON	2	2	15,700	9,310	12,505	12,505		
1	AOC C	LEAD	2	2	11	8.5	9.6	9.6	30	
1	AOC C	M,P-XYLENE (SUM OF ISOMERS)	2	2	0.0090	0.0020	0.0055	0.0055		
1	AOC C	MAGNESIUM	2	2	4,950	2,900	3,925	3,925		
1	AOC C	MANGANESE	2	2	546	387	467	467		
1	AOC C	NICKEL	2	2	7.7	4.3	6.0	6.0	16	
1	AOC C	O-XYLENE (1,2-DIMETHYLBENZENE)	2	2	0.0020	5.00E-04	0.0013	0.0013		
1	AOC C	p,p'-DDE	2	1	8.00E-04	8.00E-04	8.00E-04	0.0012	0.0033	
1	AOC C	POTASSIUM	2	2	1,070	577	824	824		
1	AOC C	SELENIUM	2	2	0.51	0.25	0.38	0.38		
1	AOC C	SODIUM	2	2	224	81	152	152		
1	AOC C	THALLIUM	2	2	0.56	0.32	0.44	0.44		
1	AOC C	TOLUENE	2	2	0.0020	5.00E-04	0.0013	0.0013	0.67	
1	AOC C	VANADIUM	2	2	45	28	36	36		
1	AOC C	XYLENES, TOTAL	2	2	0.012	0.0020	0.0070	0.0070	0.050	
1	**AOC C**	**ZINC**	**2**	**2**	**287**	**75**	**181**	**181**	**124**	**X**
1	**SWMU 14**	**2-METHYLNAPHTHALENE**	**3**	**3**	**4.5**	**0.52**	**2.5**	**2.5**	**0.33**	**X**
1	SWMU 14	ALUMINUM	3	3	22,300	13,500	18,133	18,133		
1	SWMU 14	ANTIMONY	3	3	2.1	0.49	1.4	1.4	12	
1	SWMU 14	ARSENIC	3	3	3.9	2.9	3.3	3.3	7.2	
1	SWMU 14	BARIUM	3	3	144	85	120	120	200	
1	SWMU 14	BENZENE	3	2	0.0050	0.0030	0.0040	0.36	0.057	
1	SWMU 14	BERYLLIUM	3	3	0.40	0.21	0.31	0.31		
1	**SWMU 14**	**bis(2-ETHYLHEXYL) PHTHALATE**	**3**	**3**	**9.4**	**3.9**	**7.4**	**7.4**	**0.18**	**X**
1	**SWMU 14**	**CADMIUM**	**3**	**3**	**6.5**	**2.5**	**5.0**	**5.0**	**1.0**	**X**
1	SWMU 14	CALCIUM	3	3	41,000	25,100	30,700	30,700		
1	SWMU 14	CARBON DISULFIDE	3	2	0.0050	0.0030	0.0040	0.36		
1	SWMU 14	CHROMIUM, TOTAL	3	3	51	33	41	41	52	
1	SWMU 14	COBALT	3	3	19	14	16	16	20	
1	**SWMU 14**	**COPPER**	**3**	**3**	**158**	**80**	**123**	**123**	**19**	**X**
1	SWMU 14	ETHYLBENZENE	3	3	0.45	0.032	0.20	0.20	3.6	
1	SWMU 14	IRON	3	3	38,100	28,400	33,733	33,733		
1	**SWMU 14**	**LEAD**	**3**	**3**	**111**	**31**	**65**	**65**	**30**	**X**
1	SWMU 14	M,P-XYLENE (SUM OF ISOMERS)	3	2	0.018	0.0070	0.013	0.37		
1	SWMU 14	MAGNESIUM	3	3	10,500	8,870	9,463	9,463		

APPENDIX C-3
Sediments Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Ecological Criteria	Exceeds Eco Criteria
1	SWMU 14	MANGANESE	3	3	607	478	547	547		
1	**SWMU 14**	**MERCURY**	**3**	**3**	**0.37**	**0.052**	**0.22**	**0.22**	**0.13**	**X**
1	SWMU 14	METHYL ETHYL KETONE (2-BUTANONE)	2	2	0.029	0.025	0.027	0.027		
1	SWMU 14	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	3	2	0.018	0.010	0.014	0.37		
1	**SWMU 14**	**NAPHTHALENE**	**3**	**3**	**3.0**	**0.28**	**1.5**	**1.5**	**0.33**	**X**
1	**SWMU 14**	**NICKEL**	**3**	**3**	**18**	**17**	**17**	**17**	**16**	**X**
1	SWMU 14	O-XYLENE (1,2-DIMETHYLBENZENE)	3	2	0.0070	0.0040	0.0055	0.36		
1	**SWMU 14**	**p,p'-DDE**	**3**	**2**	**0.012**	**0.0062**	**0.0091**	**0.013**	**0.0033**	**X**
1	**SWMU 14**	**p,p'-DDT**	**3**	**1**	**0.013**	**0.013**	**0.013**	**0.015**	**0.0033**	**X**
1	**SWMU 14**	**PHENANTHRENE**	**3**	**3**	**1.2**	**0.22**	**0.76**	**0.76**	**0.33**	**X**
1	SWMU 14	POTASSIUM	3	3	2,650	1,400	2,057	2,057		
1	**SWMU 14**	**PYRENE**	**3**	**2**	**0.51**	**0.40**	**0.45**	**0.92**	**0.33**	**X**
1	SWMU 14	SELENIUM	3	2	1.2	0.92	1.1	0.76		
1	SWMU 14	SILVER	3	1	0.14	0.14	0.14	0.087	2.0	
1	SWMU 14	SODIUM	3	3	422	345	386	386		
1	SWMU 14	THALLIUM	3	1	0.67	0.67	0.67	0.40		
1	SWMU 14	TOLUENE	3	2	0.0050	0.0020	0.0035	0.36	0.67	
1	SWMU 14	VANADIUM	3	3	100	79	92	92		
1	SWMU 14	XYLENES, TOTAL	3	2	0.024	0.011	0.018	0.37	0.050	
1	**SWMU 14**	**ZINC**	**3**	**3**	**513**	**213**	**391**	**391**	**124**	**X**
1	AOC B	1,4-DICHLOROBENZENE	1	1	1.1	1.1	1.1	1.1		
1	AOC B	ARSENIC	1	1	3.1	3.1	3.1	3.1	7.2	
1	AOC B	BARIUM	1	1	85	85	85	85	200	
1	AOC B	BENZENE	1	1	0.0030	0.0030	0.0030	0.0030	0.057	
1	**AOC B**	**CADMIUM**	**1**	**1**	**32**	**32**	**32**	**32**	**1.0**	**X**
1	**AOC B**	**CHROMIUM, TOTAL**	**1**	**1**	**2,200**	**2,200**	**2,200**	**2,200**	**52**	**X**
1	**AOC B**	**COPPER**	**1**	**1**	**351**	**351**	**351**	**351**	**19**	**X**
1	AOC B	ETHYLBENZENE	1	1	0.022	0.022	0.022	0.022	3.6	
1	**AOC B**	**LEAD**	**1**	**1**	**676**	**676**	**676**	**676**	**30**	**X**
1	AOC B	M,P-XYLENE (SUM OF ISOMERS)	1	1	0.20	0.20	0.20	0.20		
1	AOC B	NICKEL	1	1	14	14	14	14	16	
1	AOC B	O-XYLENE (1,2-DIMETHYLBENZENE)	1	1	0.061	0.061	0.061	0.061		
1	AOC B	PETROLEUM HYDROCARBONS	1	1	8,000	8,000	8,000	8,000		
1	AOC B	SELENIUM	1	1	1.0	1.0	1.0	1.0		
1	**AOC B**	**SILVER**	**1**	**1**	**2.7**	**2.7**	**2.7**	**2.7**	**2.0**	**X**
1	**AOC B**	**TOLUENE**	**1**	**1**	**4.6**	**4.6**	**4.6**	**4.6**	**0.67**	**X**
1	**AOC B**	**XYLENES, TOTAL**	**1**	**1**	**0.26**	**0.26**	**0.26**	**0.26**	**0.050**	**X**
1	**AOC B**	**ZINC**	**2**	**2**	**4,090**	**1,950**	**3,020**	**3,020**	**124**	**X**

Notes:
Values are presented in units of milligrams per kilogram (mg/kg)
[1] Phase refers to the Phase I PA/SI investigation (October 2000) and the Phase II expanded PA/SI investigation (July 2001)
[2] Best estimate of the mean is the average of all values using one half of the detection limit for undetected values.
N = Number of Samples
X Bold "X" denotes that maximum detected concentration exceeds screening criteria.

Appendix C-4
Groundwater Statistical Data Summary

APPENDIX C-4
Groundwater Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Tap Water PRG (HI = 0.1)[3]	MCL[4]	Exceeds Tap Water PRG	Exceeds MCL
1	AOC C	ALUMINUM	1	1	4,390	4,390	4,390	4,390	3,650		X	
1	AOC C	BARIUM	1	1	156	156	156	156	255	2,000		
1	AOC C	BARIUM, DISSOLVED	1	1	124	124	124	124				
1	AOC C	CALCIUM	1	1	70,900	70,900	70,900	70,900				
1	AOC C	CALCIUM, DISSOLVED	1	1	66,600	66,600	66,600	66,600				
1	AOC C	CHROMIUM, DISSOLVED	1	1	1.2	1.2	1.2	1.2				
1	AOC C	CHROMIUM, TOTAL	1	1	17	17	17	17	11	100	X	
1	AOC C	COBALT	1	1	3.3	3.3	3.3	3.3	73			
1	AOC C	COPPER	1	1	11	11	11	11	146	1,300		
1	AOC C	IRON	1	1	5,720	5,720	5,720	5,720	1,095		X	
1	AOC C	LEAD, DISSOLVED	1	1	1.4	1.4	1.4	1.4				
1	AOC C	MAGNESIUM	1	1	42,100	42,100	42,100	42,100				
1	AOC C	MAGNESIUM, DISSOLVED	1	1	40,000	40,000	40,000	40,000				
1	AOC C	MANGANESE	1	1	177	177	177	177	88		X	
1	AOC C	MANGANESE, DISSOLVED	1	1	23	23	23	23				
1	AOC C	NICKEL	1	1	9.1	9.1	9.1	9.1	73	100		
1	AOC C	NICKEL, DISSOLVED	1	1	5.7	5.7	5.7	5.7				
1	AOC C	POTASSIUM	1	1	4,980	4,980	4,980	4,980				
1	AOC C	POTASSIUM, DISSOLVED	1	1	4,650	4,650	4,650	4,650				
1	AOC C	SELENIUM, DISSOLVED	1	1	2.7	2.7	2.7	2.7				
1	AOC C	SODIUM	1	1	157,000	157,000	157,000	157,000				
1	AOC C	SODIUM, DISSOLVED	1	1	155,000	155,000	155,000	155,000				
1	AOC C	VANADIUM	1	1	28	28	28	28	26		X	
1	AOC C	VANADIUM, DISSOLVED	1	1	12	12	12	12				
1	AOC C	ZINC	1	1	18	18	18	18	1,095			
1	AOC F	ALUMINUM	5	5	18,800	221	4,338	4,338	3,650		X	
1	AOC F	ANTIMONY	5	1	1.6	1.6	1.6	0.88	1.5	6.0	X	
1	AOC F	ANTIMONY, DISSOLVED	5	1	1.9	1.9	1.9	0.94				
1	AOC F	BARIUM	5	5	141	61	82	82	255	2,000		
1	AOC F	BARIUM, DISSOLVED	5	5	71	55	63	63				
1	AOC F	CADMIUM, DISSOLVED	5	2	0.20	0.20	0.20	0.14				
1	AOC F	CALCIUM	5	5	48,000	37,500	42,820	42,820				
1	AOC F	CALCIUM, DISSOLVED	5	5	48,600	38,400	43,040	43,040				
1	AOC F	CHROMIUM, DISSOLVED	5	5	2.3	0.90	1.2	1.2				
1	AOC F	CHROMIUM, TOTAL	5	5	28	1.8	9.5	9.5	11	100	X	
1	AOC F	COBALT	5	3	15	0.93	5.9	3.6	73			
1	AOC F	COPPER	5	5	46	2.9	13	13	146	1,300		
1	AOC F	COPPER, DISSOLVED	5	5	3.8	2.6	3.0	3.0				
1	AOC F	DIETHYL PHTHALATE	5	2	10	8.0	9.0	5.1	2,920			
1	AOC F	IRON	5	5	23,900	257	5,496	5,496	1,095		X	
1	AOC F	LEAD	5	2	3.4	1.2	2.3	1.3		15		
1	AOC F	LEAD, DISSOLVED	5	3	1.7	1.1	1.4	1.0				
1	AOC F	MAGNESIUM	5	5	38,600	25,400	30,320	30,320				
1	AOC F	MAGNESIUM, DISSOLVED	5	5	34,900	25,300	28,800	28,800				
1	AOC F	MANGANESE	5	5	819	29	273	273	88		X	
1	AOC F	MANGANESE, DISSOLVED	5	5	155	20	109	109				

APPENDIX C-4
Groundwater Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Tap Water PRG (HI = 0.1)[3]	MCL[4]	Exceeds Tap Water PRG	Exceeds MCL
1	AOC F	NICKEL	5	5	15	2.0	5.2	5.2	73	100		
1	AOC F	NICKEL, DISSOLVED	5	4	1.8	1.0	1.5	1.3				
1	AOC F	POTASSIUM	5	5	5,650	3,320	3,944	3,944				
1	AOC F	POTASSIUM, DISSOLVED	5	5	4,120	3,380	3,666	3,666				
1	AOC F	SELENIUM	5	4	7.2	2.6	4.6	3.9	18	50		
1	AOC F	SELENIUM, DISSOLVED	5	4	6.7	3.6	5.6	4.7				
1	AOC F	SODIUM	5	5	251,000	140,000	221,000	221,000				
1	AOC F	SODIUM, DISSOLVED	5	5	250,000	146,000	220,600	220,600				
1	**AOC F**	**VANADIUM**	**5**	**5**	**84**	**19**	**37**	**37**	**26**		**X**	
1	AOC F	VANADIUM, DISSOLVED	5	5	29	17	21	21				
1	AOC F	ZINC	5	3	50	2.8	21	13	1,095			
1	AOC F	ZINC, DISSOLVED	5	2	118	7.3	63	26				
2	**AOC K**	**ALUMINUM**	**5**	**4**	**9,100**	**680**	**3,173**	**2,548**	**3,650**		**X**	
2	**AOC K**	**BARIUM**	**5**	**5**	**390**	**94**	**205**	**205**	**255**	**2,000**	**X**	
2	AOC K	BARIUM, DISSOLVED	5	5	200	92	142	142				
2	**AOC K**	**bis(2-ETHYLHEXYL) PHTHALATE**	**5**	**1**	**19**	**19**	**19**	**5.9**	**4.8**	**6.0**	**X**	**X**
2	AOC K	CALCIUM	5	5	120,000	76,000	95,400	95,400				
2	AOC K	CALCIUM, DISSOLVED	5	5	110,000	64,000	87,400	87,400				
2	**AOC K**	**CHROMIUM, TOTAL**	**5**	**3**	**19**	**4.8**	**9.6**	**5.9**	**11**	**100**	**X**	
2	AOC K	COBALT	5	2	23	5.4	14	5.8	73			
2	AOC K	COBALT, DISSOLVED	5	1	1.1	1.1	1.1	0.39				
2	AOC K	COPPER	5	4	26	5.1	12	10.0	146	1,300		
2	AOC K	COPPER, DISSOLVED	5	3	4.0	2.8	3.3	2.2				
2	**AOC K**	**IRON**	**5**	**5**	**9,600**	**86**	**3,075**	**3,075**	**1,095**		**X**	
2	AOC K	MAGNESIUM	5	5	76,000	49,000	57,200	57,200				
2	AOC K	MAGNESIUM, DISSOLVED	5	5	71,000	42,000	54,000	54,000				
2	**AOC K**	**MANGANESE**	**5**	**5**	**1,300**	**18**	**394**	**394**	**88**		**X**	
2	AOC K	MANGANESE, DISSOLVED	5	4	370	7.4	194	156				
2	AOC K	NICKEL	5	3	30	9.2	17	10	73	100		
2	AOC K	NICKEL, DISSOLVED	5	3	7.0	2.8	4.6	2.9				
2	AOC K	POTASSIUM	5	5	8,500	5,100	6,340	6,340				
2	AOC K	POTASSIUM, DISSOLVED	5	5	8,800	4,700	6,200	6,200				
2	AOC K	SELENIUM, DISSOLVED	5	1	6.4	6.4	6.4	3.1				
2	AOC K	SODIUM	5	5	210,000	160,000	178,000	178,000				
2	AOC K	SODIUM, DISSOLVED	5	5	200,000	160,000	176,000	176,000				
2	**AOC K**	**THALLIUM**	**5**	**2**	**9.3**	**8.0**	**8.7**	**4.5**	**0.24**	**2.0**	**X**	**X**
2	AOC K	THALLIUM, DISSOLVED	5	2	6.4	5.3	5.9	3.4				
2	AOC K	TOLUENE	5	3	0.75	0.43	0.60	0.56	72	1,000		
2	**AOC K**	**VANADIUM**	**5**	**5**	**64**	**6.9**	**23**	**23**	**26**		**X**	
2	AOC K	VANADIUM, DISSOLVED	5	5	8.2	4.9	7.1	7.1				
2	AOC K	ZINC	5	2	28	22	25	12	1,095			
2	AOC K	ZINC, DISSOLVED	5	1	9.7	9.7	9.7	3.9				
1	**SWMU 14**	**ALUMINUM**	**2**	**2**	**26,100**	**152**	**13,126**	**13,126**	**3,650**		**X**	
1	SWMU 14	ALUMINUM, DISSOLVED	2	1	28	28	28	20				
1	**SWMU 14**	**ANTIMONY**	**2**	**1**	**2.3**	**2.3**	**2.3**	**1.5**	**1.5**	**6.0**	**X**	
1	SWMU 14	ANTIMONY, DISSOLVED	2	1	2.1	2.1	2.1	1.4				

APPENDIX C-4
Groundwater Statistical Data Summary
NFA Report for Nine Sites
Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Tap Water PRG (HI = 0.1)[3]	MCL[4]	Exceeds Tap Water PRG	Exceeds MCL
1	SWMU 14	BARIUM	2	2	250	92	171	171	255	2,000		
1	SWMU 14	BARIUM, DISSOLVED	2	2	90	89	90	90				
1	SWMU 14	CALCIUM	2	2	86,300	49,600	67,950	67,950				
1	SWMU 14	CALCIUM, DISSOLVED	2	2	58,700	51,600	55,150	55,150				
1	SWMU 14	CHROMIUM, DISSOLVED	2	2	1.8	1.6	1.7	1.7				
1	**SWMU 14**	**CHROMIUM, TOTAL**	**2**	**2**	**68**	**3.3**	**36**	**36**	**11**	**100**	**X**	
1	SWMU 14	COBALT	2	1	22	22	22	11	73			
1	SWMU 14	COBALT, DISSOLVED	2	1	0.94	0.94	0.94	0.60				
1	SWMU 14	COPPER	2	1	70	70	70	36	146	1,300		
1	SWMU 14	COPPER, DISSOLVED	2	1	3.5	3.5	3.5	2.2				
1	**SWMU 14**	**DIELDRIN**	**2**	**1**	**0.010**	**0.010**	**0.010**	**0.010**	**0.0042**		**X**	
1	**SWMU 14**	**IRON**	**2**	**2**	**32,100**	**147**	**16,124**	**16,124**	**1,095**		**X**	
1	SWMU 14	IRON, DISSOLVED	2	2	12	12	12	12				
1	SWMU 14	LEAD	2	1	5.1	5.1	5.1	2.8		15		
1	SWMU 14	LEAD, DISSOLVED	2	1	1.2	1.2	1.2	0.88				
1	SWMU 14	MAGNESIUM	2	2	35,700	24,800	30,250	30,250				
1	SWMU 14	MAGNESIUM, DISSOLVED	2	2	25,700	23,200	24,450	24,450				
1	**SWMU 14**	**MANGANESE**	**2**	**2**	**1,820**	**97**	**959**	**959**	**88**		**X**	
1	SWMU 14	MANGANESE, DISSOLVED	2	2	1,160	84	622	622				
1	SWMU 14	NICKEL	2	2	40	1.5	21	21	73	100		
1	SWMU 14	NICKEL, DISSOLVED	2	1	12	12	12	6.4				
1	SWMU 14	POTASSIUM	2	2	5,680	3,120	4,400	4,400				
1	SWMU 14	POTASSIUM, DISSOLVED	2	2	3,250	3,060	3,155	3,155				
1	SWMU 14	SELENIUM	2	1	5.2	5.2	5.2	3.1	18	50		
1	SWMU 14	SODIUM	2	2	116,000	108,000	112,000	112,000				
1	SWMU 14	SODIUM, DISSOLVED	2	2	118,000	96,100	107,050	107,050				
1	**SWMU 14**	**VANADIUM**	**2**	**2**	**108**	**20**	**64**	**64**	**26**		**X**	
1	SWMU 14	VANADIUM, DISSOLVED	2	2	20	15	18	18				
1	SWMU 14	ZINC	2	2	92	3.8	48	48	1,095			
1	SWMU 14	ZINC, DISSOLVED	2	2	3.4	3.0	3.2	3.2				
1	**SWMU 15**	**ALUMINUM**	**1**	**1**	**8,700**	**8,700**	**8,700**	**8,700**	**3,650**		**X**	
1	**SWMU 15**	**ANTIMONY**	**1**	**1**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**6.0**	**X**	
1	SWMU 15	BARIUM	1	1	174	174	174	174	255	2,000		
1	SWMU 15	BARIUM, DISSOLVED	1	1	108	108	108	108				
1	SWMU 15	BERYLLIUM	1	1	0.31	0.31	0.31	0.31	7.3	4.0		
1	SWMU 15	CADMIUM, DISSOLVED	1	1	0.23	0.23	0.23	0.23				
1	SWMU 15	CALCIUM	1	1	78,200	78,200	78,200	78,200				
1	SWMU 15	CALCIUM, DISSOLVED	1	1	72,300	72,300	72,300	72,300				
1	SWMU 15	CHROMIUM, DISSOLVED	1	1	2.0	2.0	2.0	2.0				
1	**SWMU 15**	**CHROMIUM, TOTAL**	**1**	**1**	**31**	**31**	**31**	**31**	**11**	**100**	**X**	
1	SWMU 15	COBALT	1	1	5.9	5.9	5.9	5.9	73			
1	SWMU 15	COPPER	1	1	15	15	15	15	146	1,300		
1	**SWMU 15**	**IRON**	**1**	**1**	**10,100**	**10,100**	**10,100**	**10,100**	**1,095**		**X**	
1	SWMU 15	LEAD	1	1	1.7	1.7	1.7	1.7		15		
1	SWMU 15	MAGNESIUM	1	1	37,800	37,800	37,800	37,800				
1	SWMU 15	MAGNESIUM, DISSOLVED	1	1	34,700	34,700	34,700	34,700				

APPENDIX C-4

Groundwater Statistical Data Summary

NFA Report for Nine Sites

Former NASD, Vieques Island, Puerto Rico

Phase[1]	SiteID	Chemical	N	Detects	Maximum Detect	Minimum Detect	Mean of Detects	Best Estimate of the Mean[2]	Tap Water PRG (HI = 0.1)[3]	MCL[4]	Exceeds Tap Water PRG	Exceeds MCL
1	**SWMU 15**	**MANGANESE**	**1**	**1**	**458**	**458**	**458**	**458**	**88**		**X**	
1	SWMU 15	MANGANESE, DISSOLVED	1	1	117	117	117	117				
1	SWMU 15	NICKEL	1	1	17	17	17	17	73	100		
1	SWMU 15	NICKEL, DISSOLVED	1	1	2.8	2.8	2.8	2.8				
1	SWMU 15	POTASSIUM	1	1	3,530	3,530	3,530	3,530				
1	SWMU 15	POTASSIUM, DISSOLVED	1	1	2,300	2,300	2,300	2,300				
1	SWMU 15	SODIUM	1	1	92,500	92,500	92,500	92,500				
1	SWMU 15	SODIUM, DISSOLVED	1	1	89,600	89,600	89,600	89,600				
1	**SWMU 15**	**VANADIUM**	**1**	**1**	**44**	**44**	**44**	**44**	**26**		**X**	
1	SWMU 15	VANADIUM, DISSOLVED	1	1	18	18	18	18				
1	SWMU 15	ZINC	1	1	31	31	31	31	1,095			
1	SWMU 15	ZINC, DISSOLVED	1	1	8.7	8.7	8.7	8.7				
1	**AOC B**	**1,4-DICHLOROBENZENE**	**1**	**1**	**36**	**36**	**36**	**36**	**0.50**	**75**	**X**	
1	AOC B	BARIUM	1	1	20	20	20	20	255	2,000		
1	AOC B	BENZENE	1	1	0.20	0.20	0.20	0.20	0.35	5.0		
1	AOC B	CHROMIUM, TOTAL	1	1	5.3	5.3	5.3	5.3	11	100		
1	AOC B	COPPER	1	1	57	57	57	57	146	1,300		
1	**AOC B**	**CRESOLS, m & p**	**1**	**1**	**798**	**798**	**798**	**798**	**18**		**X**	
1	AOC B	ETHYLBENZENE	1	1	0.80	0.80	0.80	0.80	2.9	700		
1	AOC B	LEAD	1	1	3.1	3.1	3.1	3.1		15		
1	AOC B	M,P-XYLENE (SUM OF ISOMERS)	1	1	3.0	3.0	3.0	3.0	21	10,000		
1	AOC B	MERCURY	1	1	0.45	0.45	0.45	0.45	1.1	2.0		
1	AOC B	NITROGEN, NITRATE-NITRITE	1	1	250	250	250	250				
1	AOC B	O-XYLENE (1,2-DIMETHYLBENZENE	1	1	2.0	2.0	2.0	2.0		10,000		
1	AOC B	PETROLEUM HYDROCARBONS	1	1	34,000	34,000	34,000	34,000				
1	AOC B	PHENOL	1	1	80	80	80	80	2,190			
1	AOC B	SULFATE (AS SO4)	1	1	27,400	27,400	27,400	27,400				
1	AOC B	SULFIDE, TOTAL	1	1	6,950	6,950	6,950	6,950				
1	**AOC B**	**TOLUENE**	**1**	**1**	**370**	**370**	**370**	**370**	**72**	**1,000**	**X**	
1	AOC B	XYLENES, TOTAL	1	1	4.0	4.0	4.0	4.0	21	10,000		
1	AOC B	ZINC	1	1	193	193	193	193	1,095			

Notes:

Values are presented in units of micrograms per liter (ug/L).

[1] Phase refers to the Phase I PA/SI investigation (October 2000) and the Phase II Expanded PA/SI investigation (July 2001).

[2] Best estimate of the mean is the average of all values using one half of the detection limit for undetected values.

[3] Region 9 Preliminary Remediation Goals (PRG). (EPA, 2002). http://www.epa.gov/region09/waste/sfund/prg/

[4] Maximum Contaminant Levels. EPA Office of Water. http://www.epa.gov/safewater/mcl.html

N = Number of samples

X Bold "X" denotes that maximum detected concentration exceeds screening criteria.

Appendix D
Risk Assessment Data Tables
(RAGS Part D Format)

Appendix D-1
SWMU 5 Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-1 Contents for SWMU 5 Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 32
Table 1: Selection of Exposure Pathways	p. 2 of 32
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Surface Soil)	p. 3 of 32
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Subsurface Soil)	p. 4 of 32
Table 3.1 RME: EPC Summary (Surface Soil)	p. 5 of 32
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 6 of 32
Table 3.3 RME: EPC Summary (Groundwater)	p. 7 of 32
Table 4.1 RME: Values Used for Daily Intake Calculations (Surface Soil – Current Timeframe)	p. 8 of 32
Table 4.2 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 9 of 32
Table 4.3 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 10 of 32
Table 4.4 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 11 of 32
Table 4.5 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 12 of 32
Table 4.6 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 13 of 32
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 14 of 32
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 15 of 32
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 16 of 32
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 17 of 32
Table 6.2: Cancer Toxicity Data – Inhalation	p. 18 of 32
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Maintenance Worker – Adult)	p.19 of 32
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p.20 of 32
Table 7.3: RME Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Adult)	p.21 of 32
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Child)	p.22 of 32
Table 7.5 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p.23 of 32
Table 7.6 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p.24 of 32

Appendix D-1 Contents for SWMU 5 Risk Assessment Tables

Table No.	Page No.
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 25 of 32
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Maintenance Worker – Adult)	p. 26 of 32
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 27 of 32
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Adult)	p. 28 of 32
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Child)	p. 29 of 32
Table 9.5 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 30 of 32
Table 9.6 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 31 of 32
Table 10.1 RME: Risk Summary	p. 32 of 32

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	SWMU 5
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 5

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Direct contact with COPCs in site soil.	Maintenance Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of workers in the area involved in lawn mowing activities.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Recreational	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
Future	Soil	Surface Soil	Direct contact with COPCs in site soil.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of future indusrtial workers at the site.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 5

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface and Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	56-55-3	BENZO(a)ANTHRACENE	0.023 J	0.038 J	mg/kg	W5-SB04	2 / 4	NA	0.038	NA	6.21E-01	NA	NA	N	BSL
	50-32-8	**BENZO(a)PYRENE**	**0.075 J**	**0.088 J**	**mg/kg**	**W5-SB01**	**2 / 4**	**NA**	**0.088**	**NA**	**6.21E-02**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	BENZO(b)FLUORANTHENE	0.05 J	0.144 J	mg/kg	W5-SB01	2 / 4	NA	0.14	NA	6.21E-01	NA	NA	N	BSL
		BENZO(g,h,i)PERYLENE	0.041 J	0.093 J	mg/kg	W5-SB04	2 / 4	NA	0.093	NA		NA	NA	N	NSV
	207-08-9	BENZO(k)FLUORANTHENE	0.059 J	0.074 J	mg/kg	W5-SB01	2 / 4	NA	0.074	NA	6.21E+00	NA	NA	N	BSL
	75-15-0	CARBON DISULFIDE	0.0005 J	0.0007 J	mg/kg	W5-SB02	3 / 4	NA	7.00E-04	NA	3.55E+01	NA	NA	N	BSL
	218-01-9	CHRYSENE	0.06 J	0.062 J	mg/kg	W5-SB01	2 / 4	NA	0.062	NA	6.21E+01	NA	NA	N	BSL
	206-44-0	FLUORANTHENE	0.041 J	0.068 J	mg/kg	W5-SB01	2 / 4	NA	0.068	NA	2.29E+02	NA	NA	N	BSL
	193-39-5	INDENO(1,2,3-c,d)PYRENE	0.037 J	0.068 J	mg/kg	W5-SB04	2 / 4	NA	0.068	NA	6.21E-01	NA	NA	N	BSL
	78-93-3	METHYL ETHYL KETONE (2-BUTANONE	0.002 J	0.002 J	mg/kg	W5-SB01	1 / 1	NA	0.0020	NA	7.33E+02	NA	NA	N	BSL
	129-00-0	PYRENE	0.065 J	0.067 J	mg/kg	W5-SB04	2 / 4	NA	0.067	NA	2.32E+02	NA	NA	N	BSL
	100-42-5	STYRENE	0.0008 J	0.0006 J	mg/kg	W5-SB04	1 / 4	NA	6.00E-04	NA	1.70E+02	NA	NA	N	BSL
	108-88-3	TOLUENE	0.0004 J	0.0004 J	mg/kg	W5-SB01	1 / 4	NA	4.00E-04	NA	5.20E+01	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 5

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	107-06-2	1,2-DICHLOROETHANE	0.0003 J	0.0003 J	mg/kg	W5-SB03	2 / 13	NA	3.00E-04	NA	6.03E-01			N	BSL
		ACENAPHTHYLENE	0.098 J	0.098 J	mg/kg	W5-SB04	1 / 13	NA	0.098	NA				N	NSV
	120-12-7	ANTHRACENE	0.02 J	0.02 J	mg/kg	W5-SB04	1 / 13	NA	0.020	NA	1.00E+04			N	BSL
	71-43-2	BENZENE	0.0002 J	0.0002 J	mg/kg	W5-SB01	3 / 13	NA	2.00E-04	NA	1.31E+00			N	BSL
	56-55-3	BENZO(a)ANTHRACENE	0.018 J	0.075 J	mg/kg	W5-SB04	2 / 13	NA	0.075	NA	2.11E+00			N	BSL
	50-32-8	BENZO(a)PYRENE	0.031 J	0.163 J	mg/kg	W5-SB04	2 / 13	NA	0.16	NA	2.11E-01			N	BSL
	205-99-2	BENZO(b)FLUORANTHENE	0.025 J	0.118 J	mg/kg	W5-SB04	2 / 13	NA	0.12	NA	2.11E+00			N	BSL
		BENZO(g,h,i)PERYLENE	0.04 J	0.184 J	mg/kg	W5-SB04	2 / 13	NA	0.18	NA				N	NSV
	207-08-9	BENZO(k)FLUORANTHENE	0.028 J	0.103 J	mg/kg	W5-SB04	2 / 13	NA	0.10	NA	2.11E+01			N	BSL
	117-81-7	bis(2-ETHYLHEXYL)PHTHALATE	0.032 J	0.032 J	mg/kg	W5-SB01	1 / 13	NA	0.032	NA	1.23E+02			N	BSL
	75-15-0	CARBON DISULFIDE	0.0003 J	0.01 J	mg/kg	W5-SB02	7 / 13	NA	0.010	NA	7.20E+01			N	BSL
	218-01-9	CHRYSENE	0.021 J	0.125 J	mg/kg	W5-SB04	2 / 13	NA	0.13	NA	2.11E+02			N	BSL
	84-74-2	DI-n-BUTYL PHTHALATE	0.031 J	0.042 J	mg/kg	W5-SB02	3 / 13	NA	0.042	NA	6.16E+03			N	BSL
	53-70-3	DIBENZ(a,h)ANTHRACENE	0.035 J	0.035 J	mg/kg	W5-SB04	1 / 13	NA	0.035	NA	2.11E-01			N	BSL
	84-66-2	DIETHYL PHTHALATE	0.068 J	0.068 J	mg/kg	W5-SB01	1 / 13	NA	0.068	NA	1.00E+04			N	BSL
	100-41-4	ETHYLBENZENE	0.001 J	0.001 J	mg/kg	W5-SB04	1 / 13	NA	0.0010	NA	1.95E+01			N	BSL
	206-44-0	FLUORANTHENE	0.021 J	0.104 J	mg/kg	W5-SB04	2 / 13	NA	0.10	NA	2.20E+03			N	BSL
	193-39-5	INDENO(1,2,3-c,d)PYRENE	0.028 J	0.144 J	mg/kg	W5-SB04	2 / 13	NA	0.14	NA	2.11E+00			N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0002 J	0.009 J	mg/kg	W5-SB04	8 / 13	NA	0.0090	NA	4.20E+01			N	BSL
	78-93-3	METHYL ETHYL KETONE (2-BUTANONE	0.002 J	0.003 J	mg/kg	W5-SB01	7 / 7	NA	0.0030	NA	2.71E+03			N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE)	0.0003 J	0.003 J	mg/kg	W5-SB04	2 / 13	NA	0.0030	NA	4.20E+01			N	BSL
		PHENANTHRENE	0.042 J	0.042 J	mg/kg	W5-SB04	1 / 13	NA	0.042	NA				N	NSV
	129-00-0	PYRENE	0.023 J	0.174 J	mg/kg	W5-SB04	2 / 13	NA	0.17	NA	2.91E+03			N	BSL
	100-42-5	STYRENE	0.0006 J	0.0006 J	mg/kg	W5-SB04	1 / 13	NA	6.00E-04	NA	1.70E+02			N	BSL
	106-88-3	TOLUENE	0.0003 J	0.001 J	mg/kg	W5-SB04	5 / 13	NA	0.0010	NA	5.20E+01			N	BSL
	1330-20-7	XYLENES, TOTAL	0.0002 J	0.012 =	mg/kg	W5-SB04	6 / 13	NA	0.012	NA	4.20E+01			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	Benzo(a)pyrene	mg/Kg	0.1295	0.376 (L)	0.088	0.088	mg/Kg	Max detect	4

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	No COPCs Identified in Subsurface Soil								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	NA								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		l	
					Antimony	0.001		l	
					Arsenic	0.03		e	
					Chromium	0.001		l	
					Iron	0.001		l	
					Manganese	0.001		l	
					Thallium	0.001		l	
					Vanadium	0.001		l	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I, May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	e	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	e	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	e	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interim Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.5.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	6,760	day		
Dermal:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.07	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	6,760	day		
Inhalation:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	6,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interim Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	c	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 5

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

SWMU 5

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

SWMU 5

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 5

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

SWMU 5

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Current
Receptor Population:	Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	9E-02	mg/Kg	6.4E-09	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.7E-08	1.8E-08	mg/kg/day			
			Exp. Route Total								4.7E-08					0.0000
			Dermal	Benzo(a)pyrene	9E-02	mg/Kg	5.5E-09	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.0E-08	1.5E-08	mg/kg/day			
			Exp. Route Total								4.0E-08					0.0000
			Inhalation	Benzo(a)pyrene	9E-02	mg/Kg	9.4E-13	mg/kg/day				2.6E-12	mg/kg/day			
			Exp. Route Total								0.0E+00					0.0000
		Exposure Point Total									8.7E-08					0.0000
	Exposure Medium Total										8.7E-08					0.0000
Medium Total											8.7E-08					0.0000
										Total of Receptor Risks Across All Media	8.7E-08				Total of Receptor Hazards Across All Media	0.0000

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	9E-02	mg/Kg	3.1E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	2.2E-07	8.6E-08	mg/kg/day			
			Exp. Route Total								2.2E-07					0.0000
			Dermal	Benzo(a)pyrene	9E-02	mg/Kg	2.6E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.9E-07	7.4E-08	mg/kg/day			
			Exp. Route Total								1.9E-07					0.0000
			Inhalation	Benzo(a)pyrene	9E-02	mg/Kg	4.5E-12	mg/kg/day				1.3E-11	mg/kg/day			
			Exp. Route Total								0.0E+00					0.0000
		Exposure Point Total									4.2E-07					0.0000
	Exposure Medium Total										4.2E-07					0.0000
Medium Total											4.2E-07					0.0000
										Total of Receptor Risks Across All Media	4.2E-07				Total of Receptor Hazards Across All Media	0.0000

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	9E-02	mg/Kg	1.2E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	9.0E-08	3.6E-08	mg/kg/day			
			Exp. Route Total								9.0E-08					0.0000
			Dermal	Benzo(a)pyrene	9E-02	mg/Kg	1.8E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.3E-07	5.3E-08	mg/kg/day			
			Exp. Route Total								1.3E-07					0.0000
			Inhalation	Benzo(a)pyrene	9E-02	mg/Kg	1.8E-12	mg/kg/day				5.3E-12	mg/kg/day			
			Exp. Route Total								0.0E+00					0.0000
		Exposure Point Total									2.2E-07					0.0000
	Exposure Medium Total										2.2E-07					0.0000
Medium Total											2.2E-07					0.0000
										Total of Receptor Risks Across All Media	2.2E-07				Total of Receptor Hazards Across All Media	0.0000

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	9E-02	mg/Kg	2.9E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	2.1E-07	3.3E-07	mg/kg/day			
			Exp. Route Total								2.1E-07					0.0000
			Dermal	Benzo(a)pyrene	9E-02	mg/Kg	1.0E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	7.6E-08	1.2E-07	mg/kg/day			
			Exp. Route Total								7.6E-08					0.0000
			Inhalation	Benzo(a)pyrene	9E-02	mg/Kg	2.1E-12	mg/kg/day				2.5E-11	mg/kg/day			
			Exp. Route Total								0.0E+00					0.0000
		Exposure Point Total									2.9E-07					0.0000
	Exposure Medium Total										2.9E-07					0.0000
Medium Total											2.9E-07					0.0000
										Total of Receptor Risks Across All Media	2.9E-07				Total of Receptor Hazards Across All Media	0.0000

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	9E-02	mg/Kg	4.1E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	3.0E-07	1.2E-07	mg/kg/day			
			Exp. Route Total								3.0E-07					0.0000
			Dermal	Benzo(a)pyrene	9E-02	mg/Kg	2.1E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.6E-07	6.3E-08	mg/kg/day			
			Exp. Route Total								1.6E-07					0.0000
			Inhalation	Benzo(a)pyrene	9E-02	mg/Kg	6.1E-12	mg/kg/day				1.8E-11	mg/kg/day			
			Exp. Route Total								0.0E+00					0.0000
		Exposure Point Total									4.6E-07					0.0000
	Exposure Medium Total										4.6E-07					0.0000
Medium Total											4.6E-07					0.0000
										Total of Receptor Risks Across All Media	4.6E-07				Total of Receptor Hazards Across All Media	0.0000

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	9E-02	mg/Kg	9.6E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	7.0E-07	1.1E-06	mg/kg/day			
			Exp. Route Total								7.0E-07					0.0000
			Dermal	Benzo(a)pyrene	9E-02	mg/Kg	3.5E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	2.6E-07	4.1E-07	mg/kg/day			
			Exp. Route Total								2.6E-07					0.0000
			Inhalation	Benzo(a)pyrene	9E-02	mg/Kg	7.1E-12	mg/kg/day				8.3E-11	mg/kg/day			
			Exp. Route Total								0.0E+00					0.0000
		Exposure Point Total									9.6E-07					0.0000
	Exposure Medium Total										9.6E-07					0.0000
Medium Total											9.6E-07					0.0000
										Total of Receptor Risks Across All Media	9.6E-07				Total of Receptor Hazards Across All Media	0.0000

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

SWMU 5

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	4.67E-08	0.00E+00	4.01E-08	NA	8.68E-08					
			Chemical Total					8.68E-08					0
		Exposure Point Total						8.68E-08					0
	Exposure Medium Total							8.68E-08					0
Medium Total								8.68E-08					0
Receptor Total							Receptor Risk Total	8.68E-08				Receptor HI Total	0

Total Organ (None Specified) HI Across All Media = 0

TA. . 3.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	2.24E-07	0.00E+00	1.93E-07	NA	4.17E-07					
			Chemical Total					4.17E-07					0
		Exposure Point Total						4.17E-07					0
	Exposure Medium Total							4.17E-07					0
Medium Total								4.17E-07					0
Receptor Total							Receptor Risk Total	4.17E-07				Receptor HI Total	0

Total Organ (None Specified) HI Across All Media = 0

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	8.97E-08	0.00E+00	1.33E-07	NA	2.23E-07					
			Chemical Total					2.23E-07					0
		Exposure Point Total						2.23E-07					0
	Exposure Medium Total							2.23E-07					0
Medium Total								2.23E-07					0
Receptor Total							Receptor Risk Total	2.23E-07				Receptor HI Total	0

Total Organ (None Specified) HI Across All Media = 0

TA... 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	2.09E-07	0.00E+00	7.61E-08	NA	2.85E-07					
			Chemical Total					2.85E-07					0
		Exposure Point Total						2.85E-07					0
	Exposure Medium Total							2.85E-07					0
Medium Total								2.85E-07					0
Receptor Total							Receptor Risk Total	2.85E-07				Receptor HI Total	0

Total Organ (None Specified) HI Across All Media = 0

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	3.02E-07	0.00E+00	1.56E-07	NA	4.58E-07					
			Chemical Total					4.58E-07					0
		Exposure Point Total						4.58E-07					0
	Exposure Medium Total							4.58E-07					0
Medium Total								4.58E-07					0
Receptor Total							Receptor Risk Total	4.58E-07				Receptor HI Total	0

Total Organ (None Specified) HI Across All Media = 0

TA[illegible] 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	7.04E-07	0.00E+00	2.56E-07	NA	9.60E-07					
			Chemical Total					9.60E-07					0
		Exposure Point Total						9.60E-07					0
	Exposure Medium Total							9.60E-07					0
Medium Total								9.60E-07					0
Receptor Total							Receptor Risk Total	9.60E-07				Receptor HI Total	0
							Sum of Residential Adult and Residential Child Risks	1.4E-06					

Total Organ (None Specified) HI Across All Media = 0

TABLE 10.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 5

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =

Total Organ 2 HI Across All Media =

Appendix D-2
SWMU 10 Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-2 Contents for SWMU 10 Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 35
Table 1: Selection of Exposure Pathways	p. 2 of 35
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Surface Soil)	p. 3 of 35
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Subsurface Soil)	p. 4 of 35
Table 3.1 RME: EPC Summary (Surface Soil)	p. 5 of 35
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 6 of 35
Table 3.3 RME: EPC Summary (Groundwater)	p. 7 of 35
Table 4.1 RME: Values Used for Daily Intake Calculations (Surface Soil – Current Timeframe)	p. 8 of 35
Table 4.2 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 9 of 35
Table 4.3 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 10 of 35
Table 4.4 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 11 of 35
Table 4.5 RME: Values Used for Daily Intake Calculations (Subsurface Soil - Current Timeframe)	p. 12 of 35
Table 4.6 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 13 of 35
Table 4.7 RME: Values Used for Daily Intake Calculations (Surface Soil – Future Timeframe)	p. 14 of 35
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 15 of 35
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 16 of 35
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 17 of 35
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 18 of 35
Table 6.2: Cancer Toxicity Data – Inhalation	p. 19 of 35
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Maintenance Worker – Adult)	p. 20 of 35
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 21 of 35
Table 7.3: RME Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Adult)	p. 22 of 35
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Child)	p. 23 of 35
Table 7.5 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Construction Worker – Adult)	p. 24 of 35

Appendix D-2 Contents for SWMU 10 Risk Assessment Tables

Table No.	Page No.
Table 7.6 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 25 of 35
Table 7.7 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 26 of 35
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 27 of 35
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Maintenance Worker – Adult)	p. 28 of 35
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 29 of 35
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Adult)	p. 30 of 35
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Child)	p. 31 of 35
Table 9.5 RME: Summary of Receptor Risks and Hazards for COPCs (Construction Worker – Adult)	p. 32 of 35
Table 9.6 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 33 of 35
Table 9.7 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 34 of 35
Table 10.1 RME: Risk Summary	p. 35 of 35

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	SWMU 10
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 10

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Direct contact with COPCs in site soil.	Maintenance Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of workers in the area involved in lawn mowing activities.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Recreational	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
	Soil	Subsurface Soil	Direct contact with COPCs in site soil.	Construction Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of utility workers and construction workers where excavations are possible.
Future	Soil	Surface Soil	Direct contact with COPCs in site soil.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of future indusrtial workers at the site.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 10

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	**7429-90-5**	**ALUMINUM**	**3740 =**	**10000 =**	**mg/kg**	**W10-SB02**	**10 / 10**	**NA**	**10,000**	**NA**	**7.61E+03**	**NA**	**NA**	**Y**	**ASL**
	7440-36-0	ANTIMONY	0.24 J	1.3 J	mg/kg	W10-SB03	10 / 10	NA	1.3	NA	3.13E+00	NA	NA	N	BSL
	7440-38-2	**ARSENIC**	**0.7 J**	**6.4 =**	**mg/kg**	**W10-SB06**	**10 / 10**	**NA**	**6.4**	**NA**	**3.90E-01**	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	BARIUM	65.5 =	299 =	mg/kg	W10-SB03	10 / 10	NA	299	NA	5.37E+02	NA	NA	N	BSL
	50-32-8	BENZO(a)PYRENE	0.04 J	0.04 J	mg/kg	W10-SB04	1 / 10	NA	0.040	NA	**6.21E-02**	NA	NA	N	BSL
	205-99-2	BENZO(b)FLUORANTHENE	0.043 J	0.043 J	mg/kg	W10-SB04	1 / 10	NA	0.043	NA	**6.21E-01**	NA	NA	N	BSL
	85-68-7	BENZYL BUTYL PHTHALATE	0.063 J	0.063 J	mg/kg	W10-SB02	1 / 10	NA	0.063	NA	1.22E+03	NA	NA	N	BSL
	7440-41-7	BERYLLIUM	0.11 J	0.19 J	mg/kg	W10-SB02	10 / 10	NA	0.19	NA	1.54E+01	NA	NA	N	BSL
		CALCIUM	1150 =	7330 =	mg/kg	W10-SB01	10 / 10	NA	7,330	NA		NA	NA	N	NSV
	18540-29-9	**CHROMIUM, TOTAL**	**5.4 =**	**35.3 =**	**mg/kg**	**W10-SB03**	**10 / 10**	**NA**	**35**	**NA**	**3.01E+01**	**NA**	**NA**	**Y**	**BSL**
	7440-48-4	COBALT	4.4 J	13.3 =	mg/kg	W10-SB02	10 / 10	NA	13	NA	9.03E+02	NA	NA	N	BSL
	7440-50-8	COPPER	18.4 =	88.8 =	mg/kg	W10-SB06	10 / 10	NA	87	NA	3.13E+02	NA	NA	N	BSL
	84-66-2	DIETHYL PHTHALATE	0.085 J	0.198 J	mg/kg	W10-SB07	3 / 10	NA	0.20	NA	4.89E+03	NA	NA	N	BSL
	7439-89-6	**IRON**	**8190 =**	**18200 =**	**mg/kg**	**W10-SB02**	**10 / 10**	**NA**	**16,200**	**NA**	**2.35E+03**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	LEAD	8.3 =	97.7 =	mg/kg	W10-SB03	10 / 10	NA	98	NA	4.00E+02	NA	NA	N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS	0.0005 J	0.0005 J	mg/kg	W10-SB05	1 / 10	NA	5.00E-04	NA	2.75E+01	NA	NA	N	BSL
		MAGNESIUM	994 J	6440 =	mg/kg	W10-SB02	10 / 10	NA	6,440	NA		NA	NA	N	NSV
	7439-96-5	**MANGANESE**	**534 =**	**735 =**	**mg/kg**	**W10-SB06**	**10 / 10**	**NA**	**735**	**NA**	**1.76E+02**	**NA**	**NA**	**Y**	**ASL**
	7487-94-7	MERCURY	0.018 J	0.079 =	mg/kg	W10-SB03	9 / 10	NA	0.079	NA	2.35E+00	NA	NA	N	BSL
	7440-02-0	NICKEL	2.9 J	20.5 =	mg/kg	W10-SB02	10 / 10	NA	21	NA	1.56E+02	NA	NA	N	BSL
	72-54-8	p,p'-DDD	0.00043 J	0.0008 J	mg/kg	W10-SB06	3 / 10	NA	8.00E-04	NA	2.44E+00	NA	NA	N	BSL
	72-55-9	p,p'-DDE	0.0012 J	0.055 =	mg/kg	W10-SB06	9 / 9	NA	0.055	NA	1.72E+00	NA	NA	N	BSL
	50-29-3	p,p'-DDT	0.00082 J	0.044 =	mg/kg	W10-SB05	9 / 9	NA	0.044	NA	1.72E+00	NA	NA	N	BSL
		POTASSIUM	621 J	1600 =	mg/kg	W10-SB01	10 / 10	NA	1,600	NA		NA	NA	N	NSV
	7782-49-2	SELENIUM	0.4 J	0.7 J	mg/kg	W10-SB04	10 / 10	NA	0.70	NA	3.91E+01	NA	NA	N	BSL
	7440-22-4	SILVER	0.054 J	0.065 J	mg/kg	W10-SB02	3 / 10	NA	0.065	NA	3.91E+01	NA	NA	N	BSL
		SODIUM	54.6 J	179 J	mg/kg	W10-SB01	9 / 10	NA	179	NA		NA	NA	N	NSV
	7440-28-0	**THALLIUM**	**0.35 J**	**1.2 J**	**mg/kg**	**W10-SB02**	**9 / 10**	**NA**	**1.2**	**NA**	**5.16E-01**	**NA**	**NA**	**Y**	**ASL**
	108-88-3	TOLUENE	0.0004 J	0.001 J	mg/kg	W10-SB05	4 / 10	NA	0.0010	NA	5.20E+01	NA	NA	N	BSL
	7440-62-2	VANADIUM	22.3 J	54.7 J	mg/kg	W10-SB02	10 / 10	NA	55	NA	5.47E+01	NA	NA	N	BSL
	1330-20-7	XYLENES, TOTAL	0.0005 J	0.0005 J	mg/kg	W10-SB05	1 / 10	NA	5.00E-04	NA	2.75E+01	NA	NA	N	BSL
	7440-66-6	ZINC	38.4 =	1130 =	mg/kg	W10-SB03	10 / 10	NA	1,130	NA	2.35E+03	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 10

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	107-06-2	1,2-DICHLOROETHANE	0.0003 J	0.0003 J	mg/kg	W10-SB06	3 / 10	NA	3.00E-04	NA	6.03E-01			N	BSL
	7429-90-5	ALUMINUM	4640 =	8560 =	mg/kg	W10-SB03	10 / 10	NA	8,560	NA	1.00E+04			N	BSL
	7440-36-0	ANTIMONY	0.2 J	0.31 J	mg/kg	W10-SB01	4 / 10	NA	0.31	NA	4.09E+01			N	BSL
	7440-38-2	ARSENIC	0.44 J	0.91 J	mg/kg	W10-SB08	3 / 10	NA	0.91	NA	1.59E+00			N	BSL
	7440-39-3	BARIUM	72.1 =	139 =	mg/kg	W10-SB03	10 / 10	NA	139	NA	6.66E+03			N	BSL
	7440-41-7	BERYLLIUM	0.16 J	0.3 J	mg/kg	W10-SB03	10 / 10	NA	0.30	NA	1.94E+03			N	BSL
		CALCIUM	1060 =	3100 =	mg/kg	W10-SB01	10 / 10	NA	3,100	NA				N	NSV
	18540-29-9	CHROMIUM, TOTAL	4.9 =	6.2 =	mg/kg	W10-SB01	10 / 10	NA	6.2	NA	6.40E+01			N	BSL
	7440-48-4	COBALT	5.3 J	10.9 =	mg/kg	W10-SB03	10 / 10	NA	11	NA	1.92E+03			N	BSL
	7440-50-8	COPPER	19.1 =	32.6 =	mg/kg	W10-SB03	10 / 10	NA	33	NA	4.09E+03			N	BSL
	84-66-2	DIETHYL PHTHALATE	0.051 J	0.214 J	mg/kg	W10-SB06	5 / 10	NA	0.21	NA	1.00E+04			N	BSL
	7439-89-6	**IRON**	**10300 =**	**17700 =**	**mg/kg**	**W10-SB03**	**10 / 10**	**NA**	**17,700**	**NA**	**1.00E+04**			**Y**	**BSL**
	7439-92-1	LEAD	0.94 =	16.2 =	mg/kg	W10-SB09	10 / 10	NA	16	NA	7.50E+02			N	BSL
		MAGNESIUM	2170 =	4020 =	mg/kg	W10-SB06	10 / 10	NA	4,020	NA				N	NSV
	7439-96-5	MANGANESE	298 =	597 =	mg/kg	W10-SB03	10 / 10	NA	597	NA	1.95E+03			N	BSL
	7487-94-7	MERCURY	0.024 J	0.024 J	mg/kg	W10-SB09	1 / 10	NA	0.024	NA	3.07E+01			N	BSL
	7440-02-0	NICKEL	2.7 J	4.5 J	mg/kg	W10-SB03	10 / 10	NA	4.5	NA	2.04E+03			N	BSL
	72-54-8	p,p'-DDD	0.00067 J	0.00067 J	mg/kg	W10-SB09	1 / 10	NA	6.70E-04	NA	9.95E+00			N	BSL
	72-55-9	p,p'-DDE	0.0008 J	0.021 =	mg/kg	W10-SB01	5 / 10	NA	0.021	NA	7.02E+00			N	BSL
	50-29-3	p,p'-DDT	0.001 J	0.011 =	mg/kg	W10-SB01	4 / 10	NA	0.011	NA	7.02E+00			N	BSL
		POTASSIUM	710 J	1190 =	mg/kg	W10-SB03	10 / 10	NA	1,190	NA				N	NSV
	7782-49-2	SELENIUM	0.43 J	0.6 J	mg/kg	W10-SB05	9 / 10	NA	0.60	NA	5.11E+02			N	BSL
		SODIUM	49.2 J	157 J	mg/kg	W10-SB10	10 / 10	NA	157	NA				N	NSV
	7440-28-0	THALLIUM	0.5 J	1.3 J	mg/kg	W10-SB05	10 / 10	NA	1.3	NA	6.75E+00			N	BSL
	7440-62-2	VANADIUM	29.3 J	56.9 J	mg/kg	W10-SB03	10 / 10	NA	57	NA	7.15E+02			N	BSL
	7440-66-6	ZINC	20.4 =	56.6 =	mg/kg	W10-SB09	10 / 10	NA	57	NA	1.00E+04			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	Aluminum	mg/Kg	5575	6917 (L)	10000	6917	mg/Kg	UCL95 (L)	2
	Arsenic	mg/Kg	2.134	3.97 (L)	6.4	3.97	mg/Kg	UCL95 (L)	2
	Chromium	mg/Kg	15.35	21.4 (NP)	35.3	21.4	mg/Kg	UCL95 (NP)	3
	Iron	mg/Kg	11210	13103 (L)	18200	13103	mg/Kg	UCL95 (L)	2
	Manganese	mg/Kg	624.7	667 (L)	735	667	mg/Kg	UCL95 (L)	2
	Thallium	mg/Kg	0.5205	0.783 (L)	1.2	0.783	mg/Kg	UCL95 (L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	Iron	mg/Kg	11965	13127 (L)	18200	13127	mg/Kg	UCL95 (L)	2

95% UCL* term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	NA								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemantal Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I, May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interim Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interim Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.5.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	330	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	h	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Dermal:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.3	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Aluminum	0.001		e	
					Arsenic	0.03		i	
					Iron	0.001		i	DAevent = Cs x CF x AF x ABS
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Inhalation:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.07	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I, May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.7.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	c	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	e	
				BW	Body Weight	15.0	kg	e	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I, May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 10

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

SWMU 10

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

SWMU 10

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 10

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

SWMU 10

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Current
Receptor Population:	Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	7E+03	mg/Kg	5.0E-04	mg/kg/day				1.4E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0014
				Arsenic	4E+00	mg/Kg	2.9E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.3E-07	8.1E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0027
				Chromium	2E+01	mg/Kg	1.6E-06	mg/kg/day				4.4E-06	mg/kg/day	3.0E-03	mg/kg/day	0.0015
				Iron	1E+04	mg/Kg	9.5E-04	mg/kg/day				2.7E-03	mg/kg/day	3.0E-01	mg/kg/day	0.0089
				Manganese	7E+02	mg/Kg	4.8E-05	mg/kg/day				1.4E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0010
				Thallium	8E-01	mg/Kg	5.7E-08	mg/kg/day				1.6E-07	mg/kg/day	8.0E-05	mg/kg/day	0.0020
			Exp. Route Total								4.3E-07					0.0174
			Dermal	Aluminum	7E+03	mg/Kg	3.3E-06	mg/kg/day				9.3E-06	mg/kg/day	4.0E-02	mg/kg/day	0.0002
				Arsenic	4E+00	mg/Kg	5.7E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	8.6E-08	1.6E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0005
				Chromium	2E+01	mg/Kg	1.0E-06	mg/kg/day				2.9E-08	mg/kg/day	3.9E-05	mg/kg/day	0.0007
				Iron	1E+04	mg/Kg	6.3E-06	mg/kg/day				1.6E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0001
				Manganese	7E+02	mg/Kg	3.2E-07	mg/kg/day				9.0E-07	mg/kg/day	5.6E-03	mg/kg/day	0.0002
				Thallium	8E-01	mg/Kg	3.8E-10	mg/kg/day				1.1E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0000
			Exp. Route Total								8.6E-08					0.0017
			Inhalation	Aluminum	7E+03	mg/Kg	7.4E-06	mg/kg/day				2.1E-07	mg/kg/day	1.4E-03	mg/kg/day	0.0001
				Arsenic	4E+00	mg/Kg	4.2E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	6.4E-10	1.2E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Chromium	2E+01	mg/Kg	2.3E-10	mg/kg/day				6.4E-10	mg/kg/day	2.3E-06	mg/kg/day	0.0003
				Iron	1E+04	mg/Kg	1.4E-07	mg/kg/day				3.9E-07	mg/kg/day			
				Manganese	7E+02	mg/Kg	7.1E-09	mg/kg/day				2.0E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0014
				Thallium	8E-01	mg/Kg	8.4E-12	mg/kg/day				2.3E-11	mg/kg/day	8.0E-05	mg/kg/day	0.0000
			Exp. Route Total								6.4E-10					0.0018
		Exposure Point Total									5.2E-07					0.0210
	Exposure Medium Total										5.2E-07					0.0210
Medium Total											5.2E-07					0.0210
										Total of Receptor Risks Across All Media	5.2E-07				Total of Receptor Hazards Across All Media	0.0210

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	7E+03	mg/Kg	2.4E-03	mg/kg/day				8.8E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0068
				Arsenic	4E+00	mg/Kg	1.4E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.1E-06	3.9E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0129
				Chromium	2E+01	mg/Kg	7.5E-06	mg/kg/day				2.1E-05	mg/kg/day	3.0E-03	mg/kg/day	0.0070
				Iron	1E+04	mg/Kg	4.6E-03	mg/kg/day				1.3E-02	mg/kg/day	3.0E-01	mg/kg/day	0.0427
				Manganese	7E+02	mg/Kg	2.3E-04	mg/kg/day				6.5E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0047
				Thallium	8E-01	mg/Kg	2.7E-07	mg/kg/day				7.7E-07	mg/kg/day	8.0E-05	mg/kg/day	0.0096
			Exp. Route Total								2.1E-06					0.0837
			Dermal	Aluminum	7E+03	mg/Kg	1.6E-05	mg/kg/day				4.5E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0011
				Arsenic	4E+00	mg/Kg	2.7E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.1E-07	7.7E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0026
				Chromium	2E+01	mg/Kg	4.9E-08	mg/kg/day				1.4E-07	mg/kg/day	3.9E-05	mg/kg/day	0.0035
				Iron	1E+04	mg/Kg	3.0E-05	mg/kg/day				8.5E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0003
				Manganese	7E+02	mg/Kg	1.5E-06	mg/kg/day				4.3E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0008
				Thallium	8E-01	mg/Kg	1.6E-09	mg/kg/day				5.1E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0001
			Exp. Route Total								4.1E-07					0.0083
			Inhalation	Aluminum	7E+03	mg/Kg	3.6E-07	mg/kg/day				1.0E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0007
				Arsenic	4E+00	mg/Kg	2.0E-10	mg/kg/day	1.5E+01	(mg/kg/day)-1	3.1E-09	5.7E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Chromium	2E+01	mg/Kg	1.1E-09	mg/kg/day				3.1E-09	mg/kg/day	2.3E-06	mg/kg/day	0.0013
				Iron	1E+04	mg/Kg	6.7E-07	mg/kg/day				1.9E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	3.4E-08	mg/kg/day				9.6E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0067
				Thallium	8E-01	mg/Kg	4.0E-11	mg/kg/day				1.1E-10	mg/kg/day	8.0E-05	mg/kg/day	0.0000
			Exp. Route Total								3.1E-09					0.0068
		Exposure Point Total									2.5E-06					0.1008
	Exposure Medium Total										2.5E-06					0.1008
Medium Total											2.5E-06					0.1008
										Total of Receptor Risks Across All Media	2.5E-06				Total of Receptor Hazards Across All Media	0.1008

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	7E+03	mg/Kg	9.7E-04	mg/kg/day				2.8E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0028
				Arsenic	4E+00	mg/Kg	5.5E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	8.3E-07	1.6E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0054
				Chromium	2E+01	mg/Kg	3.0E-06	mg/kg/day				8.7E-06	mg/kg/day	3.0E-03	mg/kg/day	0.0029
				Iron	1E+04	mg/Kg	1.6E-03	mg/kg/day				5.3E-03	mg/kg/day	3.0E-01	mg/kg/day	0.0178
				Manganese	7E+02	mg/Kg	9.3E-05	mg/kg/day				2.7E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0019
				Thallium	8E-01	mg/Kg	1.1E-07	mg/kg/day				3.2E-07	mg/kg/day	8.0E-05	mg/kg/day	0.0040
			Exp. Route Total								8.3E-07					0.0348
			Dermal	Aluminum	7E+03	mg/Kg	1.1E-05	mg/kg/day				3.2E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0008
				Arsenic	4E+00	mg/Kg	1.9E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.8E-07	5.5E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0018
				Chromium	2E+01	mg/Kg	3.4E-06	mg/kg/day				9.9E-06	mg/kg/day	3.9E-05	mg/kg/day	0.0025
				Iron	1E+04	mg/Kg	2.1E-05	mg/kg/day				6.1E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0002
				Manganese	7E+02	mg/Kg	1.1E-06	mg/kg/day				3.1E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0006
				Thallium	8E-01	mg/Kg	1.2E-09	mg/kg/day				3.8E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0000
			Exp. Route Total								2.8E-07					0.0060
			Inhalation	Aluminum	7E+03	mg/Kg	1.4E-07	mg/kg/day				4.1E-07	mg/kg/day	1.4E-03	mg/kg/day	0.0003
				Arsenic	4E+00	mg/Kg	8.1E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.2E-09	2.4E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Chromium	2E+01	mg/Kg	4.4E-10	mg/kg/day				1.3E-09	mg/kg/day	2.3E-06	mg/kg/day	0.0006
				Iron	1E+04	mg/Kg	2.7E-07	mg/kg/day				7.8E-07	mg/kg/day			
				Manganese	7E+02	mg/Kg	1.4E-08	mg/kg/day				4.0E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0028
				Thallium	8E-01	mg/Kg	1.6E-11	mg/kg/day				4.7E-11	mg/kg/day	8.0E-05	mg/kg/day	0.0000
			Exp. Route Total								1.2E-09					0.0036
		Exposure Point Total									1.1E-06					0.0444
	Exposure Medium Total										1.1E-06					0.0444
Medium Total											1.1E-06					0.0444
									Total of Receptor Risks Across All Media		1.1E-06			Total of Receptor Hazards Across All Media		0.0444

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	7E+03	mg/Kg	2.3E-03	mg/kg/day				2.6E-02	mg/kg/day	1.0E+00	mg/kg/day	0.0263
				Arsenic	4E+00	mg/Kg	1.3E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.9E-06	1.5E-05	mg/kg/day	3.0E-04	mg/kg/day	0.0503
				Chromium	2E+01	mg/Kg	7.0E-06	mg/kg/day				6.1E-05	mg/kg/day	3.0E-03	mg/kg/day	0.0271
				Iron	1E+04	mg/Kg	4.3E-03	mg/kg/day				5.0E-02	mg/kg/day	3.0E-01	mg/kg/day	0.1659
				Manganese	7E+02	mg/Kg	2.2E-04	mg/kg/day				2.5E-03	mg/kg/day	1.4E-01	mg/kg/day	0.0181
				Thallium	8E-01	mg/Kg	2.5E-07	mg/kg/day				3.0E-06	mg/kg/day	8.0E-05	mg/kg/day	0.0372
				Vanadium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-03	mg/kg/day	0.0000
			Exp. Route Total								1.9E-06					0.3249
			Dermal	Aluminum	7E+03	mg/Kg	6.3E-06	mg/kg/day				7.4E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0018
				Arsenic	4E+00	mg/Kg	1.1E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.6E-07	1.3E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0042
				Chromium	2E+01	mg/Kg	2.0E-08	mg/kg/day				2.3E-07	mg/kg/day	3.9E-05	mg/kg/day	0.0058
				Iron	1E+04	mg/Kg	1.2E-05	mg/kg/day				1.4E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0005
				Manganese	7E+02	mg/Kg	6.1E-07	mg/kg/day				7.1E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0013
				Thallium	8E-01	mg/Kg	7.1E-10	mg/kg/day				8.3E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0001
			Exp. Route Total								1.6E-07					0.0137
			Inhalation	Aluminum	7E+03	mg/Kg	1.7E-07	mg/kg/day				1.9E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0014
				Arsenic	4E+00	mg/Kg	9.5E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.4E-09	1.1E-09	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Chromium	2E+01	mg/Kg	5.1E-10	mg/kg/day				6.0E-09	mg/kg/day	2.3E-06	mg/kg/day	0.0026
				Iron	1E+04	mg/Kg	3.1E-07	mg/kg/day				3.7E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	1.6E-08	mg/kg/day				1.9E-07	mg/kg/day	1.4E-05	mg/kg/day	0.0130
				Thallium	6E-01	mg/Kg	1.9E-11	mg/kg/day				2.2E-10	mg/kg/day	6.0E-05	mg/kg/day	0.0000
			Exp. Route Total								1.4E-09					0.0170
		Exposure Point Total									2.1E-06					0.3556
	Exposure Medium Total										2.1E-06					0.3556
Medium Total											2.1E-06					0.3556
										Total of Receptor Risks Across All Media	2.1E-06				Total of Receptor Hazards Across All Media	0.3556

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Current
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Subsurface Soil	Subsurface Soil	Ingestion	Iron	1E+04	mg/Kg	3.0E-04	mg/kg/day				4.2E-02	mg/kg/day	3.0E-01	mg/kg/day	0.141
			Exp. Route Total								0.0E+00					0.141
			Dermal	Iron	1E+04	mg/Kg	9.1E-07	mg/kg/day				1.3E-04	mg/kg/day	3.0E-01	mg/kg/day	0.000
			Exp. Route Total								0.0E+00					0.000
			Inhalation	Iron	1E+04	mg/Kg	1.3E-08	mg/kg/day				1.9E-06	mg/kg/day	N/A	N/A	#VALUE!
			Exp. Route Total								0.0E+00					0.000
		Exposure Point Total									0.0E+00					0.142
	Exposure Medium Total										0.0E+00					0.142
Medium Total											0.0E+00					0.142
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	0.142

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	7E+03	mg/Kg	3.2E-03	mg/kg/day				9.5E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0095
				Arsenic	4E+00	mg/Kg	1.9E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.8E-06	5.4E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0181
				Chromium	2E+01	mg/Kg	1.0E-05	mg/kg/day				2.9E-05	mg/kg/day	3.0E-03	mg/kg/day	0.0098
				Iron	1E+04	mg/Kg	6.2E-03	mg/kg/day				1.8E-02	mg/kg/day	3.0E-01	mg/kg/day	0.0598
				Manganese	7E+02	mg/Kg	3.1E-04	mg/kg/day				9.1E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0065
				Thallium	6E-01	mg/Kg	3.7E-07	mg/kg/day				1.1E-06	mg/kg/day	8.0E-05	mg/kg/day	0.0134
			Exp. Route Total								2.8E-06					0.1171
			Dermal	Aluminum	7E+03	mg/Kg	1.3E-05	mg/kg/day				3.8E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0009
				Arsenic	4E+00	mg/Kg	2.2E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.3E-07	6.5E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0022
				Chromium	2E+01	mg/Kg	4.0E-08	mg/kg/day				1.2E-07	mg/kg/day	3.9E-05	mg/kg/day	0.0030
				Iron	1E+04	mg/Kg	2.5E-05	mg/kg/day				7.2E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0002
				Manganese	7E+02	mg/Kg	1.2E-06	mg/kg/day				3.6E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0007
				Thallium	8E-01	mg/Kg	1.5E-09	mg/kg/day				4.3E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0001
			Exp. Route Total								3.3E-07					0.0071
			Inhalation	Aluminum	7E+03	mg/Kg	4.8E-07	mg/kg/day				1.4E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0010
				Arsenic	4E+00	mg/Kg	2.7E-10	mg/kg/day	1.5E+01	(mg/kg/day)-1	4.1E-09	6.0E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Chromium	2E+01	mg/Kg	1.5E-09	mg/kg/day				4.3E-09	mg/kg/day	2.3E-06	mg/kg/day	0.0019
				Iron	1E+04	mg/Kg	9.1E-07	mg/kg/day				2.6E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	4.6E-06	mg/kg/day				1.3E-07	mg/kg/day	1.4E-05	mg/kg/day	0.0094
				Thallium	6E-01	mg/Kg	5.4E-11	mg/kg/day				1.6E-10	mg/kg/day	8.0E-05	mg/kg/day	0.0000
			Exp. Route Total								4.1E-09					0.0123
		Exposure Point Total									3.1E-06					0.1365
	Exposure Medium Total										3.1E-06					0.1365
Medium Total											3.1E-06					0.1365
									Total of Receptor Risks Across All Media		3.1E-06			Total of Receptor Hazards Across All Media		0.1365

TABLE 7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	7E+03	mg/Kg	7.6E-03	mg/kg/day				8.8E-02	mg/kg/day	1.0E+00	mg/kg/day	0.0884
				Arsenic	4E+00	mg/Kg	4.4E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	6.5E-06	5.1E-05	mg/kg/day	3.0E-04	mg/kg/day	0.1692
				Chromium	2E+01	mg/Kg	2.3E-05	mg/kg/day				2.7E-04	mg/kg/day	3.0E-03	mg/kg/day	0.0912
				Iron	1E+04	mg/Kg	1.4E-02	mg/kg/day				1.7E-01	mg/kg/day	3.0E-01	mg/kg/day	0.5584
				Manganese	7E+02	mg/Kg	7.3E-04	mg/kg/day				8.5E-03	mg/kg/day	1.4E-01	mg/kg/day	0.0609
				Thallium	8E-01	mg/Kg	8.8E-07	mg/kg/day				1.0E-05	mg/kg/day	6.0E-05	mg/kg/day	0.1251
			Exp. Route Total								6.5E-06					1.0933
			Dermal	Aluminum	7E+03	mg/Kg	2.1E-05	mg/kg/day				2.5E-04	mg/kg/day	4.0E-02	mg/kg/day	0.0062
				Arsenic	4E+00	mg/Kg	3.7E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	5.5E-07	4.3E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0142
				Chromium	2E+01	mg/Kg	6.6E-08	mg/kg/day				7.7E-07	mg/kg/day	3.9E-05	mg/kg/day	0.0198
				Iron	1E+04	mg/Kg	4.0E-05	mg/kg/day				4.7E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0016
				Manganese	7E+02	mg/Kg	2.0E-06	mg/kg/day				2.4E-05	mg/kg/day	5.8E-03	mg/kg/day	0.0043
				Thallium	8E-01	mg/Kg	2.4E-09	mg/kg/day				2.8E-08	mg/kg/day	8.0E-05	mg/kg/day	0.0004
			Exp. Route Total								5.5E-07					0.0462
			Inhalation	Aluminum	7E+03	mg/Kg	5.6E-07	mg/kg/day				6.5E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0045
				Arsenic	4E+00	mg/Kg	3.2E-10	mg/kg/day	1.5E+01	(mg/kg/day)-1	4.8E-09	3.7E-09	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Chromium	2E+01	mg/Kg	1.7E-09	mg/kg/day				2.0E-06	mg/kg/day	2.3E-06	mg/kg/day	0.0088
				Iron	1E+04	mg/Kg	1.1E-06	mg/kg/day				1.2E-05	mg/kg/day			
				Manganese	7E+02	mg/Kg	5.4E-06	mg/kg/day				6.3E-07	mg/kg/day	1.4E-05	mg/kg/day	0.0439
				Thallium	8E-01	mg/Kg	6.3E-11	mg/kg/day				7.4E-10	mg/kg/day	8.0E-05	mg/kg/day	0.0000
			Exp. Route Total								4.8E-09					0.0572
		Exposure Point Total									7.1E-06					1.1968
	Exposure Medium Total										7.1E-06					1.1968
Medium Total											7.1E-06					1.1968
									Total of Receptor Risks Across All Media		7.1E-06			Total of Receptor Hazards Across All Media		1.1968

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

SWMU 10

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

0.01740364 0.00182218 0.00173442

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.00140777	0.00014477	0.00023228	0.001784819
			Arsenic	4.33E-07	8.37E-10	8.57E-08	NA	5.19E-07	Skin	0.00269328	4.1692E-07	0.00053327	0.003226968
			Chromium						Respiratory, not specified	0.00145179	0.00027969	0.00073706	0.002468552
			Iron						Gastrointestinal	0.00688918	0	5.8669E-05	0.008947853
			Manganese						Neurological	0.00096964	0.001397	0.00015999	0.002526632
			Thallium						Hair loss, liver	0.00199198	2.9294E-07	1.3147E-05	0.002005416
			Chemical Total					5.19E-07					0.02096024
		Exposure Point Total						5.19E-07					0.02096024
	Exposure Medium Total							5.19E-07					0.02096024
Medium Total								5.19E-07					0.02096024
Receptor Total							Receptor Risk Total	5.19E-07				Receptor HI Total	0.02096024

Total Organ (Body weight) HI Across All Media =	0.001784819
Total Organ (Skin) HI Across All Media =	0.003226968
Total Organ (Respiratory, not specified) HI Across All Media =	0.002468552
Total Organ (Gastrointestinal) HI Across All Media =	0.008947853
Total Organ (Neurological) HI Across All Media =	0.002526632
Total Organ (Hair loss, liver) HI Across All Media =	0.002005416

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.0067681	0.00069602	0.00111674	0.008580859
			Arsenic	2.08E-06	3.06E-09	4.12E-07	NA	2.50E-06	Skin	0.01294847	2.0044E-06	0.0025638	0.015514268
			Chromium						Respiratory, not specified	0.00697978	0.00134468	0.00354358	0.011866036
			Iron						Gastrointestinal	0.04273646	0	0.00028206	0.043018525
			Manganese						Neurological	0.00466173	0.00671636	0.00076919	0.01214727
			Thallium						Hair loss, liver	0.00957661	1.4084E-06	6.3207E-05	0.009641425
			Chemical Total					2.50E-06					0.100770384
		Exposure Point Total						2.50E-06					0.100770384
	Exposure Medium Total							2.50E-06					0.100770384
Medium Total								2.50E-06					0.100770384
Receptor Total							Receptor Risk Total	2.50E-06				Receptor HI Total	0.100770384

Total Organ (Body weight) HI Across All Media =	0.008580859
Total Organ (Skin) HI Across All Media =	0.015514268
Total Organ (Respiratory, not specified) HI Across All Media =	0.011866036
Total Organ (Gastrointestinal) HI Across All Media =	0.043018525
Total Organ (Neurological) HI Across All Media =	0.01214727
Total Organ (Hair loss, liver) HI Across All Media =	0.009641425

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.00281553	0.00028954	0.00080243	0.003907501
			Arsenic	8.31E-07	1.22E-09	2.84E-07	NA	1.12E-06	Skin	0.00538658	8.3383E-07	0.0018422	0.0072296
			Chromium						Respiratory, not specified	0.00290359	0.00055939	0.00254622	0.006009197
			Iron						Gastrointestinal	0.01777837	0	0.00020267	0.017981043
			Manganese						Neurological	0.00193928	0.002794	0.00055269	0.005285978
			Thallium						Hair loss, liver	0.00398395	5.8588E-07	4.5417E-05	0.004029956
			Chemical Total					1.12E-06					0.044443275
		Exposure Point Total						1.12E-06					0.044443275
	Exposure Medium Total							1.12E-06					0.044443275
Medium Total								1.12E-06					0.044443275
Receptor Total							Receptor Risk Total	1.12E-06				Receptor HI Total	0.044443275

Total Organ (Body weight) HI Across All Media =	0.003907501
Total Organ (Skin) HI Across All Media =	0.0072296
Total Organ (Respiratory, not specified) HI Across All Media =	0.006009197
Total Organ (Gastrointestinal) HI Across All Media =	0.017981043
Total Organ (Neurological) HI Across All Media =	0.005285978
Total Organ (Hair loss, liver) HI Across All Media =	0.004029956

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child (8 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.02627828	0.00135121	0.00183948	0.02946897
			Arsenic	1.94E-08	1.43E-09	1.63E-07	NA	2.10E-06	Skin	0.05027458	3.8912E-06	0.00422308	0.054501537
			Chromium						Respiratory, not specified	0.02710015	0.00261047	0.00583696	0.035547577
			Iron						Gastrointestinal	0.16593145	0	0.00046461	0.166396054
			Manganese						Neurological	0.01809993	0.01303869	0.001267	0.032405619
			Thallium						Hair loss, liver	0.03718358	2.7341E-06	0.00010411	0.03729041
			Chemical Total					2.10E-06					0.355610168
		Exposure Point Total						2.10E-06					0.355610168
	Exposure Medium Total							2.10E-06					0.355610168
Medium Total								2.10E-06					0.355610168
Receptor Total							Receptor Risk Total	2.10E-06				Receptor HI Total	0.355610168

Total Organ (Body weight) HI Across All Media =	0.02946897
Total Organ (Skin) HI Across All Media =	0.054501537
Total Organ (Respiratory, not specified) HI Across All Media =	0.035547577
Total Organ (Gastrointestinal) HI Across All Media =	0.166396054
Total Organ (Neurological) HI Across All Media =	0.032405619
Total Organ (Hair loss, liver) HI Across All Media =	0.03729041

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Current
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Subsurface Soil	Iron						Gastrointestinal	0.14128865		0.00042387	0.141712516
			Chemical Total					0.00E+00					0.141712516
		Exposure Point Total						0.00E+00					0.141712516
	Exposure Medium Total							0.00E+00					0.141712516
Medium Total								0.00E+00					0.141712516
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	0.141712516

Total Organ (Gastrointestinal) HI Across All Media = 0.141712516

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.00947534	0.00097443	0.00094517	0.011394936
			Arsenic	2.80E-06	4.11E-09	3.35E-07	NA	3.14E-08	Skin	0.01812785	2.8062E-06	0.0021699	0.020300564
			Chromium						Respiratory, not specified	0.00977169	0.00188255	0.00299916	0.014653396
			Iron						Gastrointestinal	0.05983105	0	0.00023873	0.060069776
			Manganese						Neurological	0.00652642	0.0094029	0.00065101	0.016580329
			Thallium						Hair loss, liver	0.01340753	1.9717E-06	5.3496E-05	0.013463002
			Chemical Total					3.14E-06					0.136462005
		Exposure Point Total						3.14E-06					0.136482005
	Exposure Medium Total							3.14E-06					0.136462005
Medium Total								3.14E-06					0.136462005
Receptor Total							Receptor Risk Total	3.14E-06				Receptor HI Total	0.136462005

Total Organ (Body weight) HI Across All Media =	0.011394936
Total Organ (Skin) HI Across All Media =	0.020300564
Total Organ (Respiratory, not specified) HI Across All Media =	0.014653396
Total Organ (Gastrointestinal) HI Across All Media =	0.060069776
Total Organ (Neurological) HI Across All Media =	0.016580329
Total Organ (Hair loss, liver) HI Across All Media =	0.013463002

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 10

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.08843653	0.00454733	0.00619056	0.09917442
			Arsenic	6.53E-06	4.80E-09	5.48E-07	NA	7.08E-06	Skin	0.1691933	1.3095E-05	0.01421224	0.183418636
			Chromium						Respiratory, not specified	0.09120244	0.00878523	0.0196436	0.11983127
			Iron						Gastrointestinal	0.55842314	0	0.00156358	0.55998672
			Manganese						Neurological	0.06091324	0.0438802	0.00426393	0.10905737
			Thallium						Hair loss, liver	0.12513699	9.2012E-06	0.00035038	0.125496571
			Chemical Total					7.08E-08					1.196764987
		Exposure Point Total						7.08E-06					1.196764987
	Exposure Medium Total							7.08E-06					1.196764987
Medium Total								7.08E-06					1.196764987
Receptor Total							Receptor Risk Total	7.08E-06				Receptor HI Total	1.196764987
							Sum of Residential Adult and Residential Child Risks	1.0E-05					

Total Organ (Body weight) HI Across All Media =	0.09917442
Total Organ (Skin) HI Across All Media =	0.183418636
Total Organ (Respiratory, not specified) HI Across All Media =	0.11963127
Total Organ (Gastrointestinal) HI Across All Media =	0.55998672
Total Organ (Neurological) HI Across All Media =	0.10905737
Total Organ (Hair loss, liver) HI Across All Media =	0.125496571

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 10

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =
Total Organ 2 HI Across All Media =

Appendix D-3
SWMU 14 Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-3 Contents for SWMU 14 Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 39
Table 1: Selection of Exposure Pathways	p. 2 of 39
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Surface Soil)	p. 3 of 39
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Subsurface Soil)	p. 4 of 39
Table 2.3: Occurrence, Distribution, and Selection of COPCs (Groundwater)	p. 5 of 39
Table 3.1 RME: EPC Summary (Surface Soil)	p. 6 of 39
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 7 of 39
Table 3.3 RME: EPC (Groundwater)	p. 8 of 39
Table 4.1 RME: Values Used for Daily Intake Calculations (Surface Soil – Current Timeframe)	p. 9 of 39
Table 4.2 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 10 of 39
Table 4.3 RME: Values Used for Daily Intake Calculations (Groundwater - Current Timeframe)	p. 11 of 39
Table 4.4 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 12 of 39
Table 4.5 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 13 of 39
Table 4.6 RME: Values Used for Daily Intake Calculations (Subsurface Soil - Future Timeframe)	p. 14 of 39
Table 4.7 RME: Values Used for Daily Intake Calculations (Surface Soil – Future Timeframe)	p. 15 of 39
Table 4.8 RME: Values Used for Daily Intake Calculations (Surface Soil – Future Timeframe)	p. 16 of 39
Table 4.9 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 17 of 39
Table 4.10 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 18 of 39
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 19 of 39
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 20 of 39
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 21 of 39
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 22 of 39
Table 6.2: Cancer Toxicity Data – Inhalation	p. 23 of 39
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Maintenance Worker – Adult)	p. 24 of 39
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 25 of 39

Appendix D-3 Contents for SWMU 14 Risk Assessment Tables

Table No.	Page No.
Table 7.3: RME Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Adult)	p. 26 of 39
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Child)	p. 27 of 39
Table 7.5 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Construction Worker – Adult)	p. 28 of 39
Table 7.6 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 29 of 39
Table 7.7 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 30 of 39
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 31 of 39
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Maintenance Worker – Adult)	p. 32 of 39
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 33 of 39
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Adult)	p. 34 of 39
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Child)	p. 35 of 39
Table 9.5 RME: Summary of Receptor Risks and Hazards for COPCs (Construction Worker – Adult)	p. 36 of 39
Table 9.6 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 37 of 39
Table 9.7 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 38 of 39
Table 10.1 RME: Risk Summary	p. 39 of 39

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	SWMU 14
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 14

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Direct contact with COPCs in site soil.	Maintenance Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of workers in the area involved in lawn mowing activities.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Recreational	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
	Soil	Subsurface Soil	Direct contact with COPCs in site soil.	Construction Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of utility workers and construction workers where excavations are possible.
Future	Soil	Surface Soil	Direct contact with COPCs in site soil.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of future indusrtial workers at the site.
	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	Scenario is protective of future indusrtial workers at the site. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
	Groundwater	Groundwatsr	Direct contact with COPCs in groundwater.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 14

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	107-06-2	1,2-DICHLOROETHANE	0.0003 J	0.0004 J	mg/kg	W14-SB08	2 / 14	NA	4.00E-04	NA	2.78E-01	NA	NA	N	BSL
	7429-90-5	**ALUMINUM**	**4900 =**	**16300 =**	**mg/kg**	**W14-SB14**	**14 / 14**	**NA**	**16,300**	**NA**	**7.61E+03**	**NA**	**NA**	**Y**	**ASL**
	7440-36-0	ANTIMONY	0.17 J	0.74 J	mg/kg	W14-SB10	12 / 14	NA	0.74	NA	3.13E+00	NA	NA	N	BSL
	7440-38-2	**ARSENIC**	**0.4 J**	**3 =**	**mg/kg**	**W14-SB14**	**13 / 14**	**NA**	**3.0**	**NA**	3.90E-01	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	BARIUM	27.4 J	159 =	mg/kg	W14-SB14	14 / 14	NA	159	NA	5.37E+02	NA	NA	N	BSL
	71-43-2	BENZENE	0.0002 J	0.0002 J	mg/kg	W14-SB06	1 / 14	NA	2.00E-04	NA	6.01E-01	NA	NA	N	BSL
	85-68-7	BENZYL BUTYL PHTHALATE	0.076 J	0.329 J	mg/kg	W14-SB10	2 / 14	NA	0.33	NA	1.22E+03	NA	NA	N	BSL
	7440-41-7	BERYLLIUM	0.072 J	0.27 J	mg/kg	W14-SB14	14 / 14	NA	0.27	NA	1.54E+01	NA	NA	N	BSL
	117-81-7	bis(2-ETHYLHEXYL)PHTHALATE	0.042 J	0.158 J	mg/kg	W14-SB10	7 / 14	NA	0.16	NA	3.47E+01	NA	NA	N	BSL
	7440-43-9	CADMIUM	0.073 J	3.2 =	mg/kg	W14-SB10	10 / 14	NA	3.2	NA	3.70E+00	NA	NA	N	BSL
		CALCIUM	1710 =	82400 =	mg/kg	W14-SB14	14 / 14	NA	82,400	NA		NA	NA	N	NSV
	75-15-0	CARBON DISULFIDE	0.0009 J	0.0009 J	mg/kg	W14-SB14	1 / 14	NA	9.00E-04	NA	3.55E+01	NA	NA	N	BSL
	18540-29-9	**CHROMIUM, TOTAL**	**5.3 J**	**31.5 =**	**mg/kg**	**W14-SB10**	**14 / 14**	**NA**	**32**	**NA**	**3.01E+00**	**NA**	**NA**	**Y**	**BSL**
	7440-48-4	COBALT	6.1 J	12.5 =	mg/kg	W14-SB08	14 / 14	NA	13	NA	9.03E+02	NA	NA	N	BSL
	7440-50-8	COPPER	14.3 =	96.6 =	mg/kg	W14-SB10	14 / 14	NA	97	NA	3.13E+02	NA	NA	N	BSL
	84-74-2	DI-n-BUTYL PHTHALATE	0.04 J	0.04 J	mg/kg	W14-SB02	1 / 14	NA	0.040	NA	6.11E+02	NA	NA	N	BSL
	60-57-1	DIELDRIN	0.00045 J	0.00045 J	mg/kg	W14-SB10	1 / 14	NA	4.50E-04	NA	3.04E-02	NA	NA	N	BSL
	131-11-3	DIMETHYL PHTHALATE	5.8 J	5.8 J	mg/kg	W14-SB02	1 / 14	NA	5.8	NA	1.00E+04	NA	NA	N	BSL
	100-41-4	ETHYLBENZENE	0.001 J	0.001 J	mg/kg	W14-SB08	1 / 14	NA	0.0010	NA	8.92E+00	NA	NA	N	BSL
	7439-89-6	**IRON**	**7490 =**	**28300 =**	**mg/kg**	**W14-SB14**	**14 / 14**	**NA**	**28,300**	**NA**	**2.35E+03**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	LEAD	2.5 =	70.7 =	mg/kg	W14-SB11	14 / 14	NA	71	NA	4.00E+02	NA	NA	N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0003 J	0.005 J	mg/kg	W14-SB08	8 / 14	NA	0.0050	NA	2.75E+01	NA	NA	N	BSL
		MAGNESIUM	1320 =	6910 =	mg/kg	W14-SB10	14 / 14	NA	6,910	NA		NA	NA	N	NSV
	7439-96-5	**MANGANESE**	**263 J**	**907 J**	**mg/kg**	**W14-SB13**	**14 / 14**	**NA**	**907**	**NA**	**1.76E+02**	**NA**	**NA**	**Y**	**ASL**
	7487-94-7	MERCURY	0.025 J	2.3 =	mg/kg	W14-SB14	10 / 14	NA	2.3	NA	2.35E+00	NA	NA	N	BSL
	72-43-5	METHOXYCHLOR	0.0012 J	0.0012 J	mg/kg	W14-SB02	1 / 14	NA	0.0012	NA	3.06E+01	NA	NA	N	BSL
	78-93-3	METHYL ETHYL KETONE (2-BUTANONE	0.018 J	0.018 J	mg/kg	W14-SB14	1 / 1	NA	0.018	NA	7.33E+02	NA	NA	N	BSL
	7440-02-0	NICKEL	3.8 J	16.4 =	mg/kg	W14-SB10	14 / 14	NA	16	NA	1.56E+02	NA	NA	N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE)	0.0003 J	0.002 J	mg/kg	W14-SB08	3 / 14	NA	0.0020	NA	2.75E+01	NA	NA	N	BSL
	72-54-8	p,p'-DDD	0.00068 J	0.00068 J	mg/kg	W14-SB05	1 / 14	NA	6.80E-04	NA	2.44E+00	NA	NA	N	BSL
	72-55-9	p,p'-DDE	0.0005 J	0.003 J	mg/kg	W14-SB05	6 / 14	NA	0.0030	NA	1.72E+00	NA	NA	N	BSL
		POTASSIUM	460 J	2740 =	mg/kg	W14-SB14	14 / 14	NA	2,740	NA		NA	NA	N	NSV
	7782-49-2	SELENIUM	0.3 J	0.64 J	mg/kg	W14-SB06	12 / 14	NA	0.64	NA	3.91E+01	NA	NA	N	BSL
	7440-22-4	SILVER	0.056 J	0.096 J	mg/kg	W14-SB14	2 / 14	NA	0.096	NA	3.91E+01	NA	NA	N	BSL
		SODIUM	50.6 J	475 J	mg/kg	W14-SB10	14 / 14	NA	475	NA		NA	NA	N	NSV
	7440-28-0	**THALLIUM**	**0.4 J**	**1.7 J**	**mg/kg**	**W14-SB08**	**11 / 14**	**NA**	**1.7**	**NA**	**5.16E-01**	**NA**	**NA**	**Y**	**ASL**
	108-88-3	TOLUENE	0.0003 J	0.001 J	mg/kg	W14-SB08	8 / 14	NA	0.0010	NA	5.20E+01	NA	NA	N	BSL
	7440-62-2	**VANADIUM**	**19.7 =**	**74.3 =**	**mg/kg**	**W14-SB14**	**14 / 14**	**NA**	**74**	**NA**	**5.47E+01**	**NA**	**NA**	**Y**	**ASL**
	1330-20-7	XYLENES, TOTAL	0.0003 J	0.007 J	mg/kg	W14-SB08	8 / 14	NA	0.0070	NA	2.75E+01	NA	NA	N	BSL
	7440-66-6	ZINC	16.5 =	229 J	mg/kg	W14-SB10	14 / 14	NA	229	NA	2.35E+03	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. Tha reported concentration is estimated.
= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 14

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurfacs soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	107-06-2	1,2-DICHLOROETHANE	0.0003 J	0.0003 J	mg/kg	W14-SB01	2 / 14	NA	3.00E-04	NA	6.03E-01			N	BSL
	7429-90-5	**ALUMINUM**	**5740 =**	**13400 =**	**mg/kg**	**W14-SB14**	**14 / 14**	**NA**	**13,400**	**NA**	**1.00E+04**			**Y**	**BSL**
	7440-36-0	ANTIMONY	0.24 J	0.26 J	mg/kg	W14-SB04	2 / 14	NA	0.26	NA	4.09E+01			N	BSL
	7440-38-2	ARSENIC	0.39 J	0.68 J	mg/kg	W14-SB14	4 / 14	NA	0.66	NA	1.59E+00			N	BSL
	7440-39-3	BARIUM	48.2 =	158 =	mg/kg	W14-SB06	14 / 14	NA	156	NA	6.66E+03			N	BSL
	71-43-2	BENZENE	0.0002 J	0.0002 J	mg/kg	W14-SB08	1 / 14	NA	2.00E-04	NA	1.31E+00			N	BSL
	7440-41-7	BERYLLIUM	0.13 J	0.31 J	mg/kg	W14-SB04	14 / 14	NA	0.31	NA	1.94E+03			N	BSL
		CALCIUM	2030 =	6280 =	mg/kg	W14-SB14	14 / 14	NA	6,280	NA				N	NSV
	18540-29-9	CHROMIUM, TOTAL	5.2 J	17.9 =	mg/kg	W14-SB11	14 / 14	NA	18	NA	6.40E+01			N	BSL
	7440-48-4	COBALT	5.8 J	12.8 =	mg/kg	W14-SB02	14 / 14	NA	13	NA	1.92E+03			N	BSL
	7440-50-8	COPPER	21.3 =	31.5 =	mg/kg	W14-SB04	14 / 14	NA	32	NA	4.09E+03			N	BSL
	7439-89-6	**IRON**	**10600 =**	**21600 =**	**mg/kg**	**W14-SB08**	**14 / 14**	**NA**	**21,600**	**NA**	**1.00E+04**			**Y**	**BSL**
	7439-92-1	LEAD	1 =	37.2 =	mg/kg	W14-SB11	14 / 14	NA	37	NA	7.50E+02			N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0003 J	0.001 J	mg/kg	W14-SB03	5 / 14	NA	0.0010	NA	4.20E+01			N	BSL
		MAGNESIUM	2020 =	4020 =	mg/kg	W14-SB04	14 / 14	NA	4,020	NA				N	NSV
	7439-96-5	MANGANESE	299 J	783 J	mg/kg	W14-SB06	14 / 14	NA	783	NA	1.95E+03			N	BSL
	7487-94-7	MERCURY	0.014 J	0.031 J	mg/kg	W14-SB13	3 / 14	NA	0.031	NA	3.07E+01			N	BSL
	7440-02-0	NICKEL	2.5 J	7.8 J	mg/kg	W14-SB04	14 / 14	NA	7.8	NA	2.04E+03			N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE)	0.0003 J	0.0004 J	mg/kg	W14-SB03	2 / 14	NA	4.00E-04	NA	4.20E+01			N	BSL
	72-54-8	p,p'-DDD	0.0012 J	0.0012 J	mg/kg	W14-SB05	1 / 14	NA	0.0012	NA	9.95E+00			N	BSL
	50-29-3	p,p'-DDT	0.038 =	0.038 =	mg/kg	W14-SB05	1 / 14	NA	0.038	NA	7.02E+00			N	BSL
		POTASSIUM	785 J	1670 =	mg/kg	W14-SB08	14 / 14	NA	1,670	NA				N	NSV
	7782-49-2	SELENIUM	0.32 J	0.81 J	mg/kg	W14-SB01	13 / 14	NA	0.81	NA	5.11E+02			N	BSL
		SODIUM	26.7 J	188 J	mg/kg	W14-SB05	13 / 14	NA	188	NA				N	NSV
	7440-28-0	THALLIUM	0.41 J	1.4 J	mg/kg	W14-SB01	13 / 14	NA	1.4	NA	6.75E+00			N	BSL
	108-88-3	TOLUENE	0.0003 J	0.001 J	mg/kg	W14-SB03	8 / 14	NA	0.0010	NA	5.20E+01			N	BSL
	7440-62-2	VANADIUM	29.9 =	63.4 =	mg/kg	W14-SB14	14 / 14	NA	63	NA	7.15E+02			N	BSL
	1330-20-7	XYLENES, TOTAL	0.0003 J	0.001 J	mg/kg	W14-SB07	5 / 14	NA	0.0010	NA	4.20E+01			N	BSL
	7440-66-6	ZINC	23.2 =	45 J	mg/kg	W14-SB10	14 / 14	NA	45	NA	1.00E+04			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 14

Scenario Timeframe: Current and Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	7429-90-5	ALUMINUM	152 J	152 J	µg/L	SWMU14-MW01	1/1	NA	152	NA	3.65E+03			N	BSL
	7440-36-0	ANTIMONY	2.3 J	2.3 J	µg/L	SWMU14-MW01	1/1	NA	2.3	NA	1.46E+00	6.0	MCL	N	BMCL
	7440-39-3	BARIUM	91.6 J	91.6 J	µg/L	SWMU14-MW01	1/1	NA	91.6	NA	2.55E+02	2,000	MCL	N	BSL
		CALCIUM	49600 =	49600 =	µg/L	SWMU14-MW01	1/1	NA	49,600	NA				N	NSV
	18540-29-9	CHROMIUM, TOTAL	3.3 J	3.3 J	µg/L	SWMU14-MW01	1/1	NA	3.3	NA	1.09E+01	100	MCL	N	BMCL
	7440-48-4	COBALT	22 J	22 J	µg/L	SWMU14-MW01	1/1	NA	22	NA	7.30E+01			N	BSL
	7440-50-8	COPPER	70.1 =	70.1 =	µg/L	SWMU14-MW01	1/1	NA	70.1	NA	1.46E+02	1,300	MCL	N	BSL
	60-57-1	**DIELDRIN**	**0.01 J**	**0.01 J**	**µg/L**	**SWMU14-MW01**	**1/1**	**NA**	**0.010**	**NA**	**4.20E-03**			**Y**	**ASL**
	7439-89-6	IRON	147 J	147 J	µg/L	SWMU14-MW01	1/1	NA	147	NA	1.09E+03			N	BSL
	7439-92-1	LEAD	5.1 =	5.1 =	µg/L	SWMU14-MW01	1/1	NA	5.1	NA		15	MCL	N	NSV
		MAGNESIUM	24800 =	24800 =	µg/L	SWMU14-MW01	1/1	NA	24,800	NA				N	NSV
	7439-96-5	**MANGANESE**	**97 =**	**97 =**	**µg/L**	SWMU14-MW01	1/1	NA	**97**	**NA**	**8.76E+01**			**Y**	**ASL**
	7440-02-0	NICKEL	1.5 J	1.5 J	µg/L	SWMU14-MW01	1/1	NA	1.5	NA	7.30E+01	100	MCL	N	BSL
		POTASSIUM	3120 J	3120 J	µg/L	SWMU14-MW01	1/1	NA	3,120	NA				N	NSV
	7782-49-2	SELENIUM	5.2 =	5.2 =	µg/L	SWMU14-MW01	1/1	NA	5.2	NA	1.82E+01	50	MCL	N	BSL
		SODIUM	106000 J	116000 J	µg/L	SWMU14-MW01	1/1	NA	116,000	NA				N	NSV
	7440-62-2	VANADIUM	20.2 J	20.2 J	µg/L	SWMU14-MW01	1/1	NA	20.2	NA	2.55E+01			N	BSL
	7440-66-6	ZINC	3.8 J	3.8 J	µg/L	SWMU14-MW01	1/1	NA	3.8	NA	1.09E+03			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	Aluminum	mg/Kg	8470.714286	10650 (L)	16300	10650	mg/Kg	UCL95 (L)	2
	Arsenic	mg/Kg	1.020357143	1.69 (L)	3	1.69	mg/Kg	UCL95 (L)	2
	Chromium	mg/Kg	15.25	21.5 (L)	31.5	21.5	mg/Kg	UCL95 (L)	2
	Iron	mg/Kg	16251.42857	20153 (L)	28300	20153	mg/Kg	UCL95 (L)	2
	Manganese	mg/Kg	524.0714286	630 (L)	907	630	mg/Kg	UCL95 (L)	2
	Thallium	mg/Kg	0.586071429	0.966 (L)	1.7	0.966	mg/Kg	UCL95 (L)	2
	Vanadium	mg/Kg	43.73571429	55.4 (L)	74.3	55.4	mg/Kg	UCL95 (L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal
L - lognormal
NP - non-parametric (bootstrap)
NC - 95% UCL not calculated (too few samples).
NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	Aluminum	mg/Kg	8745.357143	9841 (L)	16300	9841	mg/Kg	UCL95 (L)	2
	Iron	mg/Kg	16568.57143	18568 (L)	28300	18568	mg/Kg	UCL95 (L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	Dieldrin	ug/L	0.01	0.01 (NP)	0.01	0.00001	mg/L	UCL95 (NP)	3
	Manganese	ug/L	97	NC (NA)	97	0.097	mg/L	Max detect	5

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF
				IR	Ingestion Rate	100	mg/day	a	BW x AT
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA
				SA	Surface Area	3300	cm^2	e	BW x AT
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	BW x AT
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Rsasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9265.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
SWMU 14

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				ET	Event Duration	0.05	hr/event	g	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	DAevent(inorganics) = Cw x Kp x ET
					Manganese	0.001		e	DAevent(dieldrin) = Cw x 7.9×10^{-5} (Exhibit B-3)
				EV	Events Frequency	5	events/day	g	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Supertund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Best professional judgement, assumed to be equivalent to dermal event duration for residential adult as recommended by EPA Region 2 (five 3-min events).

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Ca x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	e	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	e	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9265.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.5.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Supertund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best protessional judgment used based on an anticipated receptor behavior.

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Construction Worker	Adult	Subsurface Soil	Cs	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	330	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	h	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Dermal:	Construction Worker	Adult	Subsurface Soil	Cs	Concentration in soil	Table 3.2	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.3	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Aluminum	0.001		e	DAevent = Cs x CF x AF x ABS
					Arsenic	0.03		i	
					Iron	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Inhalation:	Construction Worker	Adult	Subsurface Soil	Cs	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9265.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.7.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.07	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interim Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.8.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	c	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was coneidered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser//otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.9.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = $\frac{Cw \times IR \times EF \times ED}{BW \times AT}$
				IR	Ingestion Rate	2	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	e	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = $\frac{DAevent \times EV \times ED \times EF \times SA \times CF}{BW \times AT}$
				SA	Surface Area	18000	cm^2	e	
				ET	Event Duration	0.25	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	DAevent(inorganics) = Cw x Kp x ET
					Manganese	0.001		e	DAevent(dieldrin) = Cw x 7.9×10^{-6}
				EV	Events Frequency	1	events/day	e	(Exhibit B-3)
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposura Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.10.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA x CF / BW x AT
				SA	Surface Area	6600	cm^2	e	
				ET	Event Duration	0.45	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	DAevent(inorganics) = Cw x Kp x ET
					Manganese	0.001		e	DAevent(dieldrin) = Cw x 7.9×10^{-5} (Exhibit B-3)
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9265.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 27 min/shower as a conservative exposure time.

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 14

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicify rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

SWMU 14

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

SWMU 14

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 14

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

SWMU 14

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Current
Receptor Population:	Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1E+04	mg/Kg	7.7E-04	mg/kg/day				2.2E-03	mg/kg/day	1.0E+00	mg/kg/day	2.2E-03
				Arsenic	2E+00	mg/Kg	1.2E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.8E-07	3.4E-07	mg/kg/day	3.0E-04	mg/kg/day	1.1E-03
				Chromium	2E+01	mg/Kg	1.6E-06	mg/kg/day				4.4E-06	mg/kg/day	3.0E-03	mg/kg/day	1.5E-03
				Iron	2E+04	mg/Kg	1.5E-03	mg/kg/day				4.1E-03	mg/kg/day	3.0E-01	mg/kg/day	1.4E-02
				Manganese	6E+02	mg/Kg	4.6E-05	mg/kg/day				1.3E-04	mg/kg/day	1.4E-01	mg/kg/day	9.2E-04
				Thallium	1E+00	mg/Kg	7.0E-08	mg/kg/day				2.0E-07	mg/kg/day	8.0E-05	mg/kg/day	2.5E-03
				Vanadium	6E+01	mg/Kg	4.0E-06	mg/kg/day				1.1E-05	mg/kg/day	7.0E-03	mg/kg/day	1.6E-03
			Exp. Route Total								1.8E-07					2.3E-02
			Dermal	Aluminum	1E+04	mg/Kg	5.1E-06	mg/kg/day				1.4E-05	mg/kg/day	4.0E-02	mg/kg/day	3.6E-04
				Arsenic	2E+00	mg/Kg	2.4E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.8E-08	6.8E-08	mg/kg/day	3.0E-04	mg/kg/day	2.3E-04
				Chromium	2E+01	mg/Kg	1.0E-06	mg/kg/day				2.9E-08	mg/kg/day	3.9E-05	mg/kg/day	7.4E-04
				Iron	2E+04	mg/Kg	9.7E-06	mg/kg/day				2.7E-05	mg/kg/day	3.0E-01	mg/kg/day	9.0E-05
				Manganese	6E+02	mg/Kg	3.0E-07	mg/kg/day				8.5E-07	mg/kg/day	5.8E-03	mg/kg/day	1.5E-04
				Thallium	1E+00	mg/Kg	4.6E-10	mg/kg/day				1.3E-09	mg/kg/day	6.0E-05	mg/kg/day	1.6E-05
				Vanadium	6E+01	mg/Kg	2.7E-08	mg/kg/day				7.4E-06	mg/kg/day	1.8E-04	mg/kg/day	4.1E-04
			Exp. Route Total								3.6E-08					2.0E-03
			Inhalation	Aluminum	1E+04	mg/Kg	1.1E-07	mg/kg/day				3.2E-07	mg/kg/day	1.4E-03	mg/kg/day	2.2E-04
				Arsenic	2E+00	mg/Kg	1.8E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	2.7E-10	5.1E-11	mg/kg/day	2.9E-04	mg/kg/day	1.8E-07
				Chromium	2E+01	mg/Kg	2.3E-10	mg/kg/day				6.4E-10	mg/kg/day	2.3E-06	mg/kg/day	2.8E-04
				Iron	2E+04	mg/Kg	2.2E-07	mg/kg/day				6.0E-07	mg/kg/day			
				Manganese	6E+02	mg/Kg	6.7E-09	mg/kg/day				1.9E-08	mg/kg/day	1.4E-05	mg/kg/day	1.3E-03
				Thallium	1E+00	mg/Kg	1.0E-11	mg/kg/day				2.9E-11	mg/kg/day	8.0E-05	mg/kg/day	3.6E-07
				Vanadium	8E+01	mg/Kg	5.9E-10	mg/kg/day				1.7E-09	mg/kg/day	1.8E-04	mg/kg/day	9.1E-06
			Exp. Route Total								2.7E-10					1.8E-03
		Exposure Point Total									2.2E-07					2.7E-02
	Exposure Medium Total										2.2E-07					2.7E-02
Medium Total											2.2E-07					2.7E-02
										Total of Receptor Risks Across All Media	2.2E-07				Total of Receptor Hazards Across All Media	2.7E-02

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1E+04	mg/Kg	3.7E-03	mg/kg/day				1.0E-02	mg/kg/day	1.0E+00	mg/kg/day	1.0E-02
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-04	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	5.9E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	8.9E-07	1.7E-06	mg/kg/day	3.0E-04	mg/kg/day	5.5E-03
				Chromium	2E+01	mg/Kg	7.5E-06	mg/kg/day				2.1E-05	mg/kg/day	3.0E-03	mg/kg/day	7.0E-03
				Iron	2E+04	mg/Kg	7.0E-03	mg/kg/day				2.0E-02	mg/kg/day	3.0E-01	mg/kg/day	6.6E-02
				Manganese	8E+02	mg/Kg	2.2E-04	mg/kg/day				6.2E-04	mg/kg/day	1.4E-01	mg/kg/day	4.4E-03
				Thallium	1E+00	mg/Kg	3.4E-07	mg/kg/day				9.5E-07	mg/kg/day	8.0E-05	mg/kg/day	1.2E-02
				Vanadium	6E+01	mg/Kg	1.9E-05	mg/kg/day				5.4E-05	mg/kg/day	7.0E-03	mg/kg/day	7.7E-03
			Exp. Route Total								8.9E-07					1.1E-01
			Dermal	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.5E-05	mg/kg/day				6.9E-05	mg/kg/day	4.0E-02	mg/kg/day	1.7E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	6.0E-05	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	1.2E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.8E-07	3.3E-07	mg/kg/day	3.0E-04	mg/kg/day	1.1E-03
				Chromium	2E+01	mg/Kg	5.0E-08	mg/kg/day				1.4E-07	mg/kg/day	3.9E-05	mg/kg/day	3.6E-03
				Iron	2E+04	mg/Kg	4.8E-05	mg/kg/day				1.3E-04	mg/kg/day	3.0E-01	mg/kg/day	4.3E-04
				Manganese	6E+02	mg/Kg	1.5E-06	mg/kg/day				4.1E-06	mg/kg/day	5.6E-03	mg/kg/day	7.3E-04
				Thallium	1E+00	mg/Kg	2.2E-09	mg/kg/day				6.2E-09	mg/kg/day	8.0E-05	mg/kg/day	7.6E-05
				Vanadium	6E+01	mg/Kg	1.3E-07	mg/kg/day				3.6E-07	mg/kg/day	1.8E-04	mg/kg/day	2.0E-03
			Exp. Route Total								1.8E-07					9.6E-03
			Inhalation	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	5.5E-07	mg/kg/day				1.5E-06	mg/kg/day	1.4E-03	mg/kg/day	1.1E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Arsenic	2E+00	mg/Kg	8.7E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.3E-09	2.4E-10	mg/kg/day	2.9E-04	mg/kg/day	6.5E-07
				Chromium	2E+01	mg/Kg	1.1E-09	mg/kg/day				3.1E-09	mg/kg/day	2.3E-06	mg/kg/day	1.4E-03
				Iron	2E+04	mg/Kg	1.0E-06	mg/kg/day				2.9E-06	mg/kg/day			
				Manganese	6E+02	mg/Kg	3.2E-06	mg/kg/day				9.1E-08	mg/kg/day	1.4E-05	mg/kg/day	6.3E-03
				Thallium	1E+00	mg/Kg	5.0E-11	mg/kg/day				1.4E-10	mg/kg/day	8.0E-05	mg/kg/day	1.7E-06
				Vanadium	6E+01	mg/Kg	2.8E-09	mg/kg/day				8.0E-09	mg/kg/day	1.8E-04	mg/kg/day	4.4E-05
			Exp. Route Total								1.3E-09					8.6E-03
		Exposure Point Total									1.1E-06					1.3E-01
	Exposure Medium Total										1.1E-06					1.3E-01
Medium Total											1.1E-06					1.3E-01
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	1E-05	mg/L	3.5E-08	mg/kg/day	1.6E+01	(mg/kg/day)-1	5.6E-07	9.8E-08	mg/kg/day	5.0E-05	mg/kg/day	2.0E-03
				Aluminum	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	1.0E+00	mg/kg/day	0.0E+00
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-04	mg/kg/day	0.0E+00
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	3.0E-03	mg/kg/day	0.0E+00
				Iron	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	3.0E-01	mg/kg/day	0.0E+00
				Manganese	1E-01	mg/L	3.4E-04	mg/kg/day				9.5E-04	mg/kg/day	1.4E-01	mg/kg/day	6.8E-03
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-03	mg/kg/day	0.0E+00
			Exp. Route Total								5.6E-07					6.8E-03
			Dermal	Dieldrin	1E-05	mg/L	4.6E-11	mg/kg/day	1.6E+01	(mg/kg/day)-1	7.3E-10	1.3E-10	mg/kg/day	5.0E-05	mg/kg/day	2.6E-06
				Aluminum	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-02	mg/kg/day	0.0E+00
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	6.0E-05	mg/kg/day	0.0E+00
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	3.9E-05	mg/kg/day	0.0E+00
				Iron	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	3.0E-01	mg/kg/day	0.0E+00
				Manganese	1E-01	mg/L	2.8E-07	mg/kg/day				7.8E-07	mg/kg/day	5.6E-03	mg/kg/day	1.4E-04
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	6.0E-05	mg/kg/day	0.0E+00
				Vanadium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	1.8E-04	mg/kg/day	0.0E+00
			Exp. Route Total								7.3E-10					1.4E-04
		Exposure Point Total									5.6E-07					6.9E-03
	Exposure Medium Total										5.6E-07					6.9E-03
Medium Total											5.6E-07					6.9E-03
										Total of Receptor Risks Across All Media	1.8E-06				Total of Receptor Hazards Across All Media	1.4E-01

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1E+04	mg/Kg	1.5E-03	mg/kg/day				4.3E-03	mg/kg/day	1.0E+00	mg/kg/day	4.3E-03
				Arsenic	2E+00	mg/Kg	2.4E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.5E-07	8.9E-07	mg/kg/day	3.0E-04	mg/kg/day	2.3E-03
				Chromium	2E+01	mg/Kg	3.0E-06	mg/kg/day				8.8E-06	mg/kg/day	3.0E-03	mg/kg/day	2.9E-03
				Iron	2E+04	mg/Kg	2.8E-03	mg/kg/day				8.2E-03	mg/kg/day	3.0E-01	mg/kg/day	2.7E-02
				Manganese	6E+02	mg/Kg	8.8E-05	mg/kg/day				2.6E-04	mg/kg/day	1.4E-01	mg/kg/day	1.8E-03
				Thallium	1E+00	mg/Kg	1.3E-07	mg/kg/day				3.9E-07	mg/kg/day	8.0E-05	mg/kg/day	4.9E-03
				Vanadium	8E+01	mg/Kg	7.7E-06	mg/kg/day				2.3E-05	mg/kg/day	7.0E-03	mg/kg/day	3.2E-03
			Exp. Route Total								3.5E-07					4.7E-02
			Dermal	Aluminum	1E+04	mg/Kg	1.7E-05	mg/kg/day				4.9E-05	mg/kg/day	4.0E-02	mg/kg/day	1.2E-03
				Arsenic	2E+00	mg/Kg	8.1E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.2E-07	2.4E-07	mg/kg/day	3.0E-04	mg/kg/day	7.8E-04
				Chromium	2E+01	mg/Kg	3.4E-08	mg/kg/day				1.0E-07	mg/kg/day	3.9E-05	mg/kg/day	2.6E-03
				Iron	2E+04	mg/Kg	3.2E-05	mg/kg/day				9.4E-05	mg/kg/day	3.0E-01	mg/kg/day	3.1E-04
				Manganese	6E+02	mg/Kg	1.0E-06	mg/kg/day				2.9E-06	mg/kg/day	5.8E-03	mg/kg/day	5.2E-04
				Thallium	1E+00	mg/Kg	1.5E-09	mg/kg/day				4.5E-09	mg/kg/day	8.0E-05	mg/kg/day	5.6E-05
				Vanadium	6E+01	mg/Kg	8.5E-08	mg/kg/day				2.6E-07	mg/kg/day	1.8E-04	mg/kg/day	1.4E-03
			Exp. Route Total								1.2E-07					6.9E-03
			Inhalation	Aluminum	1E+04	mg/Kg	2.2E-07	mg/kg/day				6.4E-07	mg/kg/day	1.4E-03	mg/kg/day	4.5E-04
				Arsenic	2E+00	mg/Kg	3.5E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	5.2E-10	1.0E-10	mg/kg/day	2.9E-04	mg/kg/day	3.5E-07
				Chromium	2E+01	mg/Kg	4.4E-10	mg/kg/day				1.3E-09	mg/kg/day	2.3E-06	mg/kg/day	5.6E-04
				Iron	2E+04	mg/Kg	4.1E-07	mg/kg/day				1.2E-06	mg/kg/day			
				Manganese	6E+02	mg/Kg	1.3E-08	mg/kg/day				3.8E-08	mg/kg/day	1.4E-05	mg/kg/day	2.8E-03
				Thallium	1E+00	mg/Kg	2.0E-11	mg/kg/day				5.8E-11	mg/kg/day	8.0E-05	mg/kg/day	7.2E-07
				Vanadium	6E+01	mg/Kg	1.1E-09	mg/kg/day				3.3E-09	mg/kg/day	1.8E-04	mg/kg/day	1.8E-05
			Exp. Route Total								5.2E-10					3.7E-03
		Exposure Point Total									4.8E-07					5.7E-02
	Exposure Medium Total										4.8E-07					5.7E-02
Medium Total											4.8E-07					5.7E-02
									Total of Receptor Risks Across All Media		4.8E-07			Total of Receptor Hazards Across All Media		5.7E-02

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1E+04	mg/Kg	3.5E-03	mg/kg/day				4.0E-02	mg/kg/day	1.0E+00	mg/kg/day	4.0E-02
				Arsenic	2E+00	mg/Kg	5.5E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	6.3E-07	6.4E-06	mg/kg/day	3.0E-04	mg/kg/day	2.1E-02
				Chromium	2E+01	mg/Kg	7.0E-08	mg/kg/day				6.2E-05	mg/kg/day	3.0E-03	mg/kg/day	2.7E-02
				Iron	2E+04	mg/Kg	6.6E-03	mg/kg/day				7.7E-02	mg/kg/day	3.0E-01	mg/kg/day	2.6E-01
				Manganese	6E+02	mg/Kg	2.1E-04	mg/kg/day				2.4E-03	mg/kg/day	1.4E-01	mg/kg/day	1.7E-02
				Thallium	1E+00	mg/Kg	3.1E-07	mg/kg/day				3.7E-06	mg/kg/day	8.0E-05	mg/kg/day	4.6E-02
				Vanadium	6E+01	mg/Kg	1.8E-05	mg/kg/day				2.1E-04	mg/kg/day	7.0E-03	mg/kg/day	3.0E-02
			Exp. Route Total								8.3E-07					4.4E-01
			Dermal	Aluminum	1E+04	mg/Kg	9.7E-06	mg/kg/day				1.1E-04	mg/kg/day	4.0E-02	mg/kg/day	2.8E-03
				Arsenic	2E+00	mg/Kg	4.6E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	6.9E-08	5.4E-07	mg/kg/day	3.0E-04	mg/kg/day	1.8E-03
				Chromium	2E+01	mg/Kg	2.0E-08	mg/kg/day				2.3E-07	mg/kg/day	3.9E-05	mg/kg/day	5.9E-03
				Iron	2E+04	mg/Kg	1.8E-05	mg/kg/day				2.1E-04	mg/kg/day	3.0E-01	mg/kg/day	7.1E-04
				Manganese	6E+02	mg/Kg	5.7E-07	mg/kg/day				6.7E-06	mg/kg/day	5.6E-03	mg/kg/day	1.2E-03
				Thallium	1E+00	mg/Kg	8.8E-10	mg/kg/day				1.0E-08	mg/kg/day	8.0E-05	mg/kg/day	1.3E-04
				Vanadium	6E+01	mg/Kg	5.1E-06	mg/kg/day				5.9E-07	mg/kg/day	1.8E-04	mg/kg/day	3.2E-03
			Exp. Route Total								6.9E-08					1.6E-02
			Inhalation	Aluminum	1E+04	mg/Kg	2.6E-07	mg/kg/day				3.0E-06	mg/kg/day	1.4E-03	mg/kg/day	2.1E-03
				Arsenic	2E+00	mg/Kg	4.0E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	6.1E-10	4.7E-10	mg/kg/day	2.9E-04	mg/kg/day	1.7E-06
				Chromium	2E+01	mg/Kg	5.1E-10	mg/kg/day				6.0E-09	mg/kg/day	2.3E-06	mg/kg/day	2.6E-03
				Iron	2E+04	mg/Kg	4.8E-07	mg/kg/day				5.6E-06	mg/kg/day			
				Manganese	6E+02	mg/Kg	1.5E-08	mg/kg/day				1.8E-07	mg/kg/day	1.4E-05	mg/kg/day	1.2E-02
				Thallium	1E+00	mg/Kg	2.3E-11	mg/kg/day				2.7E-10	mg/kg/day	8.0E-05	mg/kg/day	3.4E-06
				Vanadium	6E+01	mg/Kg	1.3E-09	mg/kg/day				1.5E-08	mg/kg/day	1.8E-04	mg/kg/day	8.5E-05
			Exp. Route Total								6.1E-10					1.7E-02
		Exposure Point Total									9.0E-07					4.7E-01
	Exposure Medium Total										9.0E-07					4.7E-01
Medium Total											9.0E-07					4.7E-01
										Total of Receptor Risks Across All Media	9.0E-07				Total of Receptor Hazards Across All Media	4.7E-01

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Current
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Subsurface Soil	Subsurface Soil	Ingestion	Aluminum	1E+04	mg/Kg	2.3E-04	mg/kg/day				3.2E-02	mg/kg/day	1.0E+00	mg/kg/day	3.2E-02
				Iron	2E+04	mg/Kg	4.3E-04	mg/kg/day				8.0E-02	mg/kg/day	3.0E-01	mg/kg/day	2.0E-01
			Exp. Route Total								0.0E+00					2.3E-01
			Dermal	Aluminum	1E+04	mg/Kg	6.8E-07	mg/kg/day				9.5E-05	mg/kg/day	4.0E-02	mg/kg/day	2.4E-03
				Iron	2E+04	mg/Kg	1.3E-06	mg/kg/day				1.8E-04	mg/kg/day	3.0E-01	mg/kg/day	6.0E-04
			Exp. Route Total								0.0E+00					3.0E-03
			Inhalation	Aluminum	1E+04	mg/Kg	1.0E-08	mg/kg/day				1.4E-06	mg/kg/day	1.4E-03	mg/kg/day	9.9E-04
				Iron	2E+04	mg/Kg	1.9E-08	mg/kg/day				2.7E-06	mg/kg/day	N/A	N/A	#VALUE!
			Exp. Route Total								0.0E+00					9.9E-04
		Exposure Point Total									0.0E+00					2.4E-01
	Exposure Medium Total										0.0E+00					2.4E-01
Medium Total											0.0E+00					2.4E-01
									Total of Receptor Risks Across All Media		0.0E+00			Total of Receptor Hazards Across All Media		2.4E-01

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1E+04	mg/Kg	5.0E-03	mg/kg/day				1.5E-02	mg/kg/day	1.0E+00	mg/kg/day	1.5E-02
				Arsenic	2E+00	mg/Kg	7.9E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.2E-06	2.3E-06	mg/kg/day	3.0E-04	mg/kg/day	7.7E-03
				Chromium	2E+01	mg/Kg	1.0E-05	mg/kg/day				2.9E-05	mg/kg/day	3.0E-03	mg/kg/day	9.8E-03
				Iron	2E+04	mg/Kg	9.5E-03	mg/kg/day				2.6E-02	mg/kg/day	3.0E-01	mg/kg/day	9.2E-02
				Manganese	6E+02	mg/Kg	3.0E-04	mg/kg/day				8.6E-04	mg/kg/day	1.4E-01	mg/kg/day	6.2E-03
				Thallium	1E+00	mg/Kg	4.5E-07	mg/kg/day				1.3E-06	mg/kg/day	8.0E-05	mg/kg/day	1.7E-02
				Vanadium	8E+01	mg/Kg	2.6E-05	mg/kg/day				7.6E-05	mg/kg/day	7.0E-03	mg/kg/day	1.1E-02
			Exp. Route Total								1.2E-06					1.6E-01
			Dermal	Aluminum	1E+04	mg/Kg	2.0E-05	mg/kg/day				5.8E-05	mg/kg/day	4.0E-02	mg/kg/day	1.5E-03
				Arsenic	2E+00	mg/Kg	9.5E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.4E-07	2.6E-07	mg/kg/day	3.0E-04	mg/kg/day	9.2E-04
				Chromium	2E+01	mg/Kg	4.0E-06	mg/kg/day				1.2E-07	mg/kg/day	3.9E-05	mg/kg/day	3.0E-03
				Iron	2E+04	mg/Kg	3.8E-05	mg/kg/day				1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	3.7E-04
				Manganese	6E+02	mg/Kg	1.2E-06	mg/kg/day				3.4E-06	mg/kg/day	5.6E-03	mg/kg/day	6.1E-04
				Thallium	1E+00	mg/Kg	1.6E-09	mg/kg/day				5.3E-09	mg/kg/day	8.0E-05	mg/kg/day	6.6E-05
				Vanadium	8E+01	mg/Kg	1.0E-07	mg/kg/day				3.0E-07	mg/kg/day	1.6E-04	mg/kg/day	1.7E-03
			Exp. Route Total								1.4E-07					8.1E-03
			Inhalation	Aluminum	1E+04	mg/Kg	7.4E-07	mg/kg/day				2.1E-06	mg/kg/day	1.4E-03	mg/kg/day	1.5E-03
				Arsenic	2E+00	mg/Kg	1.2E-10	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.6E-09	3.4E-10	mg/kg/day	2.9E-04	mg/kg/day	1.2E-06
				Chromium	2E+01	mg/Kg	1.5E-09	mg/kg/day				4.3E-09	mg/kg/day	2.3E-06	mg/kg/day	1.9E-03
				Iron	2E+04	mg/Kg	1.4E-06	mg/kg/day				4.1E-06	mg/kg/day			
				Manganese	6E+02	mg/Kg	4.4E-08	mg/kg/day				1.3E-07	mg/kg/day	1.4E-05	mg/kg/day	8.9E-03
				Thallium	1E+00	mg/Kg	6.7E-11	mg/kg/day				1.9E-10	mg/kg/day	8.0E-05	mg/kg/day	2.4E-06
				Vanadium	8E+01	mg/Kg	3.8E-09	mg/kg/day				1.1E-08	mg/kg/day	1.6E-04	mg/kg/day	6.1E-05
			Exp. Route Total								1.6E-09					1.2E-02
		Exposure Point Total									1.3E-06					1.8E-01
	Exposure Medium Total										1.3E-06					1.8E-01
Medium Total											1.3E-06					1.8E-01
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	1E-05	mg/L	9.4E-08	mg/kg/day	1.6E+01	(mg/kg/day)-1	1.5E-06	2.7E-07	mg/kg/day	5.0E-05	mg/kg/day	5.5E-03
				Manganese	1E-01	mg/L	9.1E-04	mg/kg/day				2.7E-03	mg/kg/day	1.4E-01	mg/kg/day	1.9E-02
			Exp. Route Total								1.5E-06					1.9E-02
			Dermal	Dieldrin	1E-05	mg/L	6.7E-11	mg/kg/day	1.6E+01	(mg/kg/day)-1	1.1E-09	1.9E-10	mg/kg/day	5.0E-05	mg/kg/day	3.9E-06
				Manganese	1E-01	mg/L	2.1E-06	mg/kg/day				6.0E-06	mg/kg/day	5.6E-03	mg/kg/day	1.1E-03
			Exp. Route Total								1.1E-09					1.1E-03
		Exposure Point Total									1.5E-06					2.0E-02
	Exposure Medium Total										1.5E-06					2.0E-02
Medium Total											1.5E-06					2.0E-02
										Total of Receptor Risks Across All Media	2.8E-06				Total of Receptor Hazards Across All Media	2.0E-01

TABLE 7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	1E+04	mg/Kg	1.2E-02	mg/kg/day				1.4E-01	mg/kg/day	1.0E+00	mg/kg/day	1.4E-01
				Arsenic	2E+00	mg/Kg	1.9E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.6E-06	2.2E-05	mg/kg/day	3.0E-04	mg/kg/day	7.2E-02
				Chromium	2E+01	mg/Kg	2.4E-05	mg/kg/day				2.7E-04	mg/kg/day	3.0E-03	mg/kg/day	9.2E-02
				Iron	2E+04	mg/Kg	2.2E-02	mg/kg/day				2.6E-01	mg/kg/day	3.0E-01	mg/kg/day	8.6E-01
				Manganese	6E+02	mg/Kg	6.9E-04	mg/kg/day				8.1E-03	mg/kg/day	1.4E-01	mg/kg/day	5.8E-02
				Thallium	1E+00	mg/Kg	1.1E-06	mg/kg/day				1.2E-05	mg/kg/day	8.0E-05	mg/kg/day	1.5E-01
				Vanadium	6E+01	mg/Kg	6.1E-05	mg/kg/day				7.1E-04	mg/kg/day	7.0E-03	mg/kg/day	1.0E-01
			Exp. Route Total								2.8E-06					1.5E+00
			Dermal	Aluminum	1E+04	mg/Kg	3.3E-05	mg/kg/day				3.8E-04	mg/kg/day	4.0E-02	mg/kg/day	9.5E-03
				Arsenic	2E+00	mg/Kg	1.6E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.3E-07	1.8E-06	mg/kg/day	3.0E-04	mg/kg/day	6.1E-03
				Chromium	2E+01	mg/Kg	8.8E-08	mg/kg/day				7.7E-07	mg/kg/day	3.9E-05	mg/kg/day	2.0E-02
				Iron	2E+04	mg/Kg	6.2E-05	mg/kg/day				7.2E-04	mg/kg/day	3.0E-01	mg/kg/day	2.4E-03
				Manganese	6E+02	mg/Kg	1.9E-06	mg/kg/day				2.3E-05	mg/kg/day	5.6E-03	mg/kg/day	4.0E-03
				Thallium	1E+00	mg/Kg	3.0E-09	mg/kg/day				3.5E-08	mg/kg/day	6.0E-05	mg/kg/day	4.3E-04
				Vanadium	6E+01	mg/Kg	1.7E-07	mg/kg/day				2.0E-06	mg/kg/day	1.8E-04	mg/kg/day	1.1E-02
			Exp. Route Total								2.3E-07					5.3E-02
			Inhalation	Aluminum	1E+04	mg/Kg	8.6E-07	mg/kg/day				1.0E-05	mg/kg/day	1.4E-03	mg/kg/day	7.0E-03
				Arsenic	2E+00	mg/Kg	1.4E-10	mg/kg/day	1.5E+01	(mg/kg/day)-1	2.0E-09	1.6E-09	mg/kg/day	2.9E-04	mg/kg/day	5.6E-06
				Chromium	2E+01	mg/Kg	1.7E-09	mg/kg/day				2.0E-08	mg/kg/day	2.3E-06	mg/kg/day	8.8E-03
				Iron	2E+04	mg/Kg	1.6E-06	mg/kg/day				1.9E-05	mg/kg/day			
				Manganese	8E+02	mg/Kg	5.1E-08	mg/kg/day				5.9E-07	mg/kg/day	1.4E-05	mg/kg/day	4.1E-02
				Thallium	1E+00	mg/Kg	7.8E-11	mg/kg/day				9.1E-10	mg/kg/day	8.0E-05	mg/kg/day	1.1E-05
				Vanadium	6E+01	mg/Kg	4.5E-09	mg/kg/day				5.2E-08	mg/kg/day	1.8E-04	mg/kg/day	2.9E-04
			Exp. Route Total								2.0E-09					5.8E-02
		Exposure Point Total									3.0E-06					1.6E+00
	Exposure Medium Total										3.0E-06					1.6E+00
Medium Total											3.0E-06					1.6E+00
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	1E-05	mg/L	5.5E-08	mg/kg/day	1.6E+01	(mg/kg/day)-1	8.8E-07	6.4E-07	mg/kg/day	5.0E-05	mg/kg/day	1.3E-02
				Manganese	1E-01	mg/L	5.3E-04	mg/kg/day				8.2E-03	mg/kg/day	1.4E-01	mg/kg/day	4.4E-02
			Exp. Route Total								8.8E-07					4.4E-02
			Dermal	Dieldrin	1E-05	mg/L	2.9E-11	mg/kg/day	1.6E+01	(mg/kg/day)-1	4.6E-10	3.3E-10	mg/kg/day	5.0E-05	mg/kg/day	6.7E-06
				Manganese	1E-01	mg/L	1.6E-06	mg/kg/day				1.8E-05	mg/kg/day	5.6E-03	mg/kg/day	3.3E-03
			Exp. Route Total								4.6E-10					3.3E-03
		Exposure Point Total									8.8E-07					4.8E-02
	Exposure Medium Total										8.8E-07					4.8E-02
Medium Total											8.8E-07					4.8E-02
									Total of Receptor Risks Across All Media		3.9E-06			Total of Receptor Hazards Across All Media		1.6E+00

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

SWMU 14

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				Cancer Risk
					Value	Units		Intake/Activity		CSF		
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.002167515	0.000222904	0.00035764	0.002748058
			Arsenic	1.84E-07	2.71E-10	3.65E-08	NA	2.21E-07	Skin	0.00114651	1.77478E-07	0.000227009	0.001373697
			Chromium						Respiratory, not specified	0.001458578	0.000281	0.000740509	0.002480087
			Iron						Gastrointestinal	0.013671963	0	9.0235E-05	0.013762198
			Manganese						Neurological	0.000915851	0.001319507	0.000151115	0.002386474
			Thallium						Hair loss, liver	0.002457534	3.61402E-07	1.62197E-05	0.002474115
			Vanadium						None Specified	0.001610735	9.11049E-06	0.000408879	0.002028725
			Chemical Total					2.21E-07					0.027253354
		Exposure Point Total						2.21E-07					0.027253354
	Exposure Medium Total							2.21E-07					0.027253354
Medium Total								2.21E-07					0.027253354
Receptor Total							Receptor Risk Total	2.21E-07				Receptor HI Total	0.027253354

Total Organ (Body weight) HI Across All Media =	0.002748058
Total Organ (Skin) HI Across All Media =	0.001373697
Total Organ (Respiratory, not specified) HI Across All Media =	0.002480087
Total Organ (Gastrointestinal) HI Across All Media =	0.013782198
Total Organ (Neurological) HI Across All Media =	0.002386474
Total Organ (Hair loss, liver) HI Across All Media =	0.002474115
Total Organ (None Specified) HI Across All Media =	0.002028725

TA. . 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.010420744	0.001071652	0.001719423	0.013211818
			Arsenic	8.86E-07	1.30E-09	1.75E-07	NA	1.06E-06	Skin	0.005512068	8.53261E-07	0.001091389	0.006604311
			Chromium						Respiratory, not specified	0.007012394	0.001350962	0.003560138	0.011923495
			Iron						Gastrointestinal	0.065730594	0	0.000433822	0.066164416
			Manganese						Neurological	0.004403131	0.006343786	0.000726517	0.011473434
			Thallium						Hair loss, liver	0.011815068	1.73751E-06	7.79795E-05	0.011894785
			Vanadium						None Specified	0.001610735	9.11049E-06	0.000408879	0.002028725
			Chemical Total					1.06E-06					0.123300983
		Exposure Point Total						1.06E-06					0.123300983
	Exposure Medium Total							1.06E-06					0.123300983
Medium Total								1.06E-06					0.123300983
Groundwater	Groundwater	Groundwater	Dieldrin	5.6E-07	NA	4.6E-10	NA	5.6E-07	Liver	0.001956947	NA	2.55088E-06	0.001959498
			Manganese						Neurological	0.006779424	NA	0.000139826	0.00691925
		Exposure Point Total						5.60E-07					0.008878748
	Exposure Medium Total							5.60E-07					0.008878748
Medium Total								5.60E-07					0.008878748
Receptor Total							Receptor Risk Total	1.62E-06				Receptor HI Total	0.13217973

Total Organ (Body weight) HI Across All Media =	0.013211818
Total Organ (Skin) HI Across All Media =	0.006604311
Total Organ (Respiratory, not specified) HI Across All Media =	0.011923495
Total Organ (Gastrointestinal) HI Across All Media =	0.066164416
Total Organ (Neurological) HI Across All Media =	0.018392683
Total Organ (Hair loss, liver) HI Across All Media =	0.011894785
Total Organ (None Specified) HI Across All Media =	0.002028725

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.004335029	0.000445807	0.001235483	0.00601632
			Arsenic	3.54E-07	5.20E-10	1.21E-07	NA	4.75E-07	Skin	0.00229302	3.54957E-07	0.000784213	0.003077588
			Chromium						Respiratory, not specified	0.002917156	0.000562	0.002558121	0.006037277
			Iron						Gastrointestinal	0.027343927	0	0.000311721	0.027655648
			Manganese						Neurological	0.001831703	0.002639015	0.000522035	0.004992753
			Thallium						Hair loss, liver	0.004915068	7.22804E-07	5.60318E-05	0.004971823
			Vanadium						None Specified	0.003221471	1.8221E-05	0.001412491	0.004652182
			Chemical Total					4.75E-07					0.057403591
		Exposure Point Total						4.75E-07					0.057403591
	Exposure Medium Total							4.75E-07					0.057403591
Medium Total								4.75E-07					0.057403591
Receptor Total							Receptor Risk Total	4.75E-07				Receptor HI Total	0.057403591

Total Organ (Body weight) HI Across All Media =	0.00601632
Total Organ (Skin) HI Across All Media =	0.003077588
Total Organ (Respiratory, not specified) HI Across All Media =	0.006037277
Total Organ (Gastrointestinal) HI Across All Media =	0.027655648
Total Organ (Neurological) HI Across All Media =	0.004992753
Total Organ (Hair loss, liver) HI Across All Media =	0.004971823
Total Organ (None Specified) HI Across All Media =	0.004652182

TA. .4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.040460274	0.002080434	0.002832219	0.045372927
			Arsenic	8.25E-07	6.07E-10	6.93E-08	NA	8.95E-07	Skin	0.021401522	1.65646E-06	0.001797728	0.023200906
			Chromium						Respiratory, not specified	0.027226788	0.002622668	0.005884231	0.035713688
			Iron						Gastrointestinal	0.255209985	0	0.000714588	0.255924573
			Manganese						Neurological	0.01709589	0.012315403	0.001196712	0.030608006
			Thallium						Hair loss, liver	0.045873973	3.37309E-06	0.000128447	0.046005793
			Vanadium						None Specified	0.030067058	8.50313E-05	0.003237991	0.03339008
			Chemical Total					8.95E-07					0.470215972
		Exposure Point Total						8.95E-07					0.470215972
	Exposure Medium Total							8.95E-07					0.470215972
Medium Total								8.95E-07					0.470215972
Receptor Total							Receptor Risk Total	8.95E-07				Receptor HI Total	0.470215972

Total Organ (Body weight) HI Across All Media =	0.045372927
Total Organ (Skin) HI Across All Media =	0.023200906
Total Organ (Respiratory, not specified) HI Across All Media =	0.035713688
Total Organ (Gastrointestinal) HI Across All Media =	0.255924573
Total Organ (Neurological) HI Across All Media =	0.030608006
Total Organ (Hair loss, liver) HI Across All Media =	0.046005793
Total Organ (None Specified) HI Across All Media =	0.03339008

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Current
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Subsurface Soil	Aluminum					0.00E+00	Body weight	0.03178	0.00099	0.00238	0.03515
			Iron						Gastrointestinal	0.1999		0.00060	0.20045
			Chemical Total					0.00E+00					0.23560
		Exposure Point Total						0.00E+00					0.23560
	Exposure Medium Total							0.00E+00					0.23560
Medium Total								0.00E+00					0.23560
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	0.23560

Total Organ (Body weight) HI Across All Media = 0.03515

Total Organ (Gastrointestinal) HI Across All Media = 0.20045

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.01459	0.00150	0.00146	0.01754
			Arsenic	1.19E-06	1.75E-09	1.43E-07	NA	1.33E-06	Skin	0.00772	0.00000	0.00092	0.00864
			Chromium						Respiratory, not specified	0.00982	0.00189	0.00301	0.01472
			Iron						Gastrointestinal	0.09202	0.00000	0.00037	0.09239
			Manganese						Neurological	0.00616	0.00888	0.00061	0.01566
			Thallium						Hair loss, liver	0.01654	0.00000	0.00007	0.01661
			Vanadium						None Specified	0.01084	0.00006	0.00166	0.01257
			Chemical Total					1.33E-06					0.1761
		Exposure Point Total						1.33E-06					0.1781
	Exposure Medium Total							1.33E-06					0.1781
Medium Total								1.33E-06					0.1781
Groundwater	Groundwater	Groundwater	Dieldrin	1.5E-06	NA	4.6E-10	NA	1.5E-06	Liver	0.005479452	NA	3.89589E-06	0.0055
			Manganese						Neurological	0.018982387	NA	0.001067759	0.0201
		Exposure Point Total						1.50E-06					0.0255
	Exposure Medium Total							1.50E-06					0.0255
Medium Total								1.50E-06					0.0255
Receptor Total							Receptor Risk Total	2.84E-06				Receptor HI Total	0.2037

Total Organ (Body weight) HI Across All Media =	0.0175
Total Organ (Respiratory, not specified) HI Across All Media =	0.0147
Total Organ (Gastrointestinal) HI Across All Media =	0.0924
Total Organ (Neurological) HI Across All Media =	0.0357
Total Organ (Hair loss, liver) HI Across All Media =	0.0166
Total Organ (None Specified) HI Across All Media =	0.0126
Total Organ (Liver) HI Across All Media =	0.0221

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.136164384	0.007001459	0.009531507	0.15269735
			Arsenic	2.78E-06	2.04E-09	2.33E-07	NA	3.01E-08	Skin	0.072024353	5.57464E-06	0.006050046	0.078079973
			Chromium						Respiratory, not specified	0.091628615	0.008826286	0.019735394	0.120190295
			Iron						Gastrointestinal	0.858879756	0	0.002404863	0.86128462
			Manganese						Neurological	0.057534247	0.041446067	0.004027397	0.103007711
			Thallium						Hair loss, liver	0.154383562	1.13517E-05	0.000432274	0.154827187
			Vanadium						None Specified	0.101187215	0.000286163	0.010897085	0.112370482
			Chemical Total					3.01E-06					1.582457599
		Exposure Point Total						3.01E-06					1.582457599
	Exposure Medium Total							3.01E-06					1.582457599
Medium Total								3.01E-06					1.582457599
Groundwater	Groundwater	Groundwater	Dieldrin	8.8E-07	NA	4.6E-10	NA	8.8E-07	Liver	0.012785388	NA	6.6663E-06	0.012792054
			Manganese						Neurological	0.044292237	NA	0.003268899	0.047580936
		Exposure Point Total						8.77E-07					0.060372991
	Exposure Medium Total							8.77E-07					0.060372991
Medium Total								8.77E-07					0.060372991
Receptor Total							Receptor Risk Total	3.89E-06				Receptor HI Total	1.642830589
							Sum of Residential Adult and Residential Child Risks	6.7E-06					

Total Organ (Body weight) HI Across All Media =	0.15269735
Total Organ (Respiratory, not specified) HI Across All Media =	0.120190295
Total Organ (Gastrointestinal) HI Across All Media =	0.86128462
Total Organ (Neurological) HI Across All Media =	0.150588647
Total Organ (Hair loss, liver) HI Across All Media =	0.154827187
Total Organ (None Specified) HI Across All Media =	0.112370482
Total Organ (Liver) HI Across All Media =	0.167619242

TAL J.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 14

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total				Receptor Risk Total					Receptor HI Total				

Total Organ 1 HI Across All Media =
Total Organ 2 HI Across All Media =

Appendix D-4
SWMU 15 Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-4 Contents for SWMU 15 Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 42
Table 1: Selection of Exposure Pathways	p. 2 of 42
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Surface Soil)	p. 3 of 42
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Groundwater	p. 5 of 42
Table 3.1 RME: EPC Summary (Surface Soil)	p. 6 of 42
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 7 of 42
Table 3.3 RME: EPC Summary (Groundwater)	p. 8 of 42
Table 4.1 RME: Values Used for Daily Intake Calculations (Surface Soil – Current Timeframe)	p. 9 of 42
Table 4.2 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 11 of 42
Table 4.3 RME: Values Used for Daily Intake Calculations (Groundwater - Future Timeframe)	p. 13 of 42
Table 4.4 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 14 of 42
Table 4.5 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 16 of 42
Table 4.6 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 18 of 42
Table 4.7 RME: Values Used for Daily Intake Calculations (Surface Soil – Future Timeframe)	p. 20 of 42
Table 4.8 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 22 of 42
Table 4.9 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 23 of 42
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 24 of 42
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 25 of 42
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 26 of 42
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 27 of 42
Table 6.2: Cancer Toxicity Data – Inhalation	p. 28 of 42
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Maintenance Worker – Adult)	p. 29 of 42
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 30 of 42
Table 7.3: RME Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Adult)	p. 31 of 42

Appendix D-4 Contents for SWMU 15 Risk Assessment Tables

Table No.	Page No.
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Child)	p. 32 of 42
Table 7.5 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 33 of 42
Table 7.6 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 34 of 42
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 35 of 42
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Maintenance Worker – Adult)	p. 36 of 42
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 37 of 42
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Adult)	p. 38 of 42
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Child)	p. 39 of 42
Table 9.5 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 40 of 42
Table 9.6 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 41 of 42
Table 10.1 RME: Risk Summary	p. 42 of 42

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	SWMU 15
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

SWMU 15

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Direct contact with COPCs in site soil.	Maintenance Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of workers in the area involved in lawn mowing activities.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Recreational	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
Future	Soil	Surface Soil	Direct contact with COPCs in site soil.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of future indusrtial workers at the site.
	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	Scenario is protective of future indusrtial workers at the site. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.

.E 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 15

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
	7440-02-0	NICKEL	3.3 J	28.3 J	mg/kg	W15-SB16	16 / 16	NA	28	NA	1.56E+02	NA	NA	N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE	0.0003 J	0.0007 J	mg/kg	W15-SB15	4 / 16	NA	7.00E-04	NA	2.75E+01	NA	NA	N	BSL
	72-55-9	p,p'-DDE	0.00042 J	0.0011 J	mg/kg	W15-SB14	3 / 16	NA	0.0011	NA	1.72E+00	NA	NA	N	BSL
	50-29-3	p,p'-DDT	0.00055 J	0.00055 J	mg/kg	W15-SB14	1 / 16	NA	5.50E-04	NA	1.72E+00	NA	NA	N	BSL
	11096-82-5	PCB-1260 (AROCHLOR 1260)	0.021 J	0.021 J	mg/kg	W15-SB03	1 / 16	NA	0.021	NA	2.22E-01	NA	NA	N	BSL
		PHENANTHRENE	0.074 J	0.074 J	mg/kg	W15-SB08	1 / 16	NA	0.074	NA		NA	NA	N	NSV
		POTASSIUM	670 J	1600 =	mg/kg	W15-SB03	16 / 16	NA	1,600	NA		NA	NA	N	NSV
	129-00-0	PYRENE	0.038 J	0.231 J	mg/kg	W15-SB08	4 / 16	NA	0.23	NA	2.32E+02	NA	NA	N	BSL
	7782-49-2	SELENIUM	0.24 J	0.97 J	mg/kg	W15-SB05	14 / 16	NA	0.97	NA	3.91E+01	NA	NA	N	BSL
		SODIUM	48.6 J	870 J	mg/kg	W15-SB16	16 / 16	NA	870	NA		NA	NA	N	NSV
	100-42-5	STYRENE	0.0002 J	0.0002 J	mg/kg	W15-SB09	1 / 16	NA	2.00E-04	NA	1.70E+02	NA	NA	N	BSL
	7440-28-0	**THALLIUM**	**0.33 J**	**0.85 J**	**mg/kg**	**W15-SB07**	**11 / 16**	**NA**	**0.85**	**NA**	**5.16E-01**	**NA**	**NA**	**Y**	**ASL**
	108-88-3	TOLUENE	0.0005 J	0.0007 J	mg/kg	W15-SB03	2 / 16	NA	7.00E-04	NA	5.20E+01	NA	NA	N	BSL
	79-01-6	TRICHLOROETHYLENE (TCE)	0.0003 J	0.0005 J	mg/kg	W15-SB05	3 / 16	NA	5.00E-04	NA	5.30E-02	NA	NA	N	BSL
	7440-62-2	**VANADIUM**	**34.6 =**	**95.9 J**	**mg/kg**	**W15-SB16**	**16 / 16**	**NA**	**96**	**NA**	**5.47E+01**	**NA**	**NA**	**Y**	**ASL**
	1330-20-7	XYLENES, TOTAL	0.0004 J	0.004 J	mg/kg	W15-SB03	11 / 16	NA	0.0040	NA	2.75E+01	NA	NA	N	BSL
	7440-66-6	ZINC	26.5 J	219 =	mg/kg	W15-SB02	16 / 16	NA	219	NA	2.35E+03	NA	NA	N	BSL
												NA	NA		

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 15

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	107-06-2	1,2-DICHLOROETHANE	0.0003 J	0.0003 J	mg/kg	W15-SB14	3 / 16	NA	3.00E-04	NA	2.78E-01	NA	NA	N	BSL
		2-HEXANONE	0.002 J	0.002 J	mg/kg	W15-SB07	1 / 16	NA	0.0020	NA		NA	NA	N	NSV
	7429-90-5	**ALUMINUM**	**5030 J**	**21400 J**	**mg/kg**	**W15-SB16**	**16 / 16**	**NA**	**21,400**	**NA**	**7.61E+03**	**NA**	**NA**	**Y**	**ASL**
	120-12-7	ANTHRACENE	0.017 J	0.017 J	mg/kg	W15-SB08	1 / 16	NA	0.017	NA	2.19E+03	NA	NA	N	BSL
	7440-36-0	ANTIMONY	0.23 J	0.84 J	mg/kg	W15-SB15	15 / 16	NA	0.84	NA	3.13E+00	NA	NA	N	BSL
	7440-38-2	**ARSENIC**	**0.45 J**	**4.6 =**	**mg/kg**	**W15-SB08**	**15 / 16**	**NA**	**4.8**	**NA**	3.90E-01	NA	NA	**Y**	**ASL**
	7440-39-3	BARIUM	44.4 =	79.6 =	mg/kg	W15-SB11	16 / 16	NA	60	NA	5.37E+02	NA	NA	N	BSL
	71-43-2	BENZENE	0.0002 J	0.0002 J	mg/kg	W15-SB10	1 / 16	NA	2.00E-04	NA	6.01E-01	NA	NA	N	BSL
	56-55-3	BENZO(a)ANTHRACENE	0.032 J	0.061 J	mg/kg	W15-SB08	2 / 16	NA	0.061	NA	**6.21E-01**	**NA**	**NA**	N	BSL
	50-32-8	**BENZO(a)PYRENE**	**0.053 J**	**0.071 J**	**mg/kg**	**W15-SB08**	**2 / 16**	**NA**	**0.071**	**NA**	**6.21E-02**	**NA**	**NA**	**Y**	**ASL**
	205-99-2	BENZO(b)FLUORANTHENE	0.027 J	0.116 J	mg/kg	W15-SB08	3 / 16	NA	0.12	NA	**6.21E-01**	**NA**	**NA**	N	BSL
		BENZO(g,h,i)PERYLENE	0.041 J	0.041 J	mg/kg	W15-SB08	1 / 16	NA	0.041	NA		NA	NA	N	NSV
	207-08-9	BENZO(k)FLUORANTHENE	0.034 J	0.098 J	mg/kg	W15-SB08	3 / 16	NA	0.098	NA	**6.21E+00**	**NA**	**NA**	N	BSL
	85-68-7	BENZYL BUTYL PHTHALATE	0.178 J	0.178 J	mg/kg	W15-SB03	1 / 16	NA	0.18	NA	1.22E+03	NA	NA	N	BSL
	7440-41-7	BERYLLIUM	0.091 J	0.18 J	mg/kg	W15-SB15	16 / 16	NA	0.18	NA	1.54E+01	NA	NA	N	BSL
	117-61-7	bis(2-ETHYLHEXYL)PHTHALATE	0.308 J	0.308 J	mg/kg	W15-SB03	1 / 16	NA	0.31	NA	3.47E+01	NA	NA	N	BSL
	7440-43-9	CADMIUM	0.1 J	2.5 =	mg/kg	W15-SB03	5 / 16	NA	2.5	NA	3.70E+00	NA	NA	N	BSL
		CALCIUM	1920 J	22700 J	mg/kg	W15-SB16	16 / 18	NA	22,700	NA		NA	NA	N	NSV
	18540-29-9	**CHROMIUM, TOTAL**	**6.6 J**	**47.5 J**	**mg/kg**	**W15-SB16**	**16 / 16**	**NA**	**48**	**NA**	**3.01E+00**	**NA**	**NA**	**Y**	**BSL**
	218-01-9	CHRYSENE	0.038 J	0.173 J	mg/kg	W15-SB08	3 / 16	NA	0.17	NA	6.21E+01	NA	NA	N	BSL
	7440-48-4	COBALT	6.5 J	16.6 J	mg/kg	W15-SB16	16 / 16	NA	17	NA	9.03E+02	NA	NA	N	BSL
	7440-50-8	COPPER	21.3 J	74.7 =	mg/kg	W15-SB03	16 / 16	NA	75	NA	3.13E+02	NA	NA	N	BSL
	60-57-1	DIELDRIN	0.00045 J	0.00045 J	mg/kg	W15-SB14	1 / 16	NA	4.50E-04	NA	3.04E-02	NA	NA	N	BSL
	84-66-2	DIETHYL PHTHALATE	0.039 J	0.039 J	mg/kg	W15-SB13	1 / 16	NA	0.039	NA	4.89E+03	NA	NA	N	BSL
	100-41-4	ETHYLBENZENE	0.0004 J	0.001 J	mg/kg	W15-SB12	3 / 16	NA	0.0010	NA	8.92E+00	NA	NA	N	BSL
	206-44-0	FLUORANTHENE	0.044 J	0.307 J	mg/kg	W15-SB08	4 / 16	NA	0.31	NA	2.29E+02	NA	NA	N	BSL
	193-39-5	INDENO(1,2,3-c,d)PYRENE	0.053 J	0.053 J	mg/kg	W15-SB08	1 / 16	NA	0.053	NA	6.21E-01	NA	NA	N	BSL
	7439-89-6	**IRON**	**11900 =**	**30100 =**	**mg/kg**	**W15-SB16**	**16 / 18**	**NA**	**30,100**	**NA**	**2.35E+03**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	LEAD	2.4 =	68.4 =	mg/kg	W15-SB03	16 / 16	NA	86	NA	4.00E+02	NA	NA	N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0004 J	0.002 J	mg/kg	W15-SB15	10 / 16	NA	0.0020	NA	2.75E+01	NA	NA	N	BSL
		MAGNESIUM	1060 J	14200 J	mg/kg	W15-SB16	16 / 16	NA	14,200	NA		NA	NA	N	NSV
	7439-96-5	**MANGANESE**	**370 =**	**786 =**	**mg/kg**	**W15-SB11**	**16 / 16**	**NA**	**786**	**NA**	**1.76E+02**	**NA**	**NA**	**Y**	**ASL**
	7487-94-7	MERCURY	0.014 J	0.11 =	mg/kg	W15-SB03	7 / 16	NA	0.11	NA	2.35E+00	NA	NA	N	BSL

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

SWMU 15

Scenario Timeframe: Current and Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	**7429-90-5**	**ALUMINUM**	**8700 =**	**8700 =**	**µg/L**	**SWMU15-MW01**	**1 / 1**	**NA**	**8,700**	**NA**	**3.65E+03**			**Y**	**ASL**
	7440-36-0	**ANTIMONY**	**1.5 J**	**1.5 J**	**µg/L**	**SWMU15-MW01**	**1 / 1**	**NA**	**1.5**	**NA**	**1.46E+00**	**6.0**	**MCL**	**Y**	**BMCL**
	7440-39-3	BARIUM	174 J	174 J	µg/L	SWMU15-MW01	1 / 1	NA	174	NA	2.55E+02	2,000	MCL	N	BSL
	7440-41-7	BERYLLIUM	0.31 J	0.31 J	µg/L	SWMU15-MW01	1 / 1	NA	0.31	NA	7.30E+00	4.0	MCL	N	BSL
		CALCIUM	78200 =	78200 =	µg/L	SWMU15-MW01	1 / 1	NA	78,200	NA				N	NSV
	18540-29-9	**CHROMIUM, TOTAL**	**30.8 =**	**30.8 =**	**µg/L**	**SWMU15-MW01**	**1 / 1**	**NA**	**31**	**NA**	**1.09E+01**	**100**	**MCL**	**Y**	**BMCL**
	7440-48-4	COBALT	5.9 J	5.9 J	µg/L	SWMU15-MW01	1 / 1	NA	5.9	NA	7.30E+01			N	BSL
	7440-50-8	COPPER	14.8 J	14.8 J	µg/L	SWMU15-MW01	1 / 1	NA	15	NA	1.46E+02	1,300	MCL	N	BSL
	7439-89-6	**IRON**	**10100 =**	**10100 =**	**µg/L**	**SWMU15-MW01**	**1 / 1**	**NA**	**10,100**	**NA**	**1.09E+03**			**Y**	**ASL**
	7439-92-1	LEAD	1.7 J	1.7 J	µg/L	SWMU15-MW01	1 / 1	NA	1.7	NA		15	MCL	N	NSV
		MAGNESIUM	37800 =	37800 =	µg/L	SWMU15-MW01	1 / 1	NA	37,800	NA				N	NSV
	7439-96-5	**MANGANESE**	**458 =**	**458 =**	**µg/L**	**SWMU15-MW01**	**1 / 1**	**NA**	**458**	**NA**	**8.78E+01**			**Y**	**ASL**
	7440-02-0	NICKEL	17.2 J	17.2 J	µg/L	SWMU15-MW01	1 / 1	NA	17	NA	7.30E+01	100	MCL	N	BSL
		POTASSIUM	3530 J	3530 J	µg/L	SWMU15-MW01	1 / 1	NA	3,530	NA				N	NSV
		SODIUM	92500 =	92500 =	µg/L	SWMU15-MW01	1 / 1	NA	92,500	NA				N	NSV
	7440-62-2	**VANADIUM**	**43.5 J**	**43.5 J**	**µg/L**	**SWMU15-MW01**	**1 / 1**	**NA**	**44**	**NA**	**2.55E+01**			**Y**	**ASL**
	7440-66-6	ZINC	30.7 =	30.7 =	µg/L	SWMU15-MW01	1 / 1	NA	31	NA	1.09E+03			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	Benzo(a)pyrene	mg/Kg	0.403588235	0.625 (L)	0.071	0.071	mg/Kg	Max detect	4
	Aluminum	mg/Kg	8160.625	9770 (NP)	21400	9770	mg/Kg	UCL95 (NP)	4
	Arsenic	mg/Kg	1.21875	1.83 (L)	4.8	1.83	mg/Kg	UCL95 (L)	4
	Chromium	mg/Kg	14.58125	18.6 (L)	47.5	18.6	mg/Kg	UCL95 (L)	4
	Iron	mg/Kg	16381.25	18289 (L)	30100	18289	mg/Kg	UCL95 (L)	4
	Manganese	mg/Kg	631.6875	677 (N)	786	677	mg/Kg	UCL95 (N)	4
	Thallium	mg/Kg	0.4215625	0.529 (N)	0.85	0.529	mg/Kg	UCL95 (N)	4
	Vanadium	mg/Kg	47.93125	53.8 (NP)	95.9	53.8	mg/Kg	UCL95 (NP)	4

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	No COPCs Identified in Subsurface Soil								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	Aluminum	ug/L	8700	NC (NA)	8700	8.7	mg/L	Max detect	5
	Antimony	ug/L	1.5	NC (NA)	1.5	0.0015	mg/L	Max detect	5
	Chromium	ug/L	16.4	33.8 (NP)	30.8	0.0308	mg/L	Max detect	4
	Iron	ug/L	10100	NC (NA)	10100	10.1	mg/L	Max detect	5
	Manganese	ug/L	458	NC (NA)	458	0.458	mg/L	Max detect	5
	Vanadium	ug/L	43.5	NC (NA)	43.5	0.0435	mg/L	Max detect	5

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Maintenance Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Maintenance Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Medium: Surface Soil
Expoaure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Industrial Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

E 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				ET	Event Duration	0.05	hr/event	g	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	5	events/day	g	
				EF	Exposure Fraquency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Best professional judgement, assumed to be equivalent to dermal event duration for residential adult as recommended by EPA Region 2 (five 3-min events).

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Recreational	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Mangenese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Recreational	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.5.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	6,760	day		
Dermal:	Residential	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.07	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Residential	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.7.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	c	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Residential	Child (8 years)	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	

TABLE 4.7.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Humen Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.8.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	2	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	18000	cm^2	e	
				ET	Event Duration	0.25	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.9.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	6600	cm^2	e	
				ET	Event Duration	0.45	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) wes considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 27 min/shower as a conservative exposure time.

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 15

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

SWMU 15

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

SWMU 15

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

SWMU 15

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, If ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

SWMU 15

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Current
Receptor Population:	Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	7E-02	mg/Kg	5.2E-09	mg/kg/day	7.3E+00	(mg/kg/day)-1	3.8E-08	1.4E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	7.1E-04	mg/kg/day				2.0E-03	mg/kg/day	1.0E+00	mg/kg/day	2.0E-03
				Arsenic	2E+00	mg/Kg	1.3E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.0E-07	3.7E-07	mg/kg/day	3.0E-04	mg/kg/day	1.2E-03
				Chromium	2E+01	mg/Kg	1.4E-08	mg/kg/day				3.8E-08	mg/kg/day	3.0E-03	mg/kg/day	1.3E-03
				Iron	2E+04	mg/Kg	1.3E-03	mg/kg/day				3.7E-03	mg/kg/day	3.0E-01	mg/kg/day	1.2E-02
				Manganese	7E+02	mg/Kg	4.9E-05	mg/kg/day				1.4E-04	mg/kg/day	1.4E-01	mg/kg/day	9.8E-04
				Thallium	5E-01	mg/Kg	3.8E-08	mg/kg/day				1.1E-07	mg/kg/dey	8.0E-05	mg/kg/day	1.3E-03
				Vanadium	5E+01	mg/Kg	3.9E-06	mg/kg/day				1.1E-05	mg/kg/day	7.0E-03	mg/kg/day	1.6E-03
			Exp. Route Total								2.4E-07					2.1E-02
			Dermal	Benzo(a)pyrene	7E-02	mg/Kg	4.4E-09	mg/kg/day	7.3E+00	(mg/kg/day)-1	3.2E-08	1.2E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	4.7E-06	mg/kg/day				1.3E-05	mg/kg/day	4.0E-02	mg/kg/day	3.3E-04
				Arsenic	2E+00	mg/Kg	2.6E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.0E-06	7.4E-08	mg/kg/day	3.0E-04	mg/kg/day	2.5E-04
				Chromium	2E+01	mg/Kg	8.9E-09	mg/kg/day				2.5E-08	mg/kg/day	3.9E-05	mg/kg/day	6.4E-04
				Iron	2E+04	mg/Kg	8.8E-06	mg/kg/day				2.5E-05	mg/kg/day	3.0E-01	mg/kg/day	8.2E-05
				Manganese	7E+02	mg/Kg	3.2E-07	mg/kg/day				9.1E-07	mg/kg/day	5.6E-03	mg/kg/day	1.6E-04
				Thallium	5E-01	mg/Kg	2.5E-10	mg/kg/day				7.1E-10	mg/kg/day	8.0E-05	mg/kg/day	8.9E-06
				Vanadium	5E+01	mg/Kg	2.6E-08	mg/kg/day				7.2E-06	mg/kg/day	1.8E-04	mg/kg/day	4.0E-04
			Exp. Route Total								7.2E-08					1.9E-03
			Inhalation	Benzo(a)pyrene	7E-02	mg/Kg	7.6E-13	mg/kg/day				2.1E-12	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.0E-07	mg/kg/day				2.9E-07	mg/kg/day	1.4E-03	mg/kg/day	2.0E-04
				Arsenic	2E+00	mg/Kg	2.0E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	2.9E-10	5.5E-11	mg/kg/day	2.9E-04	mg/kg/day	1.9E-07
				Chromium	2E+01	mg/Kg	2.0E-10	mg/kg/day				5.6E-10	mg/kg/day	2.3E-06	mg/kg/day	2.4E-04
				Iron	2E+04	mg/Kg	2.0E-07	mg/kg/day				5.5E-07	mg/kg/day			
				Manganese	7E+02	mg/Kg	7.2E-09	mg/kg/day				2.0E-08	mg/kg/day	1.4E-05	mg/kg/day	1.4E-03
				Thallium	5E-01	mg/Kg	5.7E-12	mg/kg/day				1.6E-11	mg/kg/day	8.0E-05	mg/kg/day	2.0E-07
				Vanadium	5E+01	mg/Kg	5.8E-10	mg/kg/day				1.6E-09	mg/kg/day	1.8E-04	mg/kg/day	8.8E-06
			Exp. Route Total								2.9E-10					1.9E-03
		Exposure Point Total									3.1E-07					2.5E-02
	Exposure Medium Total										3.1E-07					2.5E-02
Medium Total											3.1E-07					2.5E-02
										Total of Receptor Risks Across All Media	3.1E-07				Total of Receptor Hazards Across All Media	2.5E-02

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
							Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
					Value	Units	Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	7E-02	mg/Kg	2.5E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.8E-07	6.9E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	3.4E-03	mg/kg/day				9.6E-03	mg/kg/day	1.0E+00	mg/kg/day	9.6E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-04	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	6.4E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	9.6E-07	1.6E-06	mg/kg/day	3.0E-04	mg/kg/day	6.0E-03
				Chromium	2E+01	mg/Kg	6.5E-06	mg/kg/day				1.8E-05	mg/kg/day	3.0E-03	mg/kg/day	6.1E-03
				Iron	2E+04	mg/Kg	6.4E-03	mg/kg/day				1.6E-02	mg/kg/day	3.0E-01	mg/kg/day	6.0E-02
				Manganese	7E+02	mg/Kg	2.4E-04	mg/kg/day				6.6E-04	mg/kg/day	1.4E-01	mg/kg/day	4.7E-03
				Thallium	5E-01	mg/Kg	1.8E-07	mg/kg/day				5.2E-07	mg/kg/day	8.0E-05	mg/kg/day	6.5E-03
				Vanadium	5E+01	mg/Kg	1.9E-05	mg/kg/day				5.3E-05	mg/kg/day	7.0E-03	mg/kg/day	7.5E-03
			Exp. Route Total								1.1E-06					1.0E-01
			Dermal	Benzo(a)pyrene	7E-02	mg/Kg	2.1E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.6E-07	6.0E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.3E-05	mg/kg/day				6.3E-05	mg/kg/day	4.0E-02	mg/kg/day	1.6E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	6.0E-05	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	1.3E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.9E-07	3.5E-07	mg/kg/day	3.0E-04	mg/kg/day	1.2E-03
				Chromium	2E+01	mg/Kg	4.3E-06	mg/kg/day				1.2E-07	mg/kg/day	3.9E-05	mg/kg/day	3.1E-03
				Iron	2E+04	mg/Kg	4.2E-05	mg/kg/day				1.2E-04	mg/kg/day	3.0E-01	mg/kg/day	3.9E-04
				Manganese	7E+02	mg/Kg	1.6E-06	mg/kg/day				4.4E-06	mg/kg/day	5.6E-03	mg/kg/day	7.6E-04
				Thallium	5E-01	mg/Kg	1.2E-09	mg/kg/day				3.4E-09	mg/kg/day	8.0E-05	mg/kg/day	4.3E-05
				Vanadium	5E+01	mg/Kg	1.2E-07	mg/kg/day				3.5E-07	mg/kg/day	1.8E-04	mg/kg/day	1.9E-03
			Exp. Route Total								3.5E-07					9.0E-03
			Inhalation	Benzo(a)pyrene	7E-02	mg/Kg	3.6E-12	mg/kg/day				1.0E-11	mg/kg/day			
				Aluminum	1E+04	mg/Kg	5.0E-07	mg/kg/day				1.4E-06	mg/kg/day	1.4E-03	mg/kg/day	9.6E-04
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Arsenic	2E+00	mg/Kg	9.4E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.4E-09	2.6E-10	mg/kg/day	2.9E-04	mg/kg/day	9.2E-07
				Chromium	2E+01	mg/Kg	9.6E-10	mg/kg/day				2.7E-09	mg/kg/day	2.3E-06	mg/kg/day	1.2E-03
				Iron	2E+04	mg/Kg	9.4E-07	mg/kg/day				2.6E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	3.5E-06	mg/kg/day				9.7E-06	mg/kg/day	1.4E-05	mg/kg/day	6.6E-03
				Thallium	5E-01	mg/Kg	2.7E-11	mg/kg/day				7.6E-11	mg/kg/day	8.0E-05	mg/kg/day	9.5E-07
				Vanadium	5E+01	mg/Kg	2.8E-09	mg/kg/day				7.7E-09	mg/kg/day	1.8E-04	mg/kg/day	4.3E-05
			Exp. Route Total								1.4E-09					9.0E-03
		Exposure Point Total									1.5E-06					1.2E-01
	Exposure Medium Total										1.5E-06					1.2E-01
Medium Total											1.5E-06					1.2E-01
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
				Aluminum	9E+00	mg/L	3.0E-02	mg/kg/day				8.5E-02	mg/kg/day	1.0E+00	mg/kg/day	8.5E-02
				Antimony	2E-03	mg/L	5.2E-06	mg/kg/day				1.5E-05	mg/kg/day	4.0E-04	mg/kg/day	3.7E-02
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	3E-02	mg/L	1.1E-04	mg/kg/day				3.0E-04	mg/kg/day	3.0E-03	mg/kg/day	1.0E-01
				Iron	1E+01	mg/L	3.5E-02	mg/kg/day				9.9E-02	mg/kg/day	3.0E-01	mg/kg/day	3.3E-01
				Manganese	5E-01	mg/L	1.6E-03	mg/kg/day				4.5E-03	mg/kg/day	1.4E-01	mg/kg/day	3.2E-02
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	4E-02	mg/L	1.5E-04	mg/kg/day				4.3E-04	mg/kg/day	7.0E-03	mg/kg/day	6.1E-02
			Exp. Route Total								0.0E+00					6.4E-01
			Dermal	Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
			Dermal	Aluminum	9E+00	mg/L	2.5E-05	mg/kg/day				7.0E-05	mg/kg/day	4.0E-02	mg/kg/day	1.6E-03
				Antimony	2E-03	mg/L	4.3E-09	mg/kg/day				1.2E-08	mg/kg/day	6.0E-05	mg/kg/day	2.0E-04
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	3E-02	mg/L	1.8E-07	mg/kg/day				5.0E-07	mg/kg/day	3.9E-05	mg/kg/day	1.3E-02
				Iron	1E+01	mg/L	2.9E-05	mg/kg/day				8.2E-05	mg/kg/day	3.0E-01	mg/kg/day	2.7E-04
				Manganese	5E-01	mg/L	1.3E-08	mg/kg/day				3.7E-08	mg/kg/day	5.6E-03	mg/kg/day	6.6E-04
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	4E-02	mg/L	1.3E-07	mg/kg/day				3.5E-07	mg/kg/day	1.8E-04	mg/kg/day	1.9E-03
			Exp. Route Total								0.0E+00					1.8E-02
		Exposure Point Total									0.0E+00					6.6E-01
	Exposure Medium Total										0.0E+00					6.6E-01
Medium Total											0.0E+00					6.6E-01
										Total of Receptor Risks Across All Media	1.5E-06				Total of Receptor Hazards Across All Media	7.8E-01

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	7E-02	mg/Kg	9.9E-09	mg/kg/day	7.3E+00	(mg/kg/day)-1	7.2E-08	2.9E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.4E-03	mg/kg/day				4.0E-03	mg/kg/day	1.0E+00	mg/kg/day	4.0E-03
				Arsenic	2E+00	mg/Kg	2.6E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.8E-07	7.4E-07	mg/kg/day	3.0E-04	mg/kg/day	2.5E-03
				Chromium	2E+01	mg/Kg	2.8E-06	mg/kg/day				7.8E-06	mg/kg/day	3.0E-03	mg/kg/day	2.5E-03
				Iron	2E+04	mg/Kg	2.6E-03	mg/kg/day				7.4E-03	mg/kg/day	3.0E-01	mg/kg/day	2.5E-02
				Manganese	7E+02	mg/Kg	9.4E-05	mg/kg/day				2.8E-04	mg/kg/day	1.4E-01	mg/kg/day	2.0E-03
				Thallium	5E-01	mg/Kg	7.4E-08	mg/kg/day				2.2E-07	mg/kg/day	8.0E-05	mg/kg/day	2.7E-03
				Vanadium	5E+01	mg/Kg	7.5E-06	mg/kg/day				2.2E-05	mg/kg/day	7.0E-03	mg/kg/day	3.1E-03
			Exp. Route Total								4.6E-07					4.2E-02
			Dermal	Benzo(a)pyrene	7E-02	mg/Kg	1.5E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.1E-07	4.3E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.6E-05	mg/kg/day				4.5E-05	mg/kg/day	4.0E-02	mg/kg/day	1.1E-03
				Arsenic	2E+00	mg/Kg	8.7E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.3E-07	2.5E-07	mg/kg/day	3.0E-04	mg/kg/day	8.5E-04
				Chromium	2E+01	mg/Kg	3.0E-08	mg/kg/day				8.6E-06	mg/kg/day	3.9E-05	mg/kg/day	2.2E-03
				Iron	2E+04	mg/Kg	2.9E-05	mg/kg/day				8.5E-05	mg/kg/day	3.0E-01	mg/kg/day	2.8E-04
				Manganese	7E+02	mg/Kg	1.1E-06	mg/kg/day				3.1E-06	mg/kg/day	5.6E-03	mg/kg/day	5.6E-04
				Thallium	5E-01	mg/Kg	8.4E-10	mg/kg/day				2.5E-09	mg/kg/day	8.0E-05	mg/kg/day	3.1E-05
				Vanadium	5E+01	mg/Kg	6.8E-08	mg/kg/day				2.5E-07	mg/kg/day	1.8E-04	mg/kg/day	1.4E-03
			Exp. Route Total								2.4E-07					6.4E-03
			Inhalation	Benzo(a)pyrene	7E-02	mg/Kg	1.5E-12	mg/kg/day				4.3E-12	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.0E-07	mg/kg/day				5.8E-07	mg/kg/day	1.4E-03	mg/kg/day	4.1E-04
				Arsenic	2E+00	mg/Kg	3.8E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	5.6E-10	1.1E-10	mg/kg/day	2.9E-04	mg/kg/day	3.8E-07
				Chromium	2E+01	mg/Kg	3.8E-10	mg/kg/day				1.1E-09	mg/kg/day	2.3E-06	mg/kg/day	4.9E-04
				Iron	2E+04	mg/Kg	3.8E-07	mg/kg/day				1.1E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	1.4E-06	mg/kg/day				4.1E-06	mg/kg/day	1.4E-05	mg/kg/day	2.8E-03
				Thallium	5E-01	mg/Kg	1.1E-11	mg/kg/day				3.2E-11	mg/kg/day	8.0E-05	mg/kg/day	4.0E-07
				Vanadium	5E+01	mg/Kg	1.1E-09	mg/kg/day				3.2E-09	mg/kg/day	1.8E-04	mg/kg/day	1.8E-05
			Exp. Route Total								5.6E-10					3.7E-03
		Exposure Point Total									6.9E-07					5.2E-02
	Exposure Medium Total										8.9E-07					5.2E-02
Medium Total											6.9E-07					5.2E-02
										Total of Receptor Risks Across All Media	6.9E-07				Total of Receptor Hazards Across All Media	5.2E-02

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Child (8 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	7E-02	mg/Kg	2.3E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.7E-07	2.7E-07	mg/kg/day			
				Aluminum	1E+04	mg/Kg	3.2E-03	mg/kg/day				3.7E-02	mg/kg/day	1.0E+00	mg/kg/day	3.7E-02
				Arsenic	2E+00	mg/Kg	8.0E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	6.9E-07	7.0E-06	mg/kg/day	3.0E-04	mg/kg/day	2.3E-02
				Chromium	2E+01	mg/Kg	6.1E-06	mg/kg/day				7.1E-05	mg/kg/day	3.0E-03	mg/kg/day	2.4E-02
				Iron	2E+04	mg/Kg	6.0E-03	mg/kg/day				6.9E-02	mg/kg/day	3.0E-01	mg/kg/day	2.3E-01
				Manganese	7E+02	mg/Kg	2.2E-04	mg/kg/day				2.6E-03	mg/kg/day	1.4E-01	mg/kg/day	1.8E-02
				Thallium	5E-01	mg/Kg	1.7E-07	mg/kg/day				2.0E-06	mg/kg/day	8.0E-05	mg/kg/day	2.5E-02
				Vanadium	5E+01	mg/Kg	1.6E-05	mg/kg/day				2.0E-04	mg/kg/day	7.0E-03	mg/kg/day	2.9E-02
			Exp. Route Total								1.1E-06					3.9E-01
			Dermal	Benzo(a)pyrene	7E-02	mg/Kg	8.4E-09	mg/kg/day	7.3E+00	(mg/kg/day)-1	6.1E-08	9.8E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	6.9E-06	mg/kg/day				1.0E-04	mg/kg/day	4.0E-02	mg/kg/day	2.6E-03
				Arsenic	2E+00	mg/Kg	5.0E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	7.5E-08	5.8E-07	mg/kg/day	3.0E-04	mg/kg/day	1.9E-03
				Chromium	2E+01	mg/Kg	1.7E-08	mg/kg/day				2.0E-07	mg/kg/day	3.9E-05	mg/kg/day	5.1E-03
				Iron	2E+04	mg/Kg	1.7E-05	mg/kg/day				1.9E-04	mg/kg/day	3.0E-01	mg/kg/day	6.5E-04
				Manganese	7E+02	mg/Kg	8.2E-07	mg/kg/day				7.2E-06	mg/kg/day	5.6E-03	mg/kg/day	1.3E-03
				Thallium	5E-01	mg/Kg	4.8E-10	mg/kg/day				5.6E-09	mg/kg/day	8.0E-05	mg/kg/day	7.0E-05
				Vanadium	5E+01	mg/Kg	4.9E-08	mg/kg/day				5.7E-07	mg/kg/day	1.8E-04	mg/kg/day	3.1E-03
			Exp. Route Total								1.4E-07					1.5E-02
			Inhalation	Benzo(a)pyrene	7E-02	mg/Kg	1.7E-12	mg/kg/day				2.0E-11	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.3E-07	mg/kg/day				2.7E-06	mg/kg/day	1.4E-03	mg/kg/day	1.9E-03
				Arsenic	2E+00	mg/Kg	4.4E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	6.6E-10	5.1E-10	mg/kg/day	2.9E-04	mg/kg/day	1.8E-06
				Chromium	2E+01	mg/Kg	4.5E-10	mg/kg/day				5.2E-09	mg/kg/day	2.3E-06	mg/kg/day	2.3E-03
				Iron	2E+04	mg/Kg	4.4E-07	mg/kg/day				5.1E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	1.6E-08	mg/kg/day				1.9E-07	mg/kg/day	1.4E-05	mg/kg/day	1.3E-02
				Thallium	5E-01	mg/Kg	1.3E-11	mg/kg/day				1.5E-10	mg/kg/day	8.0E-05	mg/kg/day	1.6E-06
				Vanadium	5E+01	mg/Kg	1.3E-09	mg/kg/day				1.5E-08	mg/kg/day	1.8E-04	mg/kg/day	8.3E-05
			Exp. Route Total								6.6E-10					1.7E-02
		Exposure Point Total									1.2E-06					4.2E-01
	Exposure Medium Total										1.2E-06					4.2E-01
Medium Total											1.2E-06					4.2E-01
									Total of Receptor Risks Across All Media		1.2E-06			Total of Receptor Hazards Across All Media		4.2E-01

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	7E-02	mg/Kg	3.3E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	2.4E-07	9.7E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	4.8E-03	mg/kg/day				1.3E-02	mg/kg/day	1.0E+00	mg/kg/day	1.3E-02
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-04	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	8.8E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.3E-06	2.5E-06	mg/kg/day	3.0E-04	mg/kg/day	8.4E-03
				Chromium	2E+01	mg/Kg	8.7E-08	mg/kg/day				2.5E-05	mg/kg/day	3.0E-03	mg/kg/day	8.5E-03
				Iron	2E+04	mg/Kg	8.6E-03	mg/kg/day				2.5E-02	mg/kg/day	3.0E-01	mg/kg/day	8.4E-02
				Manganese	7E+02	mg/Kg	3.2E-04	mg/kg/day				9.3E-04	mg/kg/day	1.4E-01	mg/kg/day	8.6E-03
				Thallium	5E-01	mg/Kg	2.5E-07	mg/kg/day				7.2E-07	mg/kg/day	8.0E-05	mg/kg/day	9.1E-03
				Vanadium	5E+01	mg/Kg	2.5E-05	mg/kg/day				7.4E-05	mg/kg/day	7.0E-03	mg/kg/day	1.1E-02
			Exp. Route Total								1.5E-06					1.4E-01
			Dermal	Benzo(a)pyrene	7E-02	mg/Kg	1.7E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	1.3E-07	5.0E-08	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.8E-05	mg/kg/day				5.3E-05	mg/kg/day	4.0E-02	mg/kg/day	1.3E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	1.0E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.5E-07	3.0E-07	mg/kg/day	3.0E-04	mg/kg/day	1.0E-03
				Chromium	2E+01	mg/Kg	3.5E-08	mg/kg/day				1.0E-07	mg/kg/day	3.9E-05	mg/kg/day	2.6E-03
				Iron	2E+04	mg/Kg	3.4E-05	mg/kg/day				1.0E-04	mg/kg/day	3.0E-01	mg/kg/day	3.3E-04
				Manganese	7E+02	mg/Kg	1.3E-06	mg/kg/day				3.7E-06	mg/kg/day	5.8E-03	mg/kg/day	6.6E-04
				Thallium	5E-01	mg/Kg	9.9E-10	mg/kg/day				2.9E-09	mg/kg/day	8.0E-05	mg/kg/day	3.6E-05
				Vanadium	5E+01	mg/Kg	1.0E-07	mg/kg/day				2.9E-07	mg/kg/day	1.8E-04	mg/kg/day	1.6E-03
			Exp. Route Total								2.8E-07					7.6E-03
			Inhalation	Benzo(a)pyrene	7E-02	mg/Kg	4.9E-12	mg/kg/day				1.4E-11	mg/kg/day			
				Aluminum	1E+04	mg/Kg	8.7E-07	mg/kg/day				2.0E-06	mg/kg/day	1.4E-03	mg/kg/day	1.4E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Arsenic	2E+00	mg/Kg	1.3E-10	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.9E-09	3.7E-10	mg/kg/day	2.9E-04	mg/kg/day	1.3E-06
				Chromium	2E+01	mg/Kg	1.3E-09	mg/kg/day				3.7E-09	mg/kg/day	2.3E-06	mg/kg/day	1.6E-03
				Iron	2E+04	mg/Kg	1.3E-06	mg/kg/day				3.7E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	4.7E-06	mg/kg/day				1.4E-07	mg/kg/day	1.4E-05	mg/kg/day	9.5E-03
				Thallium	5E-01	mg/Kg	3.7E-11	mg/kg/day				1.1E-10	mg/kg/day	8.0E-05	mg/kg/day	1.3E-06
				Vanadium	5E+01	mg/Kg	3.7E-09	mg/kg/day				1.1E-08	mg/kg/day	1.8E-04	mg/kg/day	6.0E-05
			Exp. Route Total								1.9E-09					1.3E-02
		Exposure Point Total									1.8E-06					1.6E-01
	Exposure Medium Total										1.8E-06					1.6E-01
Medium Total											1.8E-06					1.6E-01
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
				Aluminum	9E+00	mg/L	8.2E-02	mg/kg/day				2.4E-01	mg/kg/day	1.0E+00	mg/kg/day	2.4E-01
				Antimony	2E-03	mg/L	1.4E-05	mg/kg/day				4.1E-05	mg/kg/day	4.0E-04	mg/kg/day	1.0E-01
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	3E-02	mg/L	2.9E-04	mg/kg/day				8.4E-04	mg/kg/day	3.0E-03	mg/kg/day	2.8E-01
				Iron	1E+01	mg/L	9.5E-02	mg/kg/day				2.8E-01	mg/kg/day	3.0E-01	mg/kg/day	9.2E-01
				Manganese	5E-01	mg/L	4.3E-03	mg/kg/day				1.3E-02	mg/kg/day	1.4E-01	mg/kg/day	9.0E-02
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	4E-02	mg/L	4.1E-04	mg/kg/day				1.2E-03	mg/kg/day	7.0E-03	mg/kg/day	1.7E-01
			Exp. Route Total								0.0E+00					1.8E+00
			Dermal	Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
				Aluminum	9E+00	mg/L	1.8E-04	mg/kg/day				5.4E-04	mg/kg/day	4.0E-02	mg/kg/day	1.3E-02
				Antimony	2E-03	mg/L	3.2E-06	mg/kg/day				9.2E-08	mg/kg/day	8.0E-05	mg/kg/day	1.5E-03
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	3E-02	mg/L	1.3E-06	mg/kg/day				3.8E-06	mg/kg/day	3.9E-05	mg/kg/day	9.7E-02
				Iron	1E+01	mg/L	2.1E-04	mg/kg/day				6.2E-04	mg/kg/day	3.0E-01	mg/kg/day	2.1E-03
				Manganese	5E-01	mg/L	9.7E-06	mg/kg/day				2.8E-05	mg/kg/day	5.6E-03	mg/kg/day	5.0E-03
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	4E-02	mg/L	9.2E-07	mg/kg/day				2.7E-06	mg/kg/day	1.8E-04	mg/kg/day	1.5E-02
			Exp. Route Total								0.0E+00					1.3E-01
		Exposure Point Total									0.0E+00					1.9E+00
	Exposure Medium Total										0.0E+00					1.9E+00
Medium Total											0.0E+00					1.9E+00
										Total of Receptor Risks Across All Media	1.8E-06				Total of Receptor Hazards Across All Media	2.1E+00

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	7E-02	mg/Kg	7.8E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	5.7E-07	9.1E-07	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.1E-02	mg/kg/day				1.2E-01	mg/kg/day	1.0E+00	mg/kg/day	1.2E-01
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-04	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	2.0E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.0E-06	2.3E-05	mg/kg/day	3.0E-04	mg/kg/day	7.6E-02
				Chromium	2E+01	mg/Kg	2.0E-05	mg/kg/day				2.4E-04	mg/kg/day	3.0E-03	mg/kg/day	7.9E-02
				Iron	2E+04	mg/Kg	2.0E-02	mg/kg/day				2.3E-01	mg/kg/day	3.0E-01	mg/kg/day	7.8E-01
				Manganese	7E+02	mg/Kg	7.4E-04	mg/kg/day				6.7E-03	mg/kg/day	1.4E-01	mg/kg/day	6.2E-02
				Thallium	5E-01	mg/Kg	5.8E-07	mg/kg/day				6.6E-05	mg/kg/day	8.0E-05	mg/kg/day	8.5E-02
				Vanadium	5E+01	mg/Kg	5.9E-05	mg/kg/day				6.9E-04	mg/kg/day	7.0E-03	mg/kg/day	9.8E-02
			Exp. Route Total								3.6E-06					1.3E+00
			Dermal	Benzo(a)pyrene	7E-02	mg/Kg	2.8E-08	mg/kg/day	7.3E+00	(mg/kg/day)-1	2.1E-07	3.3E-07	mg/kg/day			
				Aluminum	1E+04	mg/Kg	3.0E-05	mg/kg/day				3.5E-04	mg/kg/day	4.0E-02	mg/kg/day	6.7E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Arsenic	2E+00	mg/Kg	1.7E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.5E-07	2.0E-06	mg/kg/day	3.0E-04	mg/kg/day	6.6E-03
				Chromium	2E+01	mg/Kg	5.7E-08	mg/kg/day				6.7E-07	mg/kg/day	3.9E-05	mg/kg/day	1.7E-02
				Iron	2E+04	mg/Kg	5.8E-05	mg/kg/day				6.5E-04	mg/kg/day	3.0E-01	mg/kg/day	2.2E-03
				Manganese	7E+02	mg/Kg	2.1E-06	mg/kg/day				2.4E-05	mg/kg/day	5.6E-03	mg/kg/day	4.3E-03
				Thallium	5E-01	mg/Kg	1.6E-09	mg/kg/day				1.9E-08	mg/kg/day	8.0E-05	mg/kg/day	2.4E-04
				Vanadium	5E+01	mg/Kg	1.7E-07	mg/kg/day				1.9E-06	mg/kg/day	1.8E-04	mg/kg/day	1.1E-02
			Exp. Route Total								4.6E-07					5.0E-02
			Inhalation	Benzo(a)pyrene	7E-02	mg/Kg	5.7E-12	mg/kg/day				6.7E-11	mg/kg/day			
				Aluminum	1E+04	mg/Kg	7.9E-07	mg/kg/day				9.2E-06	mg/kg/day	1.4E-03	mg/kg/day	6.4E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Arsenic	2E+00	mg/Kg	1.5E-10	mg/kg/day	1.5E+01	(mg/kg/day)-1	2.2E-09	1.7E-09	mg/kg/day	2.9E-04	mg/kg/day	6.0E-06
				Chromium	2E+01	mg/Kg	1.5E-09	mg/kg/day				1.7E-08	mg/kg/day	2.3E-06	mg/kg/day	7.6E-03
				Iron	2E+04	mg/Kg	1.5E-06	mg/kg/day				1.7E-05	mg/kg/day			
				Manganese	7E+02	mg/Kg	5.5E-08	mg/kg/day				6.4E-07	mg/kg/day	1.4E-05	mg/kg/day	4.5E-02
				Thallium	5E-01	mg/Kg	4.3E-11	mg/kg/day				5.0E-10	mg/kg/day	8.0E-05	mg/kg/day	6.2E-06
				Vanadium	5E+01	mg/Kg	4.3E-09	mg/kg/day				5.1E-08	mg/kg/day	1.8E-04	mg/kg/day	2.8E-04
			Exp. Route Total								2.2E-09					5.9E-02
		Exposure Point Total									4.0E-06					1.4E+00
	Exposure Medium Total										4.0E-06					1.4E+00
Medium Total											4.0E-06					1.4E+00
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
				Aluminum	9E+00	mg/L	4.8E-02	mg/kg/day				5.6E-01	mg/kg/day	1.0E+00	mg/kg/day	5.6E-01
				Antimony	2E-03	mg/L	8.2E-06	mg/kg/day				9.6E-05	mg/kg/day	4.0E-04	mg/kg/day	2.4E-01
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	3E-02	mg/L	1.7E-04	mg/kg/day				2.0E-03	mg/kg/day	3.0E-03	mg/kg/day	6.6E-01
				Iron	1E+01	mg/L	5.5E-02	mg/kg/day				6.5E-01	mg/kg/day	3.0E-01	mg/kg/day	2.2E+00
				Manganese	5E-01	mg/L	2.5E-03	mg/kg/day				2.9E-02	mg/kg/day	1.4E-01	mg/kg/day	2.1E-01
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	4E-02	mg/L	2.4E-04	mg/kg/day				2.8E-03	mg/kg/day	7.0E-03	mg/kg/day	4.0E-01
			Exp. Route Total								0.0E+00					4.2E+00
			Dermal	Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
				Aluminum	9E+00	mg/L	1.4E-04	mg/kg/day				1.7E-03	mg/kg/day	4.0E-02	mg/kg/day	4.1E-02
				Antimony	2E-03	mg/L	2.4E-06	mg/kg/day				2.8E-07	mg/kg/day	8.0E-05	mg/kg/day	4.7E-03
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	3E-02	mg/L	1.0E-06	mg/kg/day				1.2E-05	mg/kg/day	3.9E-05	mg/kg/day	3.0E-01
				Iron	1E+01	mg/L	1.6E-04	mg/kg/day				1.9E-03	mg/kg/day	3.0E-01	mg/kg/day	6.4E-03
				Manganese	5E-01	mg/L	7.5E-08	mg/kg/day				8.7E-05	mg/kg/day	5.6E-03	mg/kg/day	1.8E-02
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	4E-02	mg/L	7.1E-07	mg/kg/day				8.3E-06	mg/kg/day	1.8E-04	mg/kg/day	4.5E-02
			Exp. Route Total								0.0E+00					4.1E-01
		Exposure Point Total									0.0E+00					4.6E+00
	Exposure Medium Total										0.0E+00					4.6E+00
Medium Total											0.0E+00					4.6E+00
										Total of Receptor Risks Across All Media	4.0E-06				Total of Receptor Hazards Across All Media	6.0E+00

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

SWMU 15

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	3.77E-08	0.00E+00	3.23E-08	NA	7.00E-08					
			Aluminum						Body weight	0.001988415	0.000204485	0.000328088	0.002520989
			Arsenic	2.00E-07	2.93E-10	3.95E-08	NA	2.39E-07	Skin	0.001241487	1.92181E-07	0.000245814	0.001487494
			Chromium						Respiratory, not specified	0.00126184	0.000243098	0.000640626	0.002145564
			Iron						Gastrointestinal	0.01240741	0	8.18889E-05	0.012489299
			Manganese						Neurological	0.000984177	0.001417947	0.000162389	0.002564513
			Thallium						Hair loss, liver	0.001345793	1.97911E-07	8.88223E-06	0.001354873
			Vanadium						None Specified	0.001584216	8.84737E-06	0.00039707	0.001970133
			Chemical Total					3.09E-07					0.024532864
		Exposure Point Total						3.09E-07					0.024532864
	Exposure Medium Total							3.09E-07					0.024532864
Medium Total								3.09E-07					0.024532864
Receptor Total							Receptor Risk Total	3.09E-07				Receptor HI Total	0.024532864

Total Organ (Body weight) HI Across All Media =	0.002520989
Total Organ (Skin) HI Across All Media =	0.001487494
Total Organ (Respiratory, not specified) HI Across All Media =	0.002145564
Total Organ (Gastrointestinal) HI Across All Media =	0.012489299
Total Organ (Neurological) HI Across All Media =	0.002564513
Total Organ (Hair loss, liver) HI Across All Media =	0.001354873
Total Organ (None Specified) HI Across All Media =	0.001970133

TAL. ..2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	1.81E-07	0.00E+00	1.55E-07	NA	3.37E-07					
			Aluminum						Body weight	0.00955969	0.0009831	0.00157735	0.012120138
			Arsenic	9.59E-07	1.41E-09	1.90E-07	NA	1.15E-06	Skin	0.00596869	9.2395E-07	0.0011818	0.007151413
			Chromium						Respiratory, not specified	0.00606654	0.00116874	0.00307993	0.010315209
			Iron						Gastrointestinal	0.05965101	0	0.0003937	0.060044708
			Manganese						Neurological	0.00473162	0.00681705	0.00078072	0.012329388
			Thallium						Hair loss, liver	0.00647016	9.5149E-07	4.2703E-05	0.006513811
			Vanadium						None Specified	0.00156422	8.8474E-06	0.00039707	0.001970133
			Chemical Total					1.49E-06					0.1104448
		Exposure Point Total						1.49E-06					0.1104448
	Exposure Medium Total							1.49E-06					0.1104448
Medium Total								1.49E-06					0.1104448
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.0851272	NA	0.00175575	0.08688295
			Antimony						Blood, longevity	0.03689276	NA	0.00020181	0.036894569
			Barium						Cardiovascular	0	NA	0	0
			Chromium						Respiratory, not specified	0.10045662	NA	0.01275026	0.113206884
			Iron						Gastrointestinal	0.32941944	NA	0.00027177	0.32969121
			Manganese						Neurological	0.03201006	NA	0.00066021	0.032670272
			Thallium						Hair loss, liver	0	NA	0	0
			Vanadium						None Specified	0.06080514	NA	0.00192939	0.062734538
		Exposure Point Total						0.00E+00					0.662080424
	Exposure Medium Total							0.00E+00					0.662080424
Medium Total								0.00E+00					0.662080424
Receptor Total							Receptor Risk Total	1.49E-06				Receptor HI Total	0.772525224

Total Organ (Body weight) HI Across All Media =	0.099003088
Total Organ (Blood, longevity) HI Across All Media =	0.036894569
Total Organ (Skin) HI Across All Media =	0.007151413
Total Organ (Respiratory, not specified) HI Across All Media =	0.123522094
Total Organ (Gastrointestinal) HI Across All Media =	0.389735918
Total Organ (Neurological) HI Across All Media =	0.04499966
Total Organ (Hair loss, liver) HI Across All Media =	0.006513811
Total Organ (None Specified) HI Across All Media =	0.064704671

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	7.23E-08	0.00E+00	1.07E-07	NA	1.80E-07					
			Aluminum						Body weight	0.00397683	0.000408971	0.001133396	0.005519197
			Arsenic	3.83E-07	5.63E-10	1.31E-07	NA	5.15E-07	Skin	0.002482975	3.84361E-07	0.000849177	0.003332536
			Chromium						Respiratory, not specified	0.002523679	0.000486196	0.002213072	0.005222947
			Iron						Gastrointestinal	0.024814821	0	0.000282889	0.02509771
			Manganese						Neurological	0.001968353	0.002835894	0.000560981	0.005365228
			Thallium						Hair loss, liver	0.002891585	3.95821E-07	3.06841E-05	0.002722665
			Vanadium						None Specified	0.003128432	1.76947E-05	0.001371697	0.004517823
			Chemical Total					6.94E-07					0.051778106
		Exposure Point Total						6.94E-07					0.051778106
	Exposure Medium Total							6.94E-07					0.051778106
Medium Total								6.94E-07					0.051778106
Receptor Total							Receptor Risk Total	6.94E-07				Receptor HI Total	0.051778106

Total Organ (Body weight) HI Across All Media =	0.005519197
Total Organ (Skin) HI Across All Media =	0.003332536
Total Organ (Respiratory, not specified) HI Across All Media =	0.005222947
Total Organ (Gastrointestinal) HI Across All Media =	0.02509771
Total Organ (Neurological) HI Across All Media =	0.005365228
Total Organ (Hair loss, liver) HI Across All Media =	0.002722665
Total Organ (None Specified) HI Across All Media =	0.004517823

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Current
Receptor Population: Recrsational
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	1.69E-07	0.00E+00	6.14E-08	NA	2.30E-07					
			Aluminum						Body weight	0.037117078	0.001908529	0.002598195	0.041623802
			Arsenic	8.94E-07	6.57E-10	7.51E-08	NA	9.70E-07	Skin	0.023174429	1.78369E-06	0.001946652	0.025122875
			Chromium						Respiratory, not specified	0.023554338	0.002268913	0.005073242	0.030896492
			Iron						Gastrointestinal	0.231804992	0	0.000648494	0.232253486
			Manganese						Neurological	0.018371298	0.013234171	0.001285991	0.03289146
			Thallium						Hair loss, liver	0.025121461	1.84717E-06	7.03401E-05	0.025193648
			Vanadium						None Specified	0.029198695	8.25755E-05	0.003144475	0.032425746
			Chemical Total					1.20E-06					0.42040751
		Exposure Point Total						1.20E-06					0.42040751
	Exposure Medium Total							1.20E-06					0.42040751
Medium Total								1.20E-06					0.42040751
Receptor Total							Receptor Risk Total	1.20E-06				Receptor HI Total	0.42040751

Total Organ (Body weight) HI Across All Media =	0.041623802
Total Organ (Skin) HI Across All Media =	0.025122875
Total Organ (Respiratory, not specified) HI Across All Media =	0.030896492
Total Organ (Gastrointestinal) HI Across All Media =	0.232253486
Total Organ (Neurological) HI Across All Media =	0.03289146
Total Organ (Hair loss, liver) HI Across All Media =	0.025193648
Total Organ (None Specified) HI Across All Media =	0.032425746

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	2.43E-07	0.00E+00	1.26E-07	NA	3.70E-07					
			Aluminum						Body weight	0.01338358	0.00137634	0.00133501	0.016094915
			Arsenic	1.29E-06	1.90E-09	1.54E-07	NA	1.45E-06	Skin	0.00835616	1.2935E-06	0.00100023	0.009357691
			Chromium						Respiratory, not specified	0.00849315	0.00163624	0.00260674	0.01273813
			Iron						Gastrointestinal	0.08351142	0	0.00033321	0.083844626
			Manganese						Neurological	0.00662427	0.00954387	0.00066077	0.01682891
			Thallium						Hair loss, liver	0.00905822	1.3321E-06	3.6142E-05	0.009095694
			Vanadium						None Specified	0.01052838	5.955E-05	0.0016157	0.012203626
			Chemical Total					1.82E-06					0.160161591
		Exposure Point Total						1.82E-06					0.160161591
	Exposure Medium Total							1.82E-06					0.160161591
Medium Total								1.82E-06					0.160161591
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.23835616	NA	0.01340753	0.251763699
			Antimony						Blood, longevity	0.10273973	NA	0.0015411	0.104280822
			Chromium						Respiratory, not specified	0.28127854	NA	0.09736585	0.378844187
			Iron						Gastrointestinal	0.92237443	NA	0.00207534	0.924449772
			Manganese						Neurological	0.08962818	NA	0.00504159	0.094869765
			Thallium						Hair loss, liver	0	NA	0	0
			Vanadium						None Specified	0.1702544	NA	0.01473355	0.184987957
		Exposure Point Total						0.00E+00					1.938796202
	Exposure Medium Total							0.00E+00					1.938796202
Medium Total								0.00E+00					1.938796202
Receptor Total							Receptor Risk Total	1.82E-06				Receptor HI Total	2.098957793

Total Organ (Body weight) HI Across All Media =	0.267858614
Total Organ (Skin) HI Across All Media =	0.104280822
Total Organ (Respiratory, not specified) HI Across All Media =	0.391380317
Total Organ (Gastrointestinal) HI Across All Media =	1.008294398
Total Organ (Neurological) HI Across All Media =	0.111498675
Total Organ (Hair loss, liver) HI Across All Media =	0.009095694
Total Organ (None Specified) HI Across All Media =	0.197191583
Total Organ (Liver) HI Across All Media =	0.009095694

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

SWMU 15

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (8 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	5.68E-07	0.00E+00	2.07E-07	NA	7.75E-07					
			Aluminum						Body weight	0.12491324	0.00642294	0.00874393	0.140080104
			Antimony						Blood, longevity	0	0	0	0
			Arsenic	3.01E-06	2.21E-09	2.53E-07	NA	3.26E-06	Skin	0.07799087	6.0364E-06	0.00655123	0.084548137
			Chromium						Respiratory, not	0.07926941	0.00763576	0.01707341	0.103978581
			Iron						Gastrointestinal	0.77943988	0	0.00218243	0.78162231
			Manganese						Neurological	0.06182648	0.04453808	0.00432785	0.110692413
			Thallium						Hair loss, liver	0.06454338	6.2164E-06	0.00023672	0.084786317
			Vanadium						None Specified	0.09826464	0.0002779	0.01058237	0.109125106
			Chemical Total					4.04E-06					1.414832968
		Exposure Point Total						4.04E-06					1.414832968
	Exposure Medium Total							4.04E-06					1.414832968
Medium Total								4.04E-06					1.414832968
Groundwater	Groundwater	Groundwater	Dieldrin	0.0E+00	NA	0.0E+00	NA	0.0E+00	Liver	0	NA	0	0
			Aluminum						Body weight	0.55616438	NA	0.04129521	0.597459589
			Antimony						Blood, longevity	0.23972603	NA	0.00474658	0.244472603
			Barium						Cardiovascular	0	NA	0	0
			Chromium						Respiratory, not	0.65631659	NA	0.2998862	0.956202787
			Iron						Gastrointestinal	2.152207	NA	0.00639205	2.158599056
			Manganese						Neurological	0.20913242	NA	0.01552808	0.224660502
			Thallium						Hair loss, liver	0	NA	0	0
			Vanadium						None Specified	0.39726027	NA	0.04537935	0.442639621
		Exposure Point Total						0.00E+00					4.624034158
	Exposure Medium Total							0.00E+00					4.624034158
Medium Total								0.00E+00					4.624034158
Receptor Total							Receptor Risk Total	4.04E-06				Receptor HI Total	6.038867125
							Sum of Residential Adult and Residential Child Risks	5.9E-06					

Total Organ (Body weight) HI Across All Media =	0.737539693
Total Organ (Blood, longevity) HI Across All Media =	0
Total Organ (Skin) HI Across All Media =	0.244472603
Total Organ (Respiratory, not specified) HI Across All Media =	1.060181367
Total Organ (Gastrointestinal) HI Across All Media =	2.940221366
Total Organ (Neurological) HI Across All Media =	0.335352916
Total Organ (Hair loss, liver) HI Across All Media =	0.084786317
Total Organ (None Specified) HI Across All Media =	0.551764727
Total Organ (Liver) HI Across All Media =	0.084786317
Total Organ (Cardiovascular) HI Across All Media =	0

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
SWMU 15

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total				Receptor Risk Total					Receptor HI Total				

Total Organ 1 HI Across All Media =
Total Organ 2 HI Across All Media =

Appendix D-5
AOC B Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-5 Contents for AOC B Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 36
Table 1: Selection of Exposure Pathways	p. 2 of 36
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Surface Soil)	p. 3 of 36
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Subsurface Soil)	p. 4 of 36
Table 2.3: Occurrence, Distribution, and Selection of COPCs (Groundwater)	p. 5 of 36
Table 3.1 RME: EPC Summary (Surface Soil)	p. 6 of 36
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 7 of 36
Table 3.3 RME: EPC Summary (Groundwater)	p. 8 of 36
Table 4.1 RME: Values Used for Daily Intake Calculations (Surface Soil – Current Timeframe)	p. 9 of 36
Table 4.2 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 10 of 36
Table 4.3 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 11 of 36
Table 4.4 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 12 of 36
Table 4.5 RME: Values Used for Daily Intake Calculations (Subsurface Soil - Current Timeframe)	p. 13 of 36
Table 4.6 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 14 of 36
Table 4.7 RME: Values Used for Daily Intake Calculations (Surface Soil – Future Timeframe)	p. 15 of 36
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 16 of 36
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 17 of 36
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 18 of 36
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 19 of 36
Table 6.2: Cancer Toxicity Data – Inhalation	p. 20 of 36
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Maintenance Worker – Adult)	p. 21 of 36
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 22 of 36
Table 7.3: RME Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Adult)	p. 23 of 36
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Child)	p. 24 of 36

Appendix D-5 Contents for AOC B Risk Assessment Tables

Table No.	Page No.
Table 7.5 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Construction Worker – Adult)	p.25 of 36
Table 7.6 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 26 of 36
Table 7.7 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 27 of 36
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 28 of 36
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Maintenance Worker – Adult)	p. 29 of 36
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 30 of 36
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Adult)	p. 31 of 36
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Child)	p. 32 of 36
Table 9.5 RME: Summary of Receptor Risks and Hazards for COPCs (Construction Worker)	p. 33 of 36
Table 9.6 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 34 of 36
Table 9.7 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 35 of 36
Table 10.1 RME: Risk Summary	p. 36 of 36

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	AOC B
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

AOC B

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Direct contact with COPCs in site soil.	Maintenance Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of workers in the area involved in lawn mowing activities.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Recreational	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of currant occasional trespasser and future recreational site users.
	Soil	Subsurface Soil	Direct contact with COPCs in site soil.	Construction Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of utility workers and construction workers where excavations are possible.
Future	Soil	Surface Soil	Direct contact with COPCs in site soil.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of futura indusrtial workers at the site.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC B

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil		1,1-DICHLOROETHENE	0.00058 J	0.00058 J	mg/kg	AB-SB15	1 / 16	NA	0.00058	NA		NA	NA	N	NSV
		2-HEXANONE	0.00066 J	0.00081 J	mg/kg	AB-SB10	2 / 16	NA	0.00081	NA		NA	NA	N	NSV
	106-47-8	4-CHLOROANILINE	0.103 J	0.136 J	mg/kg	AB-SB13	2 / 16	NA	0.136	NA	2.44E+01	NA	NA	N	BSL
	7429-90-5	**ALUMINUM**	**4300 =**	**14000 =**	**mg/kg**	**WWTPSB002**	**16 / 16**	NA	**14000**	NA	**7.61E+03**	NA	NA	Y	**ASL**
	7440-36-0	ANTIMONY	0.35 J	0.73 J	mg/kg	WWTPSB004	11 / 16	NA	0.73	NA	3.13E+00	NA	NA	N	BSL
	7440-38-2	ARSENIC	0.66 J	1.1 J	mg/kg	WWTPSB004	3 / 16	NA	1.1	NA	**3.90E-01**	NA	NA	Y	ASL
	7440-39-3	BARIUM	40 J	114 =	mg/kg	AB-SB08	16 / 16	NA	114	NA	5.37E+02	NA	NA	N	BSL
		BENZO(g,h,i)PERYLENE	0.037 J	0.037 J	mg/kg	WWTPSB003	1 / 16	NA	0.037	NA		NA	NA	N	NSV
	7440-41-7	BERYLLIUM	0.11 J	0.28 J	mg/kg	AB-SB12	15 / 16	NA	0.28	NA	1.54E+01	NA	NA	N	BSL
	117-81-7	bis(2-ETHYLHEXYL)PHTHALATE	0.111 J	0.182 J	mg/kg	AB-SB08	3 / 16	NA	0.182	NA	3.47E+01	NA	NA	N	BSL
	7440-43-9	CADMIUM	0.0389 J	0.46 J	mg/kg	AB-SB06	3 / 16	NA	0.46	NA	3.70E+00	NA	NA	N	BSL
		CALCIUM	1200 J	8060 =	mg/kg	AB-SB05	16 / 16	NA	8060	NA		NA	NA	N	NSV
	18540-29-9	CHROMIUM, TOTAL	6.4 =	22 =	mg/kg	AB-SB15	16 / 16	NA	22	NA	3.01E+01	NA	NA	N	BSL
	7440-48-4	COBALT	2.8 J	11 J	mg/kg	WWTPSB002	16 / 16	NA	11	NA	9.03E+02	NA	NA	N	BSL
	7440-50-8	COPPER	16 =	86 =	mg/kg	AB-SB08	16 / 16	NA	86	NA	3.13E+02	NA	NA	N	BSL
	60-57-1	DIELDRIN	0.00077 J	0.0039 =	mg/kg	AB-SB05	3 / 16	NA	0.0039	NA	3.04E-02	NA	NA	N	BSL
	7439-89-6	**IRON**	**11000 =**	**26000 =**	**mg/kg**	**WWTPSB002**	**16 / 16**	NA	**26000**	NA	**2.35E+03**	NA	NA	Y	**ASL**
	7439-92-1	LEAD	2.3 =	15 =	mg/kg	AB-SB08	16 / 16	NA	15	NA	4.00E+02	NA	NA	N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0014 J	0.0014 J	mg/kg	AB-SB05	1 / 16	NA	0.0014	NA	2.75E+01	NA	NA	N	BSL
		MAGNESIUM	1100 J	4300 =	mg/kg	WWTPSB003	16 / 16	NA	4300	NA		NA	NA	N	NSV
	7439-96-5	**MANGANESE**	**54 =**	**618 =**	**mg/kg**	**AB-SB05**	**16 / 16**	NA	**618**	NA	**1.76E+02**	NA	NA	Y	**ASL**
	7487-94-7	MERCURY	0.0099 J	0.151 =	mg/kg	AB-SB13	16 / 16	NA	0.151	NA	2.35E+00	NA	NA	N	BSL
	78-93-3	METHYL ETHYL KETONE (2-BUTANONE)	0.0028 J	0.01 J	mg/kg	WWTPSB003	3 / 4	NA	0.01	NA	7.33E+02	NA	NA	N	BSL
	108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANON	0.0046 J	0.0046 J	mg/kg	AB-SB10	1 / 16	NA	0.0046	NA	7.87E+01	NA	NA	N	BSL
	7440-02-0	NICKEL	2.7 J	8.5 J	mg/kg	AB-SB15	16 / 16	NA	8.5	NA	1.56E+02	NA	NA	N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE)	0.00051 J	0.00051 J	mg/kg	AB-SB05	1 / 16	NA	0.00051	NA	2.75E+01	NA	NA	N	BSL
	72-55-9	p,p'-DDE	0.00057 J	0.0016 J	mg/kg	AB-SB11	5 / 16	NA	0.0016	NA	1.72E+00	NA	NA	N	BSL
	11096-82-5	PCB-1260 (AROCHLOR 1260)	0.01 J	0.019 J	mg/kg	AB-SB08	4 / 16	NA	0.019	NA	2.22E-01	NA	NA	N	BSL
		POTASSIUM	680 J	1670 =	mg/kg	AB-SB12	16 / 16	NA	1670	NA		NA	NA	N	NSV
	7782-49-2	SELENIUM	0.65 J	1.2 =	mg/kg	WWTPSB003	9 / 16	NA	1.2	NA	3.91E+01	NA	NA	N	BSL
	7440-22-4	SILVER	0.0846 J	0.29 J	mg/kg	AB-SB08	8 / 16	NA	0.29	NA	3.91E+01	NA	NA	N	BSL
		SODIUM	52 J	188 J	mg/kg	AB-SB05	16 / 16	NA	188	NA		NA	NA	N	NSV
	127-18-4	TETRACHLOROETHYLENE(PCE)	0.00025 J	0.00037 J	mg/kg	AB-SB09	2 / 16	NA	0.00037	NA	1.51E+00	NA	NA	N	BSL
	7440-28-0	**THALLIUM**	**0.51 J**	**0.68 J**	**mg/kg**	**WWTPSB002**	**2 / 16**	NA	**0.68**	NA	**5.16E-01**	NA	NA	Y	**ASL**
	108-88-3	TOLUENE	0.0003 J	0.0003 J	mg/kg	AB-SB14	2 / 16	NA	0.0003	NA	5.20E+01	NA	NA	N	BSL
	7440-62-2	**VANADIUM**	**34 =**	**73 =**	**mg/kg**	**WWTPSB002**	**16 / 16**	NA	73	NA	**5.47E+01**	NA	NA	Y	**ASL**
	1330-20-7	XYLENES, TOTAL	0.0019 J	0.0019 J	mg/kg	AB-SB05	1 / 16	NA	0.0019	NA	2.75E+01	NA	NA	N	BSL
	7440-66-6	ZINC	29 =	164 =	mg/kg	AB-SB06	16 / 16	NA	164	NA	2.35E+03	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminent level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC B

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil		1,1-DICHLOROETHENE	0.00085 J	0.0011 J	mg/kg	AB-SB15	2 / 20	NA	0.00110	NA				N	NSV
	309-00-2	ALDRIN	0.00055 J	0.00055 J	mg/kg	AB-SB14	1 / 16	NA	0.00055	NA	1.01E-01			N	BSL
	7429-90-5	**ALUMINUM**	**4700 =**	**17600 =**	**mg/kg**	**AB-SB07**	**16 / 16**	**NA**	**17600**	**NA**	**1.00E+04**			**Y**	**ASL**
	7440-36-0	ANTIMONY	0.31 J	0.43 J	mg/kg	WWTPSB003	4 / 16	NA	0	NA	4.09E+01			N	BSL
	7440-38-2	ARSENIC	0.52 J	0.74 J	mg/kg	AB-SB07	5 / 20	NA	1	NA	1.59E+00			N	BSL
	7440-39-3	BARIUM	31 J	118 =	mg/kg	AB-SB11	20 / 20	NA	118	NA	6.66E+03			N	BSL
	7440-41-7	BERYLLIUM	0.13 J	0.5 J	mg/kg	AB-SB11	13 / 16	NA	1	NA	1.94E+03			N	BSL
	117-81-7	bis(2-ETHYLHEXYL)PHTHALATE	0.093 J	0.093 J	mg/kg	AB-SB09	1 / 16	NA	0	NA	1.23E+02			N	BSL
		CALCIUM	1200 =	6790 =	mg/kg	AB-SB10	16 / 16	NA	6790	NA				N	NSV
	18540-29-9	CHROMIUM, TOTAL	5.4 =	14 =	mg/kg	AB-SB06	20 / 20	NA	14	NA	6.40E+01			N	BSL
	7440-48-4	COBALT	3.6 J	13 =	mg/kg	AB-SB11	16 / 16	NA	13	NA	1.92E+03			N	BSL
	7440-50-8	COPPER	16 =	38 =	mg/kg	AB-SB07	20 / 20	NA	38	NA	4.09E+03			N	BSL
	7439-89-6	**IRON**	**12000 =**	**30300 =**	**mg/kg**	**AB-SB07**	**16 / 16**	**NA**	**30300**	**NA**	**1.00E+04**			**Y**	**ASL**
	7439-92-1	LEAD	0.65 =	3.5 =	mg/kg	WWTPSB002	8 / 20	NA	4	NA	7.50E+02			N	BSL
		MAGNESIUM	1800 =	4210 =	mg/kg	AB-SB08	16 / 16	NA	4210	NA				N	NSV
	7439-96-5	MANGANESE	95 J	735 =	mg/kg	AB-SB08	16 / 16	NA	735	NA	1.95E+03			N	BSL
	7487-94-7	MERCURY	0.0033 J	0.0214 J	mg/kg	AB-SB10	16 / 20	NA	0.0214	NA	3.07E+01			N	BSL
	108-10-1	METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANON	0.001 J	0.0042 J	mg/kg	AB-SB08	3 / 16	NA	0.0042	NA	2.84E+02			N	BSL
	7440-02-0	NICKEL	2.5 J	8.9 J	mg/kg	WWTPSB003	20 / 20	NA	6.9	NA	2.04E+03			N	BSL
		POTASSIUM	810 J	1870 =	mg/kg	AB-SB10	16 / 16	NA	1870	NA				N	NSV
	7782-49-2	SELENIUM	0.57 J	0.93 J	mg/kg	WWTPSB002	12 / 20	NA	1	NA	5.11E+02			N	BSL
	7440-22-4	SILVER	0.0895 J	0.13 J	mg/kg	AB-SB11	5 / 20	NA	0	NA	5.11E+02			N	BSL
		SODIUM	40 J	160 J	mg/kg	AB-SB10	16 / 16	NA	160	NA				N	NSV
	7440-28-0	THALLIUM	0.4 J	0.4 J	mg/kg	WWTPSB004	1 / 16	NA	0	NA	6.75E+00			N	BSL
	108-88-3	TOLUENE	0.00021 J	0.00035 J	mg/kg	AB-SB16	4 / 20	NA	0	NA	5.20E+01			N	BSL
	7440-62-2	VANADIUM	35 =	82 =	mg/kg	AB-SB07	16 / 16	NA	82	NA	7.15E+02			N	BSL
	7440-66-6	ZINC	18 =	99.1 J	mg/kg	WWTPSB002	20 / 20	NA	99	NA	1.00E+04			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC B

Scenario Timeframe: Current and Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	106-46-7	1,4-DICHLOROBENZENE	36 =	36 =	µg/L	WWTPWW001	1 / 1	NA	36	NA	5.02E-01	75	MCL	N	BMCL
	7440-39-3	BARIUM	20.2 J	20.2 J	µg/L	WWTPWW001	1 / 1	NA	20	NA	2.55E+02	2,000	MCL	N	BSL
	71-43-2	BENZENE	0.2 J	0.2 J	µg/L	WWTPWW001	1 / 1	NA	0.2	NA	3.36E-01	5.0	MCL	N	BSL
	18540-29-9	CHROMIUM, TOTAL	5.3 J	5.3 J	µg/L	WWTPWW001	1 / 1	NA	5.3	NA	1.09E+01	100	MCL	N	BSL
	7440-50-8	COPPER	57.1 =	57.1 =	µg/L	WWTPWW001	1 / 1	NA	57	NA	1.46E+02	1,300	MCL	N	BSL
		CRESOLS, m & p	798 =	798 =	µg/L	WWTPWW001	1 / 1	NA	798	NA				N	NSV
	100-41-4	ETHYLBENZENE	0.8 J	0.8 J	µg/L	WWTPWW001	1 / 1	NA	0.8	NA	2.91E+00	700	MCL	N	BSL
	7439-92-1	LEAD	3.1 =	3.1 =	µg/L	WWTPWW001	1 / 1	NA	3.1	NA		15	MCL	N	NSV
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	3 =	3 =	µg/L	WWTPWW001	1 / 1	NA	3.0	NA	2.10E+01	10,000	MCL	N	BSL
	7487-94-7	MERCURY	0.45 =	0.45 =	µg/L	WWTPWW001	1 / 1	NA	0.45	NA	1.09E+00	2.0	MCL	N	BSL
		NITROGEN, NITRATE-NITRITE	250 =	250 =	µg/L	WWTPWW001	1 / 1	NA	250	NA				N	NSV
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE)	2 =	2 =	µg/L	WWTPWW001	1 / 1	NA	2	NA	2.10E+01	10,000	MCL	N	BSL
		PETROLEUM HYDROCARBONS	34000 =	34000 =	µg/L	WWTPWW001	1 / 1	NA	34000	NA				N	NSV
	108-95-2	PHENOL	80 =	80 =	µg/L	WWTPWW001	1 / 1	NA	80	NA	2.19E+03			N	BSL
		SULFATE (AS SO4)	27400 =	27400 =	µg/L	WWTPWW001	1 / 1	NA	27400	NA				N	NSV
		SULFIDE, TOTAL	6950 =	8950 =	µg/L	WWTPWW001	1 / 1	NA	6950	NA				N	NSV
	108-88-3	TOLUENE	370 =	370 =	µg/L	WWTPWW001	1 / 1	NA	370	NA	7.23E+01	1,000	MCL	N	BMCL
	1330-20-7	XYLENES, TOTAL	4 =	4 =	µg/L	WWTPWW001	1 / 1	NA	4	NA	2.10E+01	10,000	MCL	N	BSL
	7440-66-6	ZINC	193 =	193 =	µg/L	WWTPWW001	1 / 1	NA	193	NA	1.09E+03			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	Aluminum	mg/Kg	8538	9557 (N)	14000	9557	mg/Kg	UCL95 (N)	1
	Arsenic	mg/Kg	0.348	0.46 (NP)	1.1	0.46	mg/Kg	UCL95 (NP)	3
	Iron	mg/Kg	15775	17475 (L)	26000	17475	mg/Kg	UCL95 (L)	2
	Manganese	mg/Kg	247	372 (L)	818	372	mg/Kg	UCL95 (L)	2
	Thallium	mg/Kg	0.40	0.678 (N)	0.68	0.678	mg/Kg	UCL95 (N)	1
	Vanadium	mg/Kg	47.3	51.5 (L)	73	51.5	mg/Kg	UCL95 (L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal
L - lognormal
NP - non-parametric (bootstrap)
NC - 95% UCL not calculated (too few samples).
NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal
L - lognormal
NP - non-parametric (bootstrap)
1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.
2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.
3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.
4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.
5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	Aluminum	mg/Kg	6800	9223 (L)	14000	9223	mg/Kg	UCL95 (L)	2
	Iron	mg/Kg	16125	20018 (L)	26000	20018	mg/Kg	UCL95 (L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	NA								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	e	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Ce x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	e	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emisalon Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical epecific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[1]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[2]Exposure Factors Handbook, Volume I,May 1989.

[3]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[4]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[5]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[6]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[a]Assumed

[b]Recommended by EPA Region 2

[c]Supplemental Guidance to RAGS; Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standerd Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

VALUES USED .LY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	6,760	day		
Dermal:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	6,760	day		
Inhalation:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03. March 25. 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Rsgion 2

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.5.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	330	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	h	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Dermal:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.3	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Aluminum	0.001		e	DAevent = Cs x CF x AF x ABS
					Arsenic	0.03		i	
					Iron	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Inhalation:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.07	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	6,760	day		
Inhalation:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.7.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	c	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	DAevent = Cs x CF x AF x ABS
					Aluminum	0.001		i	
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I, May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

AOC B

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specifiec	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

AOC B

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

AOC B

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Not Applicable								

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

AOC B

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

AOC B

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Current
Receptor Population:	Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	6.9E-04	mg/kg/day				1.9E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0019
				Arsenic	5E-01	mg/Kg	3.3E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	5.0E-08	9.4E-08	mg/kg/day	3.0E-04	mg/kg/day	0.0003
				Iron	2E+04	mg/Kg	1.3E-03	mg/kg/day				3.6E-03	mg/kg/day	3.0E-01	mg/kg/day	0.0119
				Manganese	4E+02	mg/Kg	2.7E-05	mg/kg/day				7.6E-05	mg/kg/day	1.4E-01	mg/kg/day	0.0005
				Thallium	7E-01	mg/Kg	4.9E-08	mg/kg/day				1.4E-07	mg/kg/day	8.0E-05	mg/kg/day	0.0017
				Vanadium	5E+01	mg/Kg	3.7E-06	mg/kg/day				1.0E-05	mg/kg/day	7.0E-03	mg/kg/day	0.0015
			Exp. Route Total								5.0E-08					0.0179
			Dermal	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	4.6E-06	mg/kg/day				1.3E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0003
				Arsenic	5E-01	mg/Kg	6.6E-09	mg/kg/day	1.5E+00	(mg/kg/day)-1	9.9E-09	1.9E-08	mg/kg/day	3.0E-04	mg/kg/day	0.0001
				Iron	2E+04	mg/Kg	8.4E-08	mg/kg/day				2.3E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0001
				Manganese	4E+02	mg/Kg	1.8E-07	mg/kg/dey				5.0E-07	mg/kg/day	5.6E-03	mg/kg/day	0.0001
				Thallium	7E-01	mg/Kg	3.3E-10	mg/kg/day				9.1E-10	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	2.5E-08	mg/kg/day				6.9E-08	mg/kg/day	1.8E-04	mg/kg/day	0.0004
			Exp. Route Total								9.9E-09					0.0009
			Inhalation	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.0E-07	mg/kg/day				2.9E-07	mg/kg/day	1.4E-03	mg/kg/day	0.0002
				Arsenic	5E-01	mg/Kg	4.9E-12	mg/kg/day	1.5E+01	(mg/kg/dey)-1	7.4E-11	1.4E-11	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	1.9E-07	mg/kg/day				5.2E-07	mg/kg/day			
				Manganese	4E+02	mg/Kg	4.0E-09	mg/kg/day				1.1E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0008
				Thallium	7E-01	mg/Kg	7.2E-12	mg/kg/day				2.0E-11	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	5.5E-10	mg/kg/day				1.5E-09	mg/kg/day	1.8E-04	mg/kg/day	0.0000
			Exp. Route Total								7.4E-11					0.0010
		Exposure Point Total									6.0E-08					0.0198
	Exposure Medium Total										6.0E-08					0.0198
Medium Total											6.0E-08					0.0198
										Total of Receptor Risks Across All Media	6.0E-08				Total of Receptor Hazards Across All Media	0.0198

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	3.3E-03	mg/kg/day				9.4E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0094
				Arsenic	5E-01	mg/Kg	1.6E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.4E-07	4.5E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0015
				Iron	2E+04	mg/Kg	6.1E-03	mg/kg/day				1.7E-02	mg/kg/day	3.0E-01	mg/kg/day	0.0570
				Manganese	4E+02	mg/Kg	1.3E-04	mg/kg/day				3.6E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0026
				Thallium	7E-01	mg/Kg	2.4E-07	mg/kg/day				6.6E-07	mg/kg/day	8.0E-05	mg/kg/day	0.0083
				Vanadium	5E+01	mg/Kg	1.8E-05	mg/kg/day				5.0E-05	mg/kg/day	7.0E-03	mg/kg/day	0.0072
			Exp. Route Total								2.4E-07					0.0859
			Dermal	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.2E-05	mg/kg/day				6.2E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0015
				Arsenic	5E-01	mg/Kg	3.2E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.8E-08	8.9E-08	mg/kg/day	3.0E-04	mg/kg/day	0.0003
				Iron	2E+04	mg/Kg	4.0E-05	mg/kg/day				1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0004
				Manganese	4E+02	mg/Kg	8.6E-07	mg/kg/day				2.4E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0004
				Thallium	7E-01	mg/Kg	1.6E-09	mg/kg/day				4.4E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0001
				Vanadium	5E+01	mg/Kg	1.2E-07	mg/kg/day				3.3E-07	mg/kg/day	1.8E-04	mg/kg/day	0.0018
			Exp. Route Total								4.8E-06					0.0045
			Inhalation	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	4.9E-07	mg/kg/day				1.4E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0010
				Arsenic	5E-01	mg/Kg	2.4E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	3.5E-10	6.6E-11	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	9.0E-07	mg/kg/day				2.5E-06	mg/kg/day			
				Manganese	4E+02	mg/Kg	1.9E-08	mg/kg/day				5.4E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0037
				Thallium	7E-01	mg/Kg	3.5E-11	mg/kg/day				9.8E-11	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	2.6E-09	mg/kg/day				7.4E-09	mg/kg/day	1.8E-04	mg/kg/day	0.0000
			Exp. Route Total								3.5E-10					0.0047
		Exposure Point Total									2.9E-07					0.0952
	Exposure Medium Total										2.9E-07					0.0952
Medium Total											2.9E-07					0.0952
										Total of Receptor Risks Across All Media	2.9E-07				Total of Receptor Hazards Across All Media	0.0952

TABLE 7.3.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
AOC B

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.3E-03	mg/kg/day				3.9E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0039
				Arsenic	5E-01	mg/Kg	8.4E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	9.8E-08	1.9E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0006
				Iron	2E+04	mg/Kg	2.4E-03	mg/kg/day				7.1E-03	mg/kg/day	3.0E-01	mg/kg/day	0.0237
				Manganese	4E+02	mg/Kg	5.2E-05	mg/kg/day				1.5E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0011
				Thallium	7E-01	mg/Kg	9.5E-08	mg/kg/day				2.8E-07	mg/kg/day	8.0E-05	mg/kg/day	0.0034
				Vanadium	5E+01	mg/Kg	7.2E-06	mg/kg/day				2.1E-05	mg/kg/day	7.0E-03	mg/kg/day	0.0030
			Exp. Route Total								9.6E-08					0.0358
			Dermal	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.5E-05	mg/kg/day				4.4E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0011
				Arsenic	5E-01	mg/Kg	2.2E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.3E-08	6.4E-08	mg/kg/day	3.0E-04	mg/kg/day	0.0002
				Iron	2E+04	mg/Kg	2.8E-05	mg/kg/day				8.1E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0003
				Manganese	4E+02	mg/Kg	5.9E-07	mg/kg/day				1.7E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0003
				Thallium	7E-01	mg/Kg	1.1E-09	mg/kg/day				3.1E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	8.2E-08	mg/kg/day				2.4E-07	mg/kg/day	1.8E-04	mg/kg/day	0.0013
			Exp. Route Total								3.3E-08					0.0033
			Inhalation	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.0E-07	mg/kg/day				5.7E-07	mg/kg/day	1.4E-03	mg/kg/day	0.0004
				Arsenic	5E-01	mg/Kg	9.4E-12	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.4E-10	2.8E-11	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	3.6E-07	mg/kg/day				1.0E-06	mg/kg/day			
				Manganese	4E+02	mg/Kg	7.6E-09	mg/kg/day				2.2E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0016
				Thallium	7E-01	mg/Kg	1.4E-11	mg/kg/day				4.1E-11	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	1.1E-09	mg/kg/day				3.1E-09	mg/kg/day	1.8E-04	mg/kg/day	0.0000
			Exp. Route Total								1.4E-10					0.0020
		Exposure Point Total									1.3E-07					0.0410
	Exposure Medium Total										1.3E-07					0.0410
Medium Total											1.3E-07					0.0410
									Total of Receptor Risks Across All Media		1.3E-07			Total of Receptor Hazards Across All Media		0.0410

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Child (8 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	3.1E-03	mg/kg/day				3.6E-02	mg/kg/day	1.0E+00	mg/kg/day	0.0363
				Arsenic	5E-01	mg/Kg	1.5E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.2E-07	1.7E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0056
				Iron	2E+04	mg/Kg	5.7E-03	mg/kg/day				6.6E-02	mg/kg/day	3.0E-01	mg/kg/day	0.2213
				Manganese	4E+02	mg/Kg	1.2E-04	mg/kg/day				1.4E-03	mg/kg/day	1.4E-01	mg/kg/day	0.0101
				Thallium	7E-01	mg/Kg	2.2E-07	mg/kg/day				2.6E-06	mg/kg/day	8.0E-05	mg/kg/day	0.0322
				Vanadium	5E+01	mg/Kg	1.7E-05	mg/kg/day				2.0E-04	mg/kg/day	7.0E-03	mg/kg/day	0.0280
			Exp. Route Total								2.2E-07					0.3337
			Dermal	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	8.7E-06	mg/kg/day				1.0E-04	mg/kg/day	4.0E-02	mg/kg/day	0.0025
				Arsenic	5E-01	mg/Kg	1.3E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.9E-08	1.5E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0005
				Iron	2E+04	mg/Kg	1.6E-05	mg/kg/day				1.9E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0006
				Manganese	4E+02	mg/Kg	3.4E-07	mg/kg/day				4.0E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0007
				Thallium	7E-01	mg/Kg	6.2E-10	mg/kg/day				7.2E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0001
				Vanadium	5E+01	mg/Kg	4.7E-08	mg/kg/day				5.5E-07	mg/kg/day	1.8E-04	mg/kg/day	0.0030
			Exp. Route Total								1.9E-08					0.0075
			Inhalation	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.3E-07	mg/kg/day				2.7E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0019
				Arsenic	5E-01	mg/Kg	1.1E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.7E-10	1.3E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	4.2E-07	mg/kg/day				4.9E-06	mg/kg/day			
				Manganese	4E+02	mg/Kg	8.9E-09	mg/kg/day				1.0E-07	mg/kg/day	1.4E-05	mg/kg/day	0.0073
				Thallium	7E-01	mg/Kg	1.8E-11	mg/kg/day				1.9E-10	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	1.2E-09	mg/kg/day				1.4E-08	mg/kg/day	1.8E-04	mg/kg/day	0.0001
			Exp. Route Total								1.7E-10					0.0092
		Exposure Point Total									2.4E-07					0.3504
	Exposure Medium Total										2.4E-07					0.3504
Medium Total											2.4E-07					0.3504
										Total of Receptor Risks Across All Media	2.4E-07				Total of Receptor Hazards Across All Media	0.3504

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Current
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Subsurface Soil	Subsurface Soil	Ingestion	Aluminum	9E+03	mg/Kg	2.1E-04	mg/kg/day				3.0E-02	mg/kg/day	1.0E+00	mg/kg/day	0.0298
				Iron	2E+04	mg/Kg	4.6E-04	mg/kg/day				6.5E-02	mg/kg/day	3.0E-01	mg/kg/day	0.2155
			Exp. Route Total								0.0E+00					0.2452
			Dermal	Aluminum	9E+03	mg/Kg	6.4E-07	mg/kg/day				8.9E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0022
				Iron	2E+04	mg/Kg	1.4E-06	mg/kg/day				1.9E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0006
			Exp. Route Total								0.0E+00					0.0029
			Inhalation	Aluminum	9E+03	mg/Kg	9.5E-09	mg/kg/day				1.3E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0009
				Iron	2E+04	mg/Kg	2.1E-08	mg/kg/day				2.9E-06	mg/kg/day	N/A	N/A	#VALUE!
			Exp. Route Total								0.0E+00					0.0009
		Exposure Point Total									0.0E+00					0.2490
	Exposure Medium Total										0.0E+00					0.2490
Medium Total											0.0E+00					0.2490
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	0.2490

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	4.5E-03	mg/kg/day				1.3E-02	mg/kg/day	1.0E+00	mg/kg/day	0.0131
				Arsenic	5E-01	mg/Kg	2.2E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.2E-07	6.3E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0021
				Iron	2E+04	mg/Kg	8.2E-03	mg/kg/day				2.4E-02	mg/kg/day	3.0E-01	mg/kg/day	0.0798
				Manganese	4E+02	mg/Kg	1.7E-04	mg/kg/day				5.1E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0036
				Thallium	7E-01	mg/Kg	3.2E-07	mg/kg/day				9.3E-07	mg/kg/day	8.0E-05	mg/kg/day	0.0116
				Vanadium	5E+01	mg/Kg	2.4E-05	mg/kg/day				7.1E-05	mg/kg/day	7.0E-03	mg/kg/day	0.0101
			Exp. Route Total								3.2E-07					0.1203
			Dermal	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.8E-05	mg/kg/day				5.2E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0013
				Arsenic	5E-01	mg/Kg	2.6E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	3.9E-08	7.5E-08	mg/kg/day	3.0E-04	mg/kg/day	0.0003
				Iron	2E+04	mg/Kg	3.3E-05	mg/kg/day				9.6E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0003
				Manganese	4E+02	mg/Kg	7.0E-07	mg/kg/day				2.0E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0004
				Thallium	7E-01	mg/Kg	1.3E-09	mg/kg/day				3.7E-09	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	9.7E-08	mg/kg/day				2.8E-07	mg/kg/day	1.8E-04	mg/kg/day	0.0015
			Exp. Route Total								3.9E-08					0.0038
			Inhalation	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	6.6E-07	mg/kg/day				1.9E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0013
				Arsenic	5E-01	mg/Kg	3.2E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	4.8E-10	9.3E-11	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	1.2E-06	mg/kg/day				3.5E-06	mg/kg/day			
				Manganese	4E+02	mg/Kg	2.8E-08	mg/kg/day				7.5E-06	mg/kg/day	1.4E-05	mg/kg/day	0.0052
				Thallium	7E-01	mg/Kg	4.7E-11	mg/kg/day				1.4E-10	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	3.6E-09	mg/kg/day				1.0E-08	mg/kg/day	1.8E-04	mg/kg/day	0.0001
			Exp. Route Total								4.8E-10					0.0066
		Exposure Point Total									3.6E-07					0.1308
	Exposure Medium Total										3.6E-07					0.1308
Medium Total											3.6E-07					0.1308
										Total of Receptor Risks Across All Media	3.6E-07			Total of Receptor Hazards Across All Media		0.1308

TABLE 7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (8 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	1.0E-02	mg/kg/day				1.2E-01	mg/kg/day	1.0E+00	mg/kg/day	0.1222
				Arsenic	5E-01	mg/Kg	5.0E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	7.6E-07	5.9E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0196
				Iron	2E+04	mg/Kg	1.9E-02	mg/kg/day				2.2E-01	mg/kg/day	3.0E-01	mg/kg/day	0.7447
				Manganese	4E+02	mg/Kg	4.1E-04	mg/kg/day				4.8E-03	mg/kg/day	1.4E-01	mg/kg/day	0.0340
				Thallium	7E-01	mg/Kg	7.4E-07	mg/kg/day				8.7E-06	mg/kg/day	8.0E-05	mg/kg/day	0.1084
				Vanadium	5E+01	mg/Kg	5.6E-05	mg/kg/day				6.8E-04	mg/kg/day	7.0E-03	mg/kg/day	0.0941
			Exp. Route Total								7.6E-07					1.1229
			Dermal	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	2.9E-05	mg/kg/day				3.4E-04	mg/kg/day	4.0E-02	mg/kg/day	0.0086
				Arsenic	5E-01	mg/Kg	4.2E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	6.4E-08	4.9E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0016
				Iron	2E+04	mg/Kg	5.4E-05	mg/kg/day				6.3E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0021
				Manganese	4E+02	mg/Kg	1.1E-08	mg/kg/day				1.3E-05	mg/kg/day	5.6E-03	mg/kg/day	0.0024
				Thallium	7E-01	mg/Kg	2.1E-09	mg/kg/day				2.4E-08	mg/kg/day	8.0E-05	mg/kg/day	0.0003
				Vanadium	5E+01	mg/Kg	1.8E-07	mg/kg/day				1.8E-06	mg/kg/day	1.8E-04	mg/kg/day	0.0101
			Exp. Route Total								6.4E-08					0.0251
			Inhalation	Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Aluminum	1E+04	mg/Kg	7.7E-07	mg/kg/day				9.0E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0063
				Arsenic	5E-01	mg/Kg	3.7E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	5.6E-10	4.3E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	1.4E-06	mg/kg/day				1.6E-05	mg/kg/day			
				Manganese	4E+02	mg/Kg	3.0E-08	mg/kg/day				3.5E-07	mg/kg/day	1.4E-05	mg/kg/day	0.0245
				Thallium	7E-01	mg/Kg	5.5E-11	mg/kg/day				6.4E-10	mg/kg/day	8.0E-05	mg/kg/day	0.0000
				Vanadium	5E+01	mg/Kg	4.1E-09	mg/kg/day				4.8E-08	mg/kg/day	1.8E-04	mg/kg/day	0.0003
			Exp. Route Total								5.6E-10					0.0310
		Exposure Point Total									8.2E-07					1.1791
	Exposure Medium Total										6.2E-07					1.1791
Medium Total											8.2E-07					1.1791
										Total of Receptor Risks Across All Media	8.2E-07				Total of Receptor Hazards Across All Media	1.1791

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

AOC B

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
								Intake/Activity		CSF		Cancer Risk
					Value	Units		Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00					
			Aluminum						Body weight	0.001945065	0.000200027	0.000320936	0.002466027
			Arsenic	5.02E-08	7.38E-11	9.93E-09	NA	6.02E-08	Skin	0.000312068	4.83077E-08	6.17894E-05	0.000373906
			Iron						Gastrointestinal	0.011855186	0	7.82442E-05	0.01193343
			Manganese						Neurological	0.000540788	0.000779138	8.92301E-05	0.001409156
			Thallium						Hair loss, liver	0.001724853	2.53655E-07	1.1384E-05	0.001736491
			Vanadium						None Specified	0.001497344	8.46914E-06	0.000380095	0.001885908
			Chemical Total					6.02E-08					0.019804919
		Exposure Point Total						6.02E-08					0.019804919
	Exposure Medium Total							6.02E-08					0.019804919
Medium Total								6.02E-08					0.019804919
Receptor Total							Receptor Risk Total	6.02E-08				Receptor HI Total	0.019804919

Total Organ (Body weight) HI Across All Media =	0.002466027
Total Organ (Skin) HI Across All Media =	0.000373906
Total Organ (Gastrointestinal) HI Across All Media =	0.01193343
Total Organ (Neurological) HI Across All Media =	0.001409156
Total Organ (Hair loss, liver) HI Across All Media =	0.001736491
Total Organ (None Specified) HI Across All Media =	0.001885908

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00					
			Aluminum						Body weight	0.009351272	0.000961669	0.00154296	0.011855901
			Arsenic	2.41E-07	3.55E-10	4.77E-08	NA	2.89E-07	Skin	0.001500326	2.32249E-07	0.000297065	0.001797623
			Iron						Gastrointestinal	0.056996086	0	0.000376174	0.05737226
			Manganese						Neurological	0.002599944	0.003745854	0.000428991	0.006774789
			Thallium						Hair loss, liver	0.008292564	1.21949E-06	5.47309E-05	0.008348514
			Vanadium						None Specified	0.001497344	8.46914E-06	0.000380095	0.001885908
			Chemical Total					2.89E-07					0.088034996
		Exposure Point Total						2.89E-07					0.088034996
	Exposure Medium Total							2.89E-07					0.088034996
Medium Total								2.89E-07					0.088034996
Receptor Total							Receptor Risk Total	2.89E-07				Receptor HI Total	0.088034996

Total Organ (Body weight) HI Across All Media =	0.011855901
Total Organ (Skin) HI Across All Media =	0.001797623
Total Organ (Gastrointestinal) HI Across All Media =	0.05737226
Total Organ (Neurological) HI Across All Media =	0.006774789
Total Organ (Hair loss, liver) HI Across All Media =	0.008348514
Total Organ (None Specified) HI Across All Media =	0.001885908

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00					
			Aluminum						Body weight	0.003890129	0.000400054	0.001108687	0.00539887
			Arsenic	9.63E-08	1.42E-10	3.29E-08	NA	1.29E-07	Skin	0.000624136	9.66154E-08	0.000213454	0.000837687
			Iron						Gastrointestinal	0.023710372	0	0.000270298	0.02398067
			Manganese						Neurological	0.001081577	0.001558275	0.000308249	0.002948102
			Thallium						Hair loss, liver	0.003449706	5.0731E-07	3.93267E-05	0.00348954
			Vanadium						None Specified	0.002994688	1.69383E-05	0.001313056	0.004324682
			Chemical Total					1.29E-07					0.040979551
		Exposure Point Total						1.29E-07					0.040979551
	Exposure Medium Total							1.29E-07					0.040979551
Medium Total								1.29E-07					0.040979551
Receptor Total							Receptor Risk Total	1.29E-07				Receptor HI Total	0.040979551

Total Organ (Body weight) HI Across All Media =	0.00539887
Total Organ (Skin) HI Across All Media =	0.000837687
Total Organ (Gastrointestinal) HI Across All Media =	0.02398067
Total Organ (Neurological) HI Across All Media =	0.002948102
Total Organ (Hair loss, liver) HI Across All Media =	0.00348954
Total Organ (None Specified) HI Across All Media =	0.004324682

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00					
			Aluminum						Body weight	0.036307872	0.001866921	0.002541551	0.040716344
			Arsenic	2.25E-07	1.65E-10	1.89E-08	NA	2.44E-07	Skin	0.005825266	4.50872E-07	0.000489322	0.00631504
			Iron						Gastrointestinal	0.221296804	0	0.000619631	0.221916435
			Manganese						Neurological	0.010094716	0.007271952	0.00070663	0.018073299
			Thallium						Hair loss, liver	0.03219726	2.36745E-06	9.01523E-05	0.03228978
			Vanadium						None Specified	0.027950424	7.90453E-05	0.003010046	0.031039515
			Chemical Total					2.44E-07					0.350350412
		Exposure Point Total						2.44E-07					0.350350412
	Exposure Medium Total							2.44E-07					0.350350412
Medium Total								2.44E-07					0.350350412
Receptor Total							Receptor Risk Total	2.44E-07				Receptor HI Total	0.350350412

Total Organ (Body weight) HI Across All Media =	0.040718344
Total Organ (Skin) HI Across All Media =	0.00631504
Total Organ (Gastrointestinal) HI Across All Media =	0.221916435
Total Organ (Neurological) HI Across All Media =	0.018073299
Total Organ (Hair loss, liver) HI Across All Media =	0.03228978
Total Organ (None Specified) HI Across All Media =	0.031039515

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Current
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Subsurface Soil	Aluminum					0.00E+00	Body weight	0.029780724	0.000928061	0.002233554	0.032942339
			Iron						Gastrointestinal	0.215457926		0.000646374	0.216104299
			Chemical Total					0.00E+00					0.249046638
		Exposure Point Total						0.00E+00					0.249046638
	Exposure Medium Total							0.00E+00					0.249046638
Medium Total								0.00E+00					0.249046638
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	0.249046838

Total Organ (Body weight) HI Across All Media =	0.032942339
Total Organ (Gastrointestinal) HI Across All Media =	0.216104299

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00					
			Aluminum						Body weight	0.013091781	0.001346337	0.001305905	0.015744023
			Arsenic	3.24E-07	4.77E-10	3.88E-08	NA	3.63E-07	Skin	0.002100457	3.25148E-07	0.000251425	0.002352206
			Iron						Gastrointestinal	0.079794521	0	0.00031838	0.080112901
			Manganese						Neurological	0.003639922	0.005244196	0.000363082	0.0092472
			Thallium						Hair loss, liver	0.011609589	1.70729E-06	4.63223E-05	0.011657619
			Vanadium						None Specified	0.010078278	5.70038E-05	0.001546628	0.01168191
			Chemical Total					3.63E-07					0.130795859
		Exposure Point Total						3.63E-07					0.130795859
	Exposure Medium Total							3.63E-07					0.130795859
Medium Total								3.63E-07					0.130795859
Receptor Total							Receptor Risk Total	3.63E-07				Receptor HI Total	0.130795859

Total Organ (Body weight) HI Across All Media =	0.015744023
Total Organ (Skin) HI Across All Media =	0.002352206
Total Organ (Gastrointestinal) HI Across All Media =	0.080112901
Total Organ (Neurological) HI Across All Media =	0.0092472
Total Organ (Hair loss, liver) HI Across All Media =	0.011657619
Total Organ (None Specified) HI Across All Media =	0.01168191

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC B

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Benzo(a)pyrene	0.00E+00	0.00E+00	0.00E+00	NA	0.00E+00					
			Aluminum						Body weight	0.122189954	0.006282906	0.008553297	0.137026157
			Arsenic	7.56E-07	5.56E-10	6.35E-08	NA	8.20E-07	Skin	0.019604262	1.51736E-06	0.001646758	0.021252537
			Iron						Gastrointestinal	0.744748858	0	0.002085297	0.746834155
			Manganese						Neurological	0.033972603	0.024472916	0.002378082	0.060823601
			Thallium						Hair loss, liver	0.108356164	7.96737E-06	0.000303397	0.108667529
			Vanadium						None Specified	0.094063927	0.000266018	0.010129961	0.104459906
			Chemical Total					8.20E-07					1.179063886
		Exposure Point Total						8.20E-07					1.179063886
	Exposure Medium Total							8.20E-07					1.179063886
Medium Total								8.20E-07					1.179063886
Receptor Total							Receptor Risk Total	8.20E-07				Receptor HI Total	1.179063886
							Sum of Residential Adult and Residential Child Risks	1.2E-06					

Total Organ (Body weight) HI Across All Media =	0.137026157
Total Organ (Skin) HI Across All Media =	0.021252537
Total Organ (Gastrointestinal) HI Across All Media =	0.746834155
Total Organ (Neurological) HI Across All Media =	0.060823601
Total Organ (Hair loss, liver) HI Across All Media =	0.108667529
Total Organ (None Specified) HI Across All Media =	0.104459906

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
AOC B

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total								Receptor Risk Total					Receptor HI Total

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

Appendix D-6
AOC C Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-6 Contents for AOC C Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 39
Table 1: Selection of Exposure Pathways	p. 2 of 39
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Surface Soil)	p. 3 of 39
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Subsurface Soil)	p. 4 of 39
Table 2.3: Occurrence, Distribution, and Selection of COPCs (Groundwater)	p. 5 of 39
Table 3.1 RME: EPC Summary (Surface Soil)	p. 6 of 39
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 7 of 39
Table 3.3 RME: EPC Summary (Groundwater)	p. 8 of 39
Table 4.1 RME: Values Used for Daily Intake Calculations (Surface Soil – Current Timeframe)	p. 9 of 39
Table 4.2 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 10 of 39
Table 4.3 RME: Values Used for Daily Intake Calculations (Groundwater - Current Timeframe)	p. 11 of 39
Table 4.4 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 12 of 39
Table 4.5 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 13 of 39
Table 4.6 RME: Values Used for Daily Intake Calculations (Subsurface Soil - Current Timeframe)	p. 14 of 39
Table 4.7 RME: Values Used for Daily Intake Calculations (Surface Soil – Future Timeframe)	p. 15 of 39
Table 4.8 RME: Values Used for Daily Intake Calculations (Surface Soil – Future Timeframe)	p. 16 of 39
Table 4.9 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 17 of 39
Table 4.10 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 18 of 39
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 19 of 39
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 20 of 39
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 21 of 39
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 22 of 39
Table 6.2: Cancer Toxicity Data – Inhalation	p. 23 of 39
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Maintenance Worker – Adult)	p. 24 of 39

Appendix D-6 Contents for AOC C Risk Assessment Tables

Table No.	Page No.
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 25 of 39
Table 7.3: RME Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Adult)	p. 26 of 39
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Child)	p. 27 of 39
Table 7.5 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Construction Worker – Adult)	p. 28 of 39
Table 7.6 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 29 of 39
Table 7.7 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 30 of 39
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 31 of 39
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Maintenance Worker – Adult)	p. 32 of 39
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 33 of 39
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Adult)	p. 34 of 39
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Child)	p. 35 of 39
Table 9.5 RME: Summary of Receptor Risks and Hazards for COPCs (Construction Worker)	p. 36 of 39
Table 9.6 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 37 of 39
Table 9.7 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 38 of 39
Table 10.1 RME: Risk Summary	p. 39 of 39

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	AOC C
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

AOC C

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Direct contact with COPCs in site soil.	Maintenance Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of workers in the area involved in lawn mowing activities.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Recreational	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
	Soil	Subsurface Soil	Direct contact with COPCs in site soil.	Construction Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of utility workers and construction workers where excavations are possible.
Future	Soil	Surface Soil	Direct contact with COPCs in site soil.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of future indusrtial workers at the site.
	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	Scenario is protective of future indusrtial workers at the site. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC C

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil	**7429-90-5**	**ALUMINUM**	**4130 =**	**9600 =**	**mg/kg**	**AC-SB09**	**15 / 15**	**NA**	**9,600**	**NA**	**7.61E+03**	**NA**	**NA**	**Y**	**ASL**
	7440-36-0	ANTIMONY	0.19 J	0.19 J	mg/kg	AC-SB06	1 / 15	NA	0.19	NA	3.13E+00	NA	NA	N	BSL
	7440-38-2	**ARSENIC**	**0.36 J**	**2.1 J**	**mg/kg**	**AC-SB03**	**11 / 15**	**NA**	**2.1**	**NA**	**3.90E-01**	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	BARIUM	30.3 J	264 =	mg/kg	AC-SB14	15 / 15	NA	264	NA	5.37E+02	NA	NA	N	BSL
	71-43-2	BENZENE	0.0001 J	0.0003 J	mg/kg	AC-SB03	2 / 15	NA	3.00E-04	NA	6.01E-01	NA	NA	N	BSL
	7440-41-7	BERYLLIUM	0.095 J	0.27 J	mg/kg	AC-SB09	15 / 15	NA	0.27	NA	1.54E+01	NA	NA	N	BSL
	7440-43-9	CALCIUM	1410 =	12600 =	mg/kg	AC-SB06	15 / 15	NA	12,600	NA		NA	NA	N	NSV
	18540-29-9	CHROMIUM, TOTAL	6.3 =	13.9 =	mg/kg	AC-SB15	15 / 15	NA	14	NA	3.01E+01	NA	NA	Y	BSL
	7440-48-4	COBALT	5.2 J	20 =	mg/kg	AC-SB14	15 / 15	NA	20	NA	9.03E+02	NA	NA	N	BSL
	7440-50-8	COPPER	13.2 =	33.9 =	mg/kg	AC-SB14	15 / 15	NA	34	NA	3.13E+02	NA	NA	N	BSL
	84-74-2	DI-n-BUTYL PHTHALATE	0.109 J	0.109 J	mg/kg	AC-SB08	1 / 15	NA	0.11	NA	6.11E+02	NA	NA	N	BSL
	100-41-4	ETHYLBENZENE	0.001 J	0.003 J	mg/kg	AC-SB03	3 / 15	NA	0.0030	NA	8.92E+00	NA	NA	N	BSL
	7439-89-6	**IRON**	**9770 =**	**21100 =**	**mg/kg**	**AC-SB04**	**15 / 15**	**NA**	**21,100**	**NA**	**2.35E+03**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	LEAD	1.1 =	8.4 =	mg/kg	AC-SB15	15 / 15	NA	8.4	NA	4.00E+02	NA	NA	N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0003 J	0.008 J	mg/kg	AC-SB04	3 / 15	NA	0.0080	NA	2.75E+01	NA	NA	N	BSL
	1330-20-7	MAGNESIUM	1330 =	4200 =	mg/kg	AC-SB15	15 / 15	NA	4,200	NA		NA	NA	N	NSV
	7439-96-5	**MANGANESE**	**249 =**	**2190 =**	**mg/kg**	**AC-SB14**	**15 / 15**	**NA**	**2,190**	**NA**	**1.76E+02**	**NA**	**NA**	**Y**	**ASL**
	7487-94-7	MERCURY	0.021 J	0.025 J	mg/kg	AC-SB07	2 / 15	NA	0.025	NA	2.35E+00	NA	NA	N	BSL
	7440-02-0	NICKEL	2.5 J	11.2 =	mg/kg	AC-SB14	15 / 15	NA	11	NA	1.56E+02	NA	NA	N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE	0.002 J	0.002 J	mg/kg	AC-SB04	1 / 15	NA	0.0020	NA	2.75E+01	NA	NA	N	BSL
	72-54-8	p,p'-DDD	0.0021 J	0.0021 J	mg/kg	AC-SB07	1 / 15	NA	0.0021	NA	2.44E+00	NA	NA	N	BSL
	72-55-9	p,p'-DDE	0.00048 J	0.0064 =	mg/kg	AC-SB07	9 / 15	NA	0.0064	NA	1.72E+00	NA	NA	N	BSL
	50-29-3	p,p'-DDT	0.00047 J	0.016 =	mg/kg	AC-SB07	5 / 15	NA	0.016	NA	1.72E+00	NA	NA	N	BSL
		POTASSIUM	672 J	1340 =	mg/kg	AC-SB02	15 / 15	NA	1,340	NA		NA	NA	N	NSV
	7782-49-2	SELENIUM	0.42 J	0.9 J	mg/kg	AC-SB01	15 / 15	NA	0.90	NA	3.91E+01	NA	NA	N	BSL
		SODIUM	46.4 J	205 J	mg/kg	AC-SB05	15 / 15	NA	205	NA		NA	NA	N	NSV
	7440-28-0	**THALLIUM**	**0.31 J**	**0.65 J**	**mg/kg**	**AC-SB04**	**9 / 15**	**NA**	**0.65**	**NA**	**5.16E-01**	**NA**	**NA**	**Y**	**ASL**
	108-88-3	TOLUENE	0.001 J	0.005 J	mg/kg	AC-SB03	3 / 15	NA	0.0050	NA	5.20E+01	NA	NA	N	BSL
	79-01-6	TRICHLOROETHYLENE (TCE)	0.0003 J	0.0003 J	mg/kg	AC-SB14	1 / 15	NA	3.00E-04	NA	5.30E-02	NA	NA	N	BSL
	7440-62-2	**VANADIUM**	**32.1 =**	**66.4 =**	**mg/kg**	**AC-SB04**	**15 / 15**	**NA**	**66**	**NA**	**5.47E+01**	**NA**	**NA**	**Y**	**ASL**
	1330-20-7	XYLENES, TOTAL	0.0003 J	0.026 J	mg/kg	AC-SB03	5 / 15	NA	0.028	NA	2.75E+01	NA	NA	N	BSL
	7440-66-6	ZINC	13.3 =	56.5 =	mg/kg	AC-SB01	15 / 15	NA	57	NA	2.35E+03	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC C

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	107-06-2	1,2-DICHLOROETHANE	0.0003 J	0.0004 J	mg/kg	AC-SB16	6 / 20	NA	4.00E-04	NA	6.03E-01			N	BSL
	7429-90-5	**ALUMINUM**	**3140 =**	**14300 J**	**mg/kg**	**AC-SB16**	**20 / 20**	NA	**14,300**	**NA**	**1.00E+04**			**Y**	**BSL**
	7440-36-0	ANTIMONY	0.17 J	0.24 J	mg/kg	AC-SB18	4 / 20	NA	0.24	NA	4.09E+01			N	BSL
	7440-38-2	ARSENIC	0.44 J	0.71 J	mg/kg	AC-SB16	5 / 20	NA	0.71	NA	1.59E+00			N	BSL
	7440-39-3	BARIUM	34.6 J	144 J	mg/kg	AC-SB16	20 / 20	NA	144	NA	6.66E+03			N	BSL
	71-43-2	BENZENE	0.0002 J	0.0004 J	mg/kg	AC-SB16	3 / 20	NA	4.00E-04	NA	1.31E+00			N	BSL
	7440-41-7	BERYLLIUM	0.088 J	0.3 J	mg/kg	AC-SB19	20 / 20	NA	0.30	NA	1.94E+03			N	BSL
		CALCIUM	1310 =	5770 =	mg/kg	AC-SB18	20 / 20	NA	5,770	NA				N	NSV
	18540-29-9	CHROMIUM, TOTAL	4.6 J	33.3 J	mg/kg	AC-SB16	20 / 20	NA	33	NA	6.40E+01			N	BSL
	7440-48-4	COBALT	3.4 J	13.9 J	mg/kg	AC-SB16	20 / 20	NA	14	NA	1.92E+03			N	BSL
	7440-50-8	COPPER	10 J	46.6 =	mg/kg	AC-SB16	20 / 20	NA	47	NA	4.09E+03			N	BSL
	84-74-2	DI-n-BUTYL PHTHALATE	0.036 J	0.036 J	mg/kg	AC-SB19	1 / 20	NA	0.036	NA	6.16E+03			N	BSL
	100-41-4	ETHYLBENZENE	0.0009 J	0.005 J	mg/kg	AC-SB18	8 / 20	NA	0.0050	NA	1.95E+01			N	BSL
	7439-89-6	**IRON**	**8670 J**	**26500 =**	**mg/kg**	**AC-SB18**	**20 / 20**	**NA**	**26,500**	**NA**	**1.00E+04**			**Y**	**BSL**
	7439-92-1	LEAD	0.58 J	7 =	mg/kg	AC-SB19	20 / 20	NA	7.0	NA	7.50E+02			N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0005 J	0.028 =	mg/kg	AC-SB16	9 / 20	NA	0.028	NA	4.20E+01			N	BSL
		MAGNESIUM	1210 J	4890 =	mg/kg	AC-SB18	20 / 20	NA	4,890	NA				N	NSV
	7439-96-5	MANGANESE	164 =	956 J	mg/kg	AC-SB16	20 / 20	NA	956	NA	1.95E+03			N	BSL
	7487-94-7	MERCURY	0.016 J	0.016 J	mg/kg	AC-SB16	1 / 20	NA	0.016	NA	3.07E+01			N	BSL
	7440-02-0	NICKEL	1.5 J	12.2 =	mg/kg	AC-SB16	20 / 20	NA	12	NA	2.04E+03			N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE	0.001 J	0.007 J	mg/kg	AC-SB18	6 / 20	NA	0.0070	NA	4.20E+01			N	BSL
		POTASSIUM	633 J	2340 J	mg/kg	AC-SB18	20 / 20	NA	2,340	NA				N	NSV
	7782-49-2	SELENIUM	0.25 J	0.94 J	mg/kg	AC-SB18	19 / 20	NA	0.94	NA	5.11E+02			N	BSL
		SODIUM	63.4 J	438 J	mg/kg	AC-SB18	20 / 20	NA	438	NA				N	NSV
	127-18-4	TETRACHLOROETHYLENE(PCE)	0.001 J	0.001 J	mg/kg	AC-SB17	1 / 20	NA	0.0010	NA	3.42E+00			N	BSL
	7440-28-0	**THALLIUM**	0.36 J	1.9 J	mg/kg	AC-SB17	16 / 20	NA	**1.9**	NA	**6.75E+00**			N	BSL
	108-88-3	TOLUENE	0.0009 J	0.008 J	mg/kg	AC-SB18	6 / 20	NA	0.0080	NA	5.20E+01			N	BSL
	7440-62-2	VANADIUM	28.1 J	76.8 J	mg/kg	AC-SB16	20 / 20	NA	77	NA	7.15E+02			N	BSL
	1330-20-7	XYLENES, TOTAL	0.0005 J	0.035 =	mg/kg	AC-SB18	9 / 20	NA	0.035	NA	4.20E+01			N	BSL
	7440-66-6	ZINC	11.3 =	39.9 =	mg/kg	AC-SB18	20 / 20	NA	40	NA	1.00E+04			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC C

Scenario Timeframe: Current and Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	**7429-90-5**	**ALUMINUM**	**4390 =**	**4390 =**	**µg/L**	**AOC-C-MW01**	**1 / 1**	**NA**	**4,390**	**NA**	**3.65E+03**			**Y**	**ASL**
	7440-39-3	BARIUM	156 J	156 J	µg/L	AOC-C-MW01	1 / 1	NA	156	NA	2.55E+02	2,000	MCL	N	BSL
		CALCIUM	70900 =	70900 =	µg/L	AOC-C-MW01	1 / 1	NA	70,900	NA				N	NSV
	18540-29-9	CHROMIUM, TOTAL	16.7 =	16.7 =	µg/L	AOC-C-MW01	1 / 1	NA	17	NA	1.09E+01	100	MCL	Y	BMCL
	7440-48-4	COBALT	3.3 J	3.3 J	µg/L	AOC-C-MW01	1 / 1	NA	3.3	NA	7.30E+01			N	BSL
	7440-50-8	COPPER	11.4 J	11.4 J	µg/L	AOC-C-MW01	1 / 1	NA	11	NA	1.46E+02	1,300	MCL	N	BSL
	7439-89-6	**IRON**	**5720 =**	**5720 =**	**µg/L**	**AOC-C-MW01**	**1 / 1**	**NA**	**5,720**	**NA**	**1.09E+03**			**Y**	**ASL**
		MAGNESIUM	42100 =	42100 =	µg/L	AOC-C-MW01	1 / 1	NA	42,100	NA				N	NSV
	7439-96-5	**MANGANESE**	**177 =**	**177 =**	**µg/L**	**AOC-C-MW01**	**1 / 1**	**NA**	**177**	**NA**	**8.76E+01**			**Y**	**ASL**
	7440-02-0	NICKEL	9.1 J	9.1 J	µg/L	AOC-C-MW01	1 / 1	NA	9.1	NA	7.30E+01	100	MCL	N	BSL
		POTASSIUM	4980 J	4980 J	µg/L	AOC-C-MW01	1 / 1	NA	4,980	NA				N	NSV
		SODIUM	157000 =	157000 =	µg/L	AOC-C-MW01	1 / 1	NA	157,000	NA				N	NSV
	7440-62-2	**VANADIUM**	**27.8 J**	**27.6 J**	**µg/L**	**AOC-C-MW01**	**1 / 1**	**NA**	**28**	**NA**	**2.55E+01**			**Y**	**ASL**
	7440-66-6	ZINC	17.6 J	17.6 J	µg/L	AOC-C-MW01	1 / 1	NA	16	NA	1.09E+03			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	Aluminum	mg/Kg	7516	8229 (N)	9600	8229	mg/Kg	UCL95 (N)	1
	Arsenic	mg/Kg	0.651	1.06 (L)	2.1	1.06	mg/Kg	UCL95 (L)	2
	Iron	mg/Kg	15011	16424 (N)	21100	16424	mg/Kg	UCL95 (N)	1
	Manganese	mg/Kg	546	738 (NP)	2190	738	mg/Kg	UCL95 (NP)	3
	Thallium	mg/Kg	0.343	0.424 (N)	0.65	0.424	mg/Kg	UCL95 (N)	1
	Vanadium	mg/Kg	46.42	51.7 (L)	68.4	51.7	mg/Kg	UCL95 (L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal
L - lognormal
NP - non-parametric (bootstrap)
NC - 95% UCL not calculated (too few samples).
NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal
L - lognormal
NP - non-parametric (bootstrap)
1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.
2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.
3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.
4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.
5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	Aluminum	mg/Kg	8478	9480 (L)	14300	9480	mg/Kg	UCL95 (L)	2
	Iron	mg/Kg	16616	18283 (L)	26500	18283	mg/Kg	UCL95 (L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	Aluminum	ug/L	4390	NC (NA)	4390	4.39	mg/L	Max detect	5
	Chromium	ug/L	16.7	NC (NA)	16.7	0.0167	mg/L	Max detect	5
	Iron	ug/L	5720	NC (NA)	5720	5.72	mg/L	Max detect	5
	Manganese	ug/L	177	NC (NA)	177	0.177	mg/L	Max detect	5
	Vanadium	ug/L	27.6	NC (NA)	27.6	0.0276	mg/L	Max detect	5

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too tew samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Maintenance Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm, May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Industrial Worker	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interim Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Groundwater	**Cw**	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Groundwater	**Cw**	Concentration in groundwater	Table 3.3	mg/L		CDi = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				ET	Event Duration	0.05	hr/event	g	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	5	events/day	g	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Best professional judgement, assumed to be equivalent to dermal event duration for residential adult as recommended by EPA Region 2 (five 3-min events).

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/westepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgmant used based on an anticipated receptor behavior.

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thellium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	e	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Hsalth Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.5.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	330	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	h	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Dermal:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.3	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Aluminum	0.001		e	DAevent = Cs x CF x AF x ABS
					Arsenic	0.03		i	
					Iron	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Inhalation:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.7.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.07	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Residential	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	c	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I, May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interim Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.9.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	2	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	18000	cm^2	e	
				ET	Event Duration	0.25	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.10.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	6600	cm^2	e	
				ET	Event Duration	0.45	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 27 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

AOC C

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

AOC C

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	6.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.62E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

AOC C

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

AOC C

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

AOC C

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Current
Receptor Population:	Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	8E+03	mg/Kg	6.0E-04	mg/kg/day				1.7E-03	mg/kg/day	1.0E+00	mg/kg/day	1.7E-03
				Arsenic	1E+00	mg/Kg	7.7E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.2E-07	2.2E-07	mg/kg/day	3.0E-04	mg/kg/day	7.2E-04
				Iron	2E+04	mg/Kg	1.2E-03	mg/kg/day				3.3E-03	mg/kg/day	3.0E-01	mg/kg/day	1.1E-02
				Manganese	7E+02	mg/Kg	5.4E-05	mg/kg/day				1.5E-04	mg/kg/day	1.4E-01	mg/kg/day	1.1E-03
				Thallium	4E-01	mg/Kg	3.1E-08	mg/kg/day				8.8E-08	mg/kg/day	6.0E-05	mg/kg/day	1.1E-03
				Vanadium	5E+01	mg/Kg	3.8E-08	mg/kg/day				1.1E-05	mg/kg/day	7.0E-03	mg/kg/day	1.5E-03
			Exp. Route Total								1.2E-07					1.7E-02
			Dermal	Aluminum	8E+03	mg/Kg	3.9E-06	mg/kg/day				1.1E-05	mg/kg/day	4.0E-02	mg/kg/day	2.8E-04
				Arsenic	1E+00	mg/Kg	1.5E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.3E-08	4.3E-08	mg/kg/day	3.0E-04	mg/kg/day	1.4E-04
				Iron	2E+04	mg/Kg	7.9E-08	mg/kg/day				2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.4E-05
				Manganese	7E+02	mg/Kg	3.5E-07	mg/kg/day				9.9E-07	mg/kg/day	5.6E-03	mg/kg/day	1.8E-04
				Thallium	4E-01	mg/Kg	2.0E-10	mg/kg/day				5.7E-10	mg/kg/day	8.0E-05	mg/kg/day	7.1E-06
				Vanadium	5E+01	mg/Kg	2.5E-08	mg/kg/day				6.9E-08	mg/kg/day	1.8E-04	mg/kg/day	3.8E-04
			Exp. Route Total								2.3E-08					1.1E-03
			Inhalation	Aluminum	8E+03	mg/Kg	8.8E-08	mg/kg/day				2.5E-07	mg/kg/day	1.4E-03	mg/kg/day	1.7E-04
				Arsenic	1E+00	mg/Kg	1.1E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.7E-10	3.2E-11	mg/kg/day	2.9E-04	mg/kg/day	1.1E-07
				Iron	2E+04	mg/Kg	1.8E-07	mg/kg/day				4.9E-07	mg/kg/day			
				Manganese	7E+02	mg/Kg	7.9E-09	mg/kg/day				2.2E-08	mg/kg/day	1.4E-05	mg/kg/day	1.5E-03
				Thallium	4E-01	mg/Kg	4.5E-12	mg/kg/day				1.3E-11	mg/kg/day	8.0E-05	mg/kg/day	1.6E-07
				Vanadium	5E+01	mg/Kg	5.5E-10	mg/kg/day				1.5E-09	mg/kg/day	1.6E-04	mg/kg/day	8.5E-06
			Exp. Route Total								1.7E-10					1.7E-03
		Exposure Point Total									1.4E-07					2.0E-02
	Exposure Medium Total										1.4E-07					2.0E-02
Medium Total											1.4E-07					2.0E-02
										Total of Receptor Risks Across All Media	1.4E-07				Total of Receptor Hazards Across All Media	2.0E-02

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	8E+03	mg/Kg	2.9E-03	mg/kg/day				8.1E-03	mg/kg/day	1.0E+00	mg/kg/day	8.1E-03
				Arsenic	1E+00	mg/Kg	3.7E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	5.6E-07	1.0E-06	mg/kg/day	3.0E-04	mg/kg/day	3.5E-03
				Iron	2E+04	mg/Kg	5.7E-03	mg/kg/day				1.6E-02	mg/kg/day	3.0E-01	mg/kg/day	5.4E-02
				Manganese	7E+02	mg/Kg	2.6E-04	mg/kg/day				7.2E-04	mg/kg/day	1.4E-01	mg/kg/day	5.2E-03
				Thallium	4E-01	mg/Kg	1.5E-07	mg/kg/day				4.1E-07	mg/kg/day	8.0E-05	mg/kg/day	5.2E-03
				Vanadium	5E+01	mg/Kg	1.6E-05	mg/kg/day				5.1E-05	mg/kg/day	7.0E-03	mg/kg/day	7.2E-03
			Exp. Route Total								5.6E-07					8.3E-02
			Dermal	Aluminum	8E+03	mg/Kg	1.9E-05	mg/kg/day				5.3E-05	mg/kg/day	4.0E-02	mg/kg/day	1.3E-03
				Arsenic	1E+00	mg/Kg	7.3E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.1E-07	2.1E-07	mg/kg/day	3.0E-04	mg/kg/day	6.6E-04
				Iron	2E+04	mg/Kg	3.6E-05	mg/kg/day				1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	3.5E-04
				Manganese	7E+02	mg/Kg	1.7E-08	mg/kg/day				4.8E-06	mg/kg/day	5.6E-03	mg/kg/day	8.5E-04
				Thallium	4E-01	mg/Kg	9.8E-10	mg/kg/day				2.7E-09	mg/kg/day	8.0E-05	mg/kg/day	3.4E-05
				Vanadium	5E+01	mg/Kg	1.2E-07	mg/kg/day				3.3E-07	mg/kg/day	1.6E-04	mg/kg/day	1.8E-03
			Exp. Route Total								1.1E-07					5.1E-03
			Inhalation	Aluminum	8E+03	mg/Kg	4.2E-07	mg/kg/day				1.2E-06	mg/kg/day	1.4E-03	mg/kg/day	8.3E-04
				Arsenic	1E+00	mg/Kg	5.4E-11	mg/kg/day	1.5E+01	(mg/kg/dey)-1	8.2E-10	1.5E-10	mg/kg/day	2.9E-04	mg/kg/day	5.4E-07
				Iron	2E+04	mg/Kg	8.4E-07	mg/kg/day				2.4E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	3.8E-08	mg/kg/day				1.1E-07	mg/kg/day	1.4E-05	mg/kg/day	7.4E-03
				Thallium	4E-01	mg/Kg	2.2E-11	mg/kg/day				6.1E-11	mg/kg/day	8.0E-05	mg/kg/day	7.6E-07
				Vanadium	5E+01	mg/Kg	2.7E-09	mg/kg/day				7.4E-09	mg/kg/day	1.8E-04	mg/kg/day	4.1E-05
			Exp. Route Total								8.2E-10					8.3E-03
		Exposure Point Total									6.7E-07					9.6E-02
	Exposure Medium Total										6.7E-07					9.6E-02
Medium Total											6.7E-07					9.6E-02
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	4E+00	mg/L	1.5E-02	mg/kg/day				4.3E-02	mg/kg/day	1.0E+00	mg/kg/day	4.3E-02
				Chromium	2E-02	mg/L	5.6E-05	mg/kg/day				1.6E-04	mg/kg/day	3.0E-03	mg/kg/day	5.4E-02
				Iron	6E+00	mg/L	2.0E-02	mg/kg/day				5.8E-02	mg/kg/day	3.0E-01	mg/kg/day	1.9E-01
				Manganese	2E-01	mg/L	6.2E-04	mg/kg/day				1.7E-03	mg/kg/day	1.4E-01	mg/kg/day	1.2E-02
				Vanadium	3E-02	mg/L	9.8E-05	mg/kg/day				2.7E-04	mg/kg/day	7.0E-03	mg/kg/day	3.9E-02
			Exp. Route Total								0.0E+00					3.3E-01
			Dermal	Aluminum	4E+00	mg/L	1.3E-05	mg/kg/day				3.5E-05	mg/kg/day	4.0E-02	mg/kg/day	6.9E-04
				Chromium	2E-02	mg/L	9.8E-06	mg/kg/day				2.7E-07	mg/kg/day	3.9E-05	mg/kg/day	6.9E-03
				Iron	6E+00	mg/L	1.6E-05	mg/kg/day				4.8E-05	mg/kg/day	3.0E-01	mg/kg/day	1.5E-04
				Manganese	2E-01	mg/L	5.1E-07	mg/kg/day				1.4E-06	mg/kg/day	5.6E-03	mg/kg/day	2.6E-04
				Vanadium	3E-02	mg/L	8.0E-08	mg/kg/day				2.2E-07	mg/kg/day	1.8E-04	mg/kg/day	1.2E-03
			Exp. Route Total								0.0E+00					9.4E-03
		Exposure Point Total									0.0E+00					3.4E-01
	Exposure Medium Total										0.0E+00					3.4E-01
Medium Total											0.0E+00					3.4E-01
										Total of Receptor Risks Across All Media	6.7E-07			Total of Receptor Hazards Across All Media		4.4E-01

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	8E+03	mg/Kg	1.1E-03	mg/kg/day				3.3E-03	mg/kg/day	1.0E+00	mg/kg/day	3.3E-03
				Arsenic	1E+00	mg/Kg	1.5E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.2E-07	4.3E-07	mg/kg/day	3.0E-04	mg/kg/day	1.4E-03
				Iron	2E+04	mg/Kg	2.3E-03	mg/kg/day				6.7E-03	mg/kg/day	3.0E-01	mg/kg/day	2.2E-02
				Manganese	7E+02	mg/Kg	1.0E-04	mg/kg/day				3.0E-04	mg/kg/day	1.4E-01	mg/kg/day	2.1E-03
				Thallium	4E-01	mg/Kg	5.9E-08	mg/kg/day				1.7E-07	mg/kg/day	8.0E-05	mg/kg/day	2.2E-03
				Vanadium	5E+01	mg/Kg	7.2E-06	mg/kg/day				2.1E-05	mg/kg/day	7.0E-03	mg/kg/day	3.0E-03
			Exp. Route Total								2.2E-07					3.4E-02
			Dermal	Aluminum	8E+03	mg/Kg	1.3E-05	mg/kg/day				3.8E-05	mg/kg/day	4.0E-02	mg/kg/day	9.5E-04
				Arsenic	1E+00	mg/Kg	5.1E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	7.6E-08	1.5E-07	mg/kg/day	3.0E-04	mg/kg/day	4.9E-04
				Iron	2E+04	mg/Kg	2.6E-05	mg/kg/day				7.6E-05	mg/kg/day	3.0E-01	mg/kg/day	2.5E-04
				Manganese	7E+02	mg/Kg	1.2E-06	mg/kg/day				3.4E-06	mg/kg/day	5.6E-03	mg/kg/day	6.1E-04
				Thallium	4E-01	mg/Kg	6.7E-10	mg/kg/day				2.0E-09	mg/kg/day	8.0E-05	mg/kg/day	2.5E-05
				Vanadium	5E+01	mg/Kg	8.2E-08	mg/kg/day				2.4E-07	mg/kg/day	1.8E-04	mg/kg/day	1.3E-03
			Exp. Route Total								7.6E-08					3.7E-03
			Inhalation	Aluminum	8E+03	mg/Kg	1.7E-07	mg/kg/day				4.9E-07	mg/kg/day	1.4E-03	mg/kg/day	3.4E-04
				Arsenic	1E+00	mg/Kg	2.2E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	3.3E-10	6.3E-11	mg/kg/day	2.9E-04	mg/kg/day	2.2E-07
				Iron	2E+04	mg/Kg	3.4E-07	mg/kg/day				9.6E-07	mg/kg/day			
				Manganese	7E+02	mg/Kg	1.5E-08	mg/kg/day				4.4E-08	mg/kg/day	1.4E-05	mg/kg/day	3.1E-03
				Thallium	4E-01	mg/Kg	8.7E-12	mg/kg/day				2.5E-11	mg/kg/day	8.0E-05	mg/kg/day	3.2E-07
				Vanadium	5E+01	mg/Kg	1.1E-09	mg/kg/day				3.1E-09	mg/kg/day	1.8E-04	mg/kg/day	1.7E-05
			Exp. Route Total								3.3E-10					3.5E-03
		Exposure Point Total									3.0E-07					4.1E-02
	Exposure Medium Total										3.0E-07					4.1E-02
Medium Total											3.0E-07					4.1E-02
										Total of Receptor Risks Across All Media	3.0E-07				Total of Receptor Hazards Across All Media	4.1E-02

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	8E+03	mg/Kg	2.7E-03	mg/kg/day				3.1E-02	mg/kg/day	1.0E+00	mg/kg/day	3.1E-02
				Arsenic	1E+00	mg/Kg	3.5E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	5.2E-07	4.0E-06	mg/kg/day	3.0E-04	mg/kg/day	1.3E-02
				Iron	2E+04	mg/Kg	5.3E-03	mg/kg/day				6.2E-02	mg/kg/day	3.0E-01	mg/kg/day	2.1E-01
				Manganese	7E+02	mg/Kg	2.4E-04	mg/kg/day				2.8E-03	mg/kg/day	1.4E-01	mg/kg/day	2.0E-02
				Thallium	4E-01	mg/Kg	1.4E-07	mg/kg/day				1.6E-06	mg/kg/day	6.0E-05	mg/kg/day	2.0E-02
				Vanadium	5E+01	mg/Kg	1.7E-05	mg/kg/day				2.0E-04	mg/kg/day	7.0E-03	mg/kg/day	2.6E-02
			Exp. Route Total								5.2E-07					3.2E-01
			Dermal	Aluminum	8E+03	mg/Kg	7.5E-06	mg/kg/day				8.8E-05	mg/kg/day	4.0E-02	mg/kg/day	2.2E-03
				Arsenic	1E+00	mg/Kg	2.9E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.3E-06	3.4E-07	mg/kg/day	3.0E-04	mg/kg/day	1.1E-03
				Iron	2E+04	mg/Kg	1.5E-05	mg/kg/day				1.7E-04	mg/kg/day	3.0E-01	mg/kg/day	5.6E-04
				Manganese	7E+02	mg/Kg	6.7E-07	mg/kg/day				7.9E-06	mg/kg/day	5.6E-03	mg/kg/day	1.4E-03
				Thallium	4E-01	mg/Kg	3.9E-10	mg/kg/day				4.5E-09	mg/kg/day	6.0E-05	mg/kg/day	5.6E-05
				Vanadium	5E+01	mg/Kg	4.7E-08	mg/kg/day				5.5E-07	mg/kg/day	1.6E-04	mg/kg/day	3.0E-03
			Exp. Route Total								4.3E-06					8.4E-03
			Inhalation	Aluminum	8E+03	mg/Kg	2.0E-07	mg/kg/day				2.3E-06	mg/kg/day	1.4E-03	mg/kg/day	1.6E-03
				Arsenic	1E+00	mg/Kg	2.5E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	3.8E-10	3.0E-10	mg/kg/day	2.9E-04	mg/kg/day	1.0E-06
				Iron	2E+04	mg/Kg	3.9E-07	mg/kg/day				4.6E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	1.8E-06	mg/kg/day				2.1E-07	mg/kg/day	1.4E-05	mg/kg/day	1.4E-02
				Thallium	4E-01	mg/Kg	1.0E-11	mg/kg/day				1.2E-10	mg/kg/day	8.0E-05	mg/kg/day	1.5E-06
				Vanadium	5E+01	mg/Kg	1.2E-09	mg/kg/day				1.4E-08	mg/kg/day	1.6E-04	mg/kg/day	7.9E-05
			Exp. Route Total								3.8E-10					1.6E-02
		Exposure Point Total									5.6E-07					3.5E-01
	Exposure Medium Total										5.6E-07					3.5E-01
Medium Total											5.6E-07					3.5E-01
										Total of Receptor Risks Across All Media	5.6E-07				Total of Receptor Hazards Across All Media	3.5E-01

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Current
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Subsurface Soil	Subsurface Soil	Ingestion	Aluminum	9E+03	mg/Kg	2.2E-04	mg/kg/day				3.1E-02	mg/kg/day	1.0E+00	mg/kg/day	3.1E-02
				Iron	2E+04	mg/Kg	4.2E-04	mg/kg/day				5.9E-02	mg/kg/day	3.0E-01	mg/kg/day	2.0E-01
			Exp. Route Total								0.0E+00					2.3E-01
			Dermal	Aluminum	9E+03	mg/Kg	6.6E-07	mg/kg/day				9.2E-05	mg/kg/day	4.0E-02	mg/kg/day	2.3E-03
				Iron	2E+04	mg/Kg	1.3E-06	mg/kg/day				1.8E-04	mg/kg/day	3.0E-01	mg/kg/day	5.9E-04
			Exp. Route Total								0.0E+00					2.9E-03
			Inhalation	Aluminum	9E+03	mg/Kg	9.7E-09	mg/kg/day				1.4E-06	mg/kg/day	1.4E-03	mg/kg/day	9.5E-04
				Iron	2E+04	mg/Kg	1.9E-08	mg/kg/day				2.6E-06	mg/kg/day	N/A	N/A	#VALUE!
			Exp. Route Total								0.0E+00					9.5E-04
		Exposure Point Total									0.0E+00					2.3E-01
	Exposure Medium Total										0.0E+00					2.3E-01
Medium Total											0.0E+00					2.3E-01
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	2.3E-01

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	8E+03	mg/Kg	3.9E-03	mg/kg/day				1.1E-02	mg/kg/day	1.0E+00	mg/kg/day	1.1E-02
				Arsenic	1E+00	mg/Kg	5.0E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	7.5E-07	1.5E-06	mg/kg/day	3.0E-04	mg/kg/day	4.6E-03
				Iron	2E+04	mg/Kg	7.7E-03	mg/kg/day				2.2E-02	mg/kg/day	3.0E-01	mg/kg/day	7.5E-02
				Manganese	7E+02	mg/Kg	3.5E-04	mg/kg/day				1.0E-03	mg/kg/day	1.4E-01	mg/kg/day	7.2E-03
				Thallium	4E-01	mg/Kg	2.0E-07	mg/kg/day				5.8E-07	mg/kg/day	6.0E-05	mg/kg/day	7.3E-03
				Vanadium	5E+01	mg/Kg	2.4E-05	mg/kg/day				7.1E-05	mg/kg/day	7.0E-03	mg/kg/day	1.0E-02
			Exp. Route Total								7.5E-07					1.2E-01
			Dermal	Aluminum	8E+03	mg/Kg	1.5E-05	mg/kg/day				4.5E-05	mg/kg/day	4.0E-02	mg/kg/day	1.1E-03
				Arsenic	1E+00	mg/Kg	6.0E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	8.9E-08	1.7E-07	mg/kg/day	3.0E-04	mg/kg/day	5.6E-04
				Iron	2E+04	mg/Kg	3.1E-05	mg/kg/day				9.0E-05	mg/kg/day	3.0E-01	mg/kg/day	3.0E-04
				Manganese	7E+02	mg/Kg	1.4E-06	mg/kg/day				4.0E-06	mg/kg/day	5.6E-03	mg/kg/day	7.2E-04
				Thallium	4E-01	mg/Kg	7.9E-10	mg/kg/day				2.3E-09	mg/kg/day	8.0E-05	mg/kg/day	2.9E-05
				Vanadium	5E+01	mg/Kg	9.7E-08	mg/kg/day				2.8E-07	mg/kg/day	1.6E-04	mg/kg/day	1.6E-03
			Exp. Route Total								8.9E-08					4.3E-03
			Inhalation	Aluminum	8E+03	mg/Kg	5.7E-07	mg/kg/day				1.7E-06	mg/kg/day	1.4E-03	mg/kg/day	1.2E-03
				Arsenic	1E+00	mg/Kg	7.3E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.1E-09	2.1E-10	mg/kg/day	2.9E-04	mg/kg/day	7.5E-07
				Iron	2E+04	mg/Kg	1.1E-06	mg/kg/day				3.3E-06	mg/kg/day			
				Manganese	7E+02	mg/Kg	5.1E-08	mg/kg/day				1.5E-07	mg/kg/day	1.4E-05	mg/kg/day	1.0E-02
				Thallium	4E-01	mg/Kg	2.9E-11	mg/kg/day				8.5E-11	mg/kg/day	8.0E-05	mg/kg/day	1.1E-06
				Vanadium	5E+01	mg/Kg	3.6E-09	mg/kg/day				1.0E-06	mg/kg/day	1.6E-04	mg/kg/day	5.7E-05
			Exp. Route Total								1.1E-09					1.2E-02
		Exposure Point Total									8.4E-07					1.3E-01
	Exposure Medium Total										8.4E-07					1.3E-01
Medium Total											8.4E-07					1.3E-01
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	4E+00	mg/L	4.1E-02	mg/kg/day				1.2E-01	mg/kg/day	1.0E+00	mg/kg/day	1.2E-01
				Chromium	2E-02	mg/L	1.6E-04	mg/kg/day				4.6E-04	mg/kg/day	3.0E-03	mg/kg/day	1.5E-01
				Iron	6E+00	mg/L	5.4E-02	mg/kg/day				1.6E-01	mg/kg/day	3.0E-01	mg/kg/day	5.2E-01
				Manganese	2E-01	mg/L	1.7E-03	mg/kg/day				4.8E-03	mg/kg/day	1.4E-01	mg/kg/day	3.5E-02
				Vanadium	3E-02	mg/L	2.6E-04	mg/kg/day				7.6E-04	mg/kg/day	7.0E-03	mg/kg/day	1.1E-01
			Exp. Route Total								0.0E+00					9.4E-01
			Dermal	Aluminum	4E+00	mg/L	9.3E-05	mg/kg/day				2.7E-04	mg/kg/day	4.0E-02	mg/kg/day	6.8E-03
				Chromium	2E-02	mg/L	7.1E-07	mg/kg/day				2.1E-06	mg/kg/day	3.9E-05	mg/kg/day	5.3E-02
				Iron	6E+00	mg/L	1.2E-04	mg/kg/day				3.5E-04	mg/kg/day	3.0E-01	mg/kg/day	1.2E-03
				Manganese	2E-01	mg/L	3.7E-06	mg/kg/day				1.1E-05	mg/kg/day	5.6E-03	mg/kg/day	1.9E-03
				Vanadium	3E-02	mg/L	5.6E-07	mg/kg/day				1.7E-06	mg/kg/day	1.8E-04	mg/kg/day	9.3E-03
			Exp. Route Total								0.0E+00					7.2E-02
		Exposure Point Total									0.0E+00					1.0E+00
	Exposure Medium Total										0.0E+00					1.0E+00
Medium Total											0.0E+00					1.0E+00
										Total of Receptor Risks Across All Media	8.4E-07				Total of Receptor Hazards Across All Media	1.1E+00

TABLE 7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
				Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	8E+03	mg/Kg	9.0E-03	mg/kg/day				1.1E-01	mg/kg/day	1.0E+00	mg/kg/day	1.1E-01
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-04	mg/kg/day	0.0E+00
				Arsenic	1E+00	mg/Kg	1.2E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.7E-06	1.4E-05	mg/kg/day	3.0E-04	mg/kg/day	4.5E-02
				Chromium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	3.0E-03	mg/kg/day	0.0E+00
				Iron	2E+04	mg/Kg	1.8E-02	mg/kg/day				2.1E-01	mg/kg/day	3.0E-01	mg/kg/day	7.0E-01
				Manganese	7E+02	mg/Kg	8.1E-04	mg/kg/day				9.4E-03	mg/kg/day	1.4E-01	mg/kg/day	6.7E-02
				Thallium	4E-01	mg/Kg	4.8E-07	mg/kg/day				5.4E-06	mg/kg/day	8.0E-05	mg/kg/day	6.8E-02
				Vanadium	5E+01	mg/Kg	5.7E-05	mg/kg/day				6.6E-04	mg/kg/day	7.0E-03	mg/kg/day	9.4E-02
			Exp. Route Total								1.7E-06					1.1E+00
				Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day	7.3E+00	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day			
			Dermal	Aluminum	8E+03	mg/Kg	2.5E-05	mg/kg/day				2.9E-04	mg/kg/day	4.0E-02	mg/kg/day	7.4E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	6.0E-05	mg/kg/day	0.0E+00
				Arsenic	1E+00	mg/Kg	9.8E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.5E-07	1.1E-06	mg/kg/day	3.0E-04	mg/kg/day	3.8E-03
				Chromium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	3.9E-05	mg/kg/day	0.0E+00
				Iron	2E+04	mg/Kg	5.0E-05	mg/kg/day				5.9E-04	mg/kg/day	3.0E-01	mg/kg/day	2.0E-03
				Manganese	7E+02	mg/Kg	2.3E-06	mg/kg/day				2.6E-05	mg/kg/day	5.6E-03	mg/kg/day	4.7E-03
				Thallium	4E-01	mg/Kg	1.3E-09	mg/kg/day				1.5E-08	mg/kg/day	8.0E-05	mg/kg/day	1.9E-04
				Vanadium	5E+01	mg/Kg	1.6E-07	mg/kg/day				1.9E-06	mg/kg/day	1.8E-04	mg/kg/day	1.0E-02
			Exp. Route Total								1.5E-07					2.8E-02
				Benzo(a)pyrene	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
			Inhalation	Aluminum	8E+03	mg/Kg	6.6E-07	mg/kg/day				7.7E-06	mg/kg/day	1.4E-03	mg/kg/day	5.4E-03
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day			
				Arsenic	1E+00	mg/Kg	6.5E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.3E-09	1.0E-09	mg/kg/day	2.9E-04	mg/kg/day	3.5E-06
				Chromium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	2.3E-06	mg/kg/day	0.0E+00
				Iron	2E+04	mg/Kg	1.3E-06	mg/kg/day				1.5E-05	mg/kg/day			
				Manganese	7E+02	mg/Kg	5.9E-08	mg/kg/day				8.9E-07	mg/kg/day	1.4E-05	mg/kg/day	4.9E-02
				Thallium	4E-01	mg/Kg	3.4E-11	mg/kg/day				4.0E-10	mg/kg/day	8.0E-05	mg/kg/day	5.0E-06
				Vanadium	5E+01	mg/Kg	4.2E-09	mg/kg/day				4.9E-08	mg/kg/day	1.8E-04	mg/kg/day	2.7E-04
			Exp. Route Total								1.3E-09					5.4E-02
		Exposure Point Total									1.9E-06					1.2E+00
	Exposure Medium Total										1.9E-06					1.2E+00
Medium Total											1.9E-06					1.2E+00
				Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	4E+00	mg/L	2.4E-02	mg/kg/day				2.8E-01	mg/kg/day	1.0E+00	mg/kg/day	2.8E-01
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	4.0E-04	mg/kg/day	0.0E+00
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	2E-02	mg/L	9.2E-05	mg/kg/day				1.1E-03	mg/kg/day	3.0E-03	mg/kg/day	3.6E-01
				Iron	6E+00	mg/L	3.1E-02	mg/kg/day				3.7E-01	mg/kg/day	3.0E-01	mg/kg/day	1.2E+00
				Manganese	2E-01	mg/L	9.7E-04	mg/kg/day				1.1E-02	mg/kg/day	1.4E-01	mg/kg/day	8.1E-02
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	3E-02	mg/L	1.5E-04	mg/kg/day				1.8E-03	mg/kg/day	7.0E-03	mg/kg/day	2.5E-01
			Exp. Route Total								0.0E+00					2.2E+00
				Dieldrin	0E+00	0E+00	0.0E+00	mg/kg/day	1.6E+01	(mg/kg/day)-1	0.0E+00	0.0E+00	mg/kg/day	5.0E-05	mg/kg/day	0.0E+00
			Dermal	Aluminum	4E+00	mg/L	7.1E-05	mg/kg/day				8.3E-04	mg/kg/day	4.0E-02	mg/kg/day	2.1E-02
				Antimony	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	6.0E-05	mg/kg/day	0.0E+00
				Barium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	7.0E-02	mg/kg/day	0.0E+00
				Chromium	2E-02	mg/L	5.4E-07	mg/kg/day				6.3E-06	mg/kg/day	3.9E-05	mg/kg/day	1.6E-01
				Iron	6E+00	mg/L	9.3E-05	mg/kg/day				1.1E-03	mg/kg/day	3.0E-01	mg/kg/day	3.6E-03
				Manganese	2E-01	mg/L	2.9E-06	mg/kg/day				3.4E-05	mg/kg/day	5.6E-03	mg/kg/day	6.0E-03
				Thallium	0E+00	0E+00	0.0E+00	mg/kg/day				0.0E+00	mg/kg/day	8.0E-05	mg/kg/day	0.0E+00
				Vanadium	3E-02	mg/L	4.5E-07	mg/kg/day				5.2E-06	mg/kg/day	1.8E-04	mg/kg/day	2.9E-02
			Exp. Route Total								0.0E+00					2.2E-01
		Exposure Point Total									0.0E+00					2.4E+00
	Exposure Medium Total										0.0E+00					2.4E+00
Medium Total											0.0E+00					2.4E+00
										Total of Receptor Risks Across All Media	1.9E-06				Total of Receptor Hazards Across All Media	3.6E+00

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

AOC C

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				Cancer Risk
					Value	Units		Intake/Activity		CSF		
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.00167479	0.00017223	0.00027634	0.002123359
			Arsenic	1.16E-07	1.70E-10	2.29E-08	NA	1.39E-07	Skin	0.00071911	1.1132E-07	0.00014238	0.000861609
			Iron						Gastrointestinal	0.01114218	0	7.3538E-05	0.011215717
			Manganese						Neurological	0.00107285	0.00154571	0.00017702	0.002795584
			Thallium						Hair loss, liver	0.00107867	1.5863E-07	7.1192E-08	0.001085947
			Vanadium						None Specified	0.00150316	8.502E-06	0.00038157	0.001893232
			Chemical Total					1.39E-07					0.019975448
		Exposure Point Total						1.39E-07					0.019975448
	Exposure Medium Total							1.39E-07					0.019975448
Medium Total								1.39E-07					0.019975448
Receptor Total							Receptor Risk Total	1.39E-07				Receptor HI Total	0.019975448

Total Organ (Body weight) HI Across All Media =	0.002123359
Total Organ (Skin) HI Across All Media =	0.000861609
Total Organ (Gastrointestinal) HI Across All Media =	0.011215717
Total Organ (Neurological) HI Across All Media =	0.002795584
Total Organ (Hair loss, liver) HI Across All Media =	0.001085947
Total Organ (None Specified) HI Across All Media =	0.001893232

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.008051859	0.00082804	0.001328557	0.010208456
			Arsenic	5.56E-07	8.17E-10	1.10E-07	NA	6.66E-07	Skin	0.003457273	5.35182E-07	0.00068454	0.004142349
			Iron						Gastrointestinal	0.053568167	0	0.00035355	0.053921717
			Manganese						Neurological	0.005157954	0.007431292	0.000851062	0.013440308
			Thallium						Hair loss, liver	0.00518591	7.62634E-07	3.4227E-05	0.0052209
			Vanadium						None Specified	0.001503159	8.50203E-06	0.000381571	0.001893232
			Chemical Total					6.86E-07					0.088826961
		Exposure Point Total						6.66E-07					0.088826961
	Exposure Medium Total							6.66E-07					0.088826961
Medium Total								6.66E-07					0.088826961
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.04295499	NA	0.000885947	0.043840937
			Chromium						Respiratory, not specified	0.054468363	NA	0.006913292	0.061381655
			Iron						Gastrointestinal	0.188562296	NA	0.000153914	0.18671621
			Manganese						Neurological	0.012370702	NA	0.000255148	0.012625847
			Vanadium						None Specified	0.038579815	NA	0.001224167	0.039803983
		Exposure Point Total						0.00E+00					0.344368632
	Exposure Medium Total							0.00E+00					0.344368632
Medium Total								0.00E+00					0.344368632
Receptor Total							Receptor Risk Total	6.66E-07				Receptor HI Total	0.433195593

Total Organ (Body weight) HI Across All Media =	0.054049393
Total Organ (Skin) HI Across All Media =	0.004142349
Total Organ (Respiratory, not specified) HI Across All Media =	0.061381655
Total Organ (Gastrointestinal) HI Across All Media =	0.240637927
Total Organ (Neurological) HI Across All Media =	0.026066155
Total Organ (Hair loss, liver) HI Across All Media =	0.0052209
Total Organ (None Specified) HI Across All Media =	0.041897215

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.00334957	0.00034446	0.00095463	0.004648666
			Arsenic	2.22E-07	3.26E-10	7.59E-06	NA	2.98E-07	Skin	0.00143823	2.2264E-07	0.00049187	0.001930322
			Iron						Gastrointestinal	0.02228436	0	0.00025404	0.022538399
			Manganese						Neurological	0.00214571	0.00309142	0.00061153	0.005848653
			Thallium						Hair loss, liver	0.00215734	3.1726E-07	2.4594E-05	0.002182249
			Vanadium						None Specified	0.00300632	1.7004E-05	0.00131815	0.004341477
			Chemical Total					2.98E-07					0.041489767
		Exposure Point Total						2.98E-07					0.041489767
	Exposure Medium Total							2.98E-07					0.041489767
Medium Total								2.98E-07					0.041489767
Receptor Total							Receptor Risk Total	2.98E-07				Receptor HI Total	0.041489767

Total Organ (Body weight) HI Across All Media =	0.004648666
Total Organ (Skin) HI Across All Media =	0.001930322
Total Organ (Gastrointestinal) HI Across All Media =	0.022538399
Total Organ (Neurological) HI Across All Media =	0.005848653
Total Organ (Hair loss, liver) HI Across All Media =	0.002182249
Total Organ (None Specified) HI Across All Media =	0.004341477

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.03126268	0.0016075	0.00218839	0.035058574
			Arsenic	5.18E-07	3.81E-10	4.35E-08	NA	5.62E-07	Skin	0.01342344	1.039E-06	0.00112757	0.014552048
			Iron						Gastrointestinal	0.20798734	0	0.00058236	0.208569701
			Manganese						Neurological	0.02002661	0.01442661	0.00140186	0.035855092
			Thallium						Hair loss, liver	0.02013516	1.4805E-06	5.6378E-05	0.020193019
			Vanadium						None Specified	0.02805897	7.9352E-05	0.00302174	0.031160057
			Chemical Total					5.62E-07					0.345388491
		Exposure Point Total						5.62E-07					0.345388491
	Exposure Medium Total							5.62E-07					0.345388491
Medium Total								5.62E-07					0.345388491
Receptor Total							Receptor Risk Total	5.62E-07				Receptor HI Total	0.345388491

Total Organ (Body weight) HI Across All Media =	0.035058574
Total Organ (Skin) HI Across All Media =	0.014552048
Total Organ (Gastrointestinal) HI Across All Media =	0.208569701
Total Organ (Neurological) HI Across All Media =	0.035855092
Total Organ (Hair lpss, liver) HI Across All Media =	0.020193019
Total Organ (None Specified) HI Across All Media =	0.031160057

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Current
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Subsurface Soil	Aluminum					0.00E+00	Body weight	0.03061057	0.00095392	0.00229579	0.033860281
			Iron						Gastrointestinal	0.19678376		0.00059035	0.197374109
			Chemical Total					0.00E+00					0.23123439
		Exposure Point Total						0.00E+00					0.23123439
	Exposure Medium Total							0.00E+00					0.23123439
Medium Total								0.00E+00					0.23123439
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	0.23123439

Total Organ (Body weight) HI Across All Media = 0.033860281

Total Organ (Gastrointestinal) HI Across All Media = 0.197374109

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.011272603	0.001159256	0.001124442	0.013556301
			Arsenic	7.47E-07	1.10E-09	8.94E-08	NA	6.37E-07	Skin	0.004840183	7.49254E-07	0.00057937	0.005420302
			Iron						Gastrointestinal	0.074995434	0	0.000299232	0.075294666
			Manganese						Neurological	0.007221135	0.010403809	0.000720308	0.018345252
			Thallium						Hair loss, liver	0.007260274	1.06769E-06	2.89685E-05	0.00729031
			Vanadium						None Specified	0.010117417	5.72252E-05	0.001552634	0.011727276
			Chemical Total					8.37E-07					0.131834106
		Exposure Point Total						8.37E-07					0.131634106
	Exposure Medium Total							8.37E-07					0.131634106
Medium Total								8.37E-07					0.131634106
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.120273973	NA	0.006765411	0.127039384
			Chromium						Respiratory, not specified	0.152511416	NA	0.052792413	0.205303829
			Iron						Gastrointestinal	0.522374429	NA	0.001175342	0.523549772
			Manganese						Neurological	0.034637965	NA	0.001948386	0.03658635
			Vanadium						None Specified	0.108023483	NA	0.009348186	0.117371669
		Exposure Point Total						0.00E+00					1.009851004
	Exposure Medium Total							0.00E+00					1.009851004
Medium Total								0.00E+00					1.009851004
Receptor Total							Receptor Risk Total	8.37E-07				Receptor HI Total	1.14148511

Total Organ (Body weight) HI Across All Media =	0.140595684
Total Organ (Respiratory, not specified) HI Across All Media =	0.205303829
Total Organ (Gastrointestinal) HI Across All Media =	0.598844437
Total Organ (Neurological) HI Across All Media =	0.054931602
Total Organ (Hair loss, liver) HI Across All Media =	0.00729031
Total Organ (None Specified) HI Across All Media =	0.129098946
Total Organ (Liver) HI Across All Media =	0.00729031

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.105210959	0.00540986	0.007364767	0.117985586
			Arsenic	1.74E-06	1.28E-09	1.46E-07	NA	1.89E-06	Skin	0.045175038	3.49652E-06	0.003794703	0.048973238
			Iron						Gastrointestinal	0.699957382	0	0.001959881	0.701917263
			Manganese						Neurological	0.06739726	0.048551108	0.004717808	0.120666176
			Thallium						Hair loss, liver	0.067762557	4.98254E-06	0.000189735	0.067957275
			Vanadium						None Specified	0.094429224	0.000267051	0.010169301	0.104865576
			Chemical Total					1.89E-06					1.162365113
		Exposure Point Total						1.89E-06					1.162365113
	Exposure Medium Total							1.89E-06					1.182365113
Medium Total								1.89E-06					1.162365113
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.280639269	NA	0.020837466	0.301476735
			Chromium						Respiratory, not specified	0.35585997	NA	0.162600632	0.518460602
			Iron						Gastrointestinal	1.218873668	NA	0.003620055	1.222493723
			Manganese						Neurological	0.080821918	NA	0.006001027	0.086822945
			Vanadium						None Specified	0.252054795	NA	0.026792413	0.280847208
		Exposure Point Total						0.00E+00					2.410101213
	Exposure Medium Total							0.00E+00					2.410101213
Medium Total								0.00E+00					2.410101213
Receptor Total							Receptor Risk Total	1.89E-06				Receptor HI Total	3.572466326
							Sum of Residential Adult and Residential Child Risks	2.7E-06					

Total Organ (Body weight) HI Across All Media =	0.419462321
Total Organ (Respiratory, not specified) HI Across All Media =	0.518460602
Total Organ (Gastrointestinal) HI Across All Media =	1.924410986
Total Organ (Neurological) HI Across All Media =	0.207489121
Total Organ (Hair loss, liver) HI Across All Media =	0.067957275
Total Organ (None Specified) HI Across All Media =	0.385712783
Total Organ (Liver) HI Across All Media =	0.067957275

TABLE 10.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC C

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =

Total Organ 2 HI Across All Media =

Appendix D-7
AOC F Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-7 Contents for AOC F Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 27
Table 1: Selection of Exposure Pathways	p. 2 of 27
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Subsurface Soil)	p. 3 of 27
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Groundwater)	p. 5 of 27
Table 3.1 RME: EPC Summary (Surface Soil)	p. 6 of 27
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 7 of 27
Table 3.3 RME: EPC Summary (Groundwater)	p. 8 of 27
Table 4.1 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 9 of 27
Table 4.2 RME: Values Used for Daily Intake Calculations (Subsurface Soil - Current Timeframe)	p. 10 of 27
Table 4.3 RME: Values Used for Daily Intake Calculations (Groundwater - Future Timeframe)	p. 11 of 27
Table 4.4 RME: Values Used for Daily Intake Calculations (Groundwater - Future Timeframe)	p. 12 of 27
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 13 of 27
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 14 of 27
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 15 of 27
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 16 of 27
Table 6.2: Cancer Toxicity Data – Inhalation	p. 17 of 27
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 18 of 27
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Construction Worker – Adult)	p. 19 of 27
Table 7.3 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 20 of 27
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 21 of 27
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 22 of 27
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 23 of 27
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Construction Worker – Adult)	p. 24 of 27
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 25 of 27

Appendix D-7 Contents for AOC F Risk Assessment Tables

Table No.	Page No.
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 26 of 27
Table 10.1 RME: Risk Summary	p. 27 of 27

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

AOC F

Site Name/OU:	AOC F
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

AOC F

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Subsurface Soil	Direct contact with COPCs in site soil.	Construction Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of utility workers and construction workers where excavations are possible.
Future	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	Scenario is protective of future indusrtial workers at the site. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative None	This scenario represents a worst-case scenario for the purpose of comparison. VOCs were not detected in site groundwater. Therefore inhalation pathway is incomplete.

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC F

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	107-06-2	1,2-DICHLOROETHANE	0.0003 J	0.0003 J	mg/kg	AF-SB02	2 / 17	NA	3.00E-04	NA	6.03E-01	NA	NA	N	BSL
	7429-90-5	ALUMINUM	8790 J	25900 J	mg/kg	AF-SB03	17 / 17	NA	25,900	NA	1.00E+04	NA	NA	Y	ASL
	7440-36-0	ANTIMONY	0.16 J	0.87 J	mg/kg	AF-SB03	5 / 17	NA	0.87	NA	4.09E+01	NA	NA	N	BSL
	7440-38-2	ARSENIC	0.46 J	0.82 J	mg/kg	AF-SB02	8 / 17	NA	0.82	NA	1.59E+00	NA	NA	N	BSL
	7440-39-3	BARIUM	63.5 =	682 =	mg/kg	AF-SB03	17 / 17	NA	682	NA	6.66E+03	NA	NA	N	BSL
	71-43-2	BENZENE	0.0002 J	0.0002 J	mg/kg	AF-SB02	1 / 17	NA	2.00E-04	NA	1.31E+00	NA	NA	N	BSL
	7440-41-7	BERYLLIUM	0.11 J	0.57 J	mg/kg	AF-SB02	17 / 17	NA	0.57	NA	1.94E+03	NA	NA	N	BSL
		CALCIUM	1790 J	11200 J	mg/kg	AF-SB03	17 / 17	NA	11,200	NA		NA	NA	N	NSV
	75-15-0	CARBON DISULFIDE	0.0003 J	0.0004 J	mg/kg	AF-SB03	2 / 17	NA	4.00E-04	NA	7.20E+01	NA	NA	N	BSL
	108-90-7	CHLOROBENZENE	0.0007 J	0.0007 J	mg/kg	AF-SB03	1 / 17	NA	7.00E-04	NA	5.30E+01	NA	NA	N	BSL
	18540-29-9	CHROMIUM, TOTAL	7.3 J	129 =	mg/kg	AF-SB01	17 / 17	NA	129	NA	6.40E+01	NA	NA	N(>10')	BSL
	7440-48-4	COBALT	6.6 J	63.2 =	mg/kg	AF-SB01	17 / 17	NA	63	NA	1.92E+03	NA	NA	N	BSL
	7440-50-8	COPPER	19.9 J	120 J	mg/kg	AF-SB01	17 / 17	NA	120	NA	4.09E+03	NA	NA	N	BSL
	7439-89-6	IRON	12500 =	52100 =	mg/kg	AF-SB03	17 / 17	NA	52,100	NA	1.00E+04	NA	NA	Y	ASL
	7439-92-1	LEAD	0.54 J	2.6 =	mg/kg	AF-SB01	14 / 17	NA	2.6	NA	7.50E+02	NA	NA	N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.0003 J	0.0009 J	mg/kg	AF-SB03	4 / 17	NA	9.00E-04	NA	4.20E+01	NA	NA	N	BSL
		MAGNESIUM	1740 J	22700 =	mg/kg	AF-SB01	17 / 17	NA	22,700	NA		NA	NA	N	NSV
	7439-96-5	MANGANESE	372 =	3490 =	mg/kg	AF-SB01	17 / 17	NA	3,490	NA	1.95E+03	NA	NA	N(>10')	BSL
	7487-94-7	MERCURY	0.015 J	0.015 J	mg/kg	AF-SB03	1 / 17	NA	0.015	NA	3.07E+01	NA	NA	N	BSL
	78-93-3	METHYL ETHYL KETONE (2-BUTANONE	0.002 J	0.007 J	mg/kg	AF-SB03	4 / 4	NA	0.0070	NA	2.71E+03	NA	NA	N	BSL
	7440-02-0	NICKEL	3.7 J	43.7 =	mg/kg	AF-SB01	17 / 17	NA	44	NA	2.04E+03	NA	NA	N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE)	0.0004 J	0.0004 J	mg/kg	AF-SB03	1 / 17	NA	4.00E-04	NA	4.20E+01	NA	NA	N	BSL
	72-55-9	p,p'-DDE	0.00047 J	0.00047 J	mg/kg	AF-SB03	1 / 17	NA	4.70E-04	NA	7.02E+00	NA	NA	N	BSL
		POTASSIUM	180 J	1710 J	mg/kg	AF-SB04	17 / 17	NA	1,710	NA		NA	NA	N	NSV
	7782-49-2	SELENIUM	0.28 J	0.54 J	mg/kg	AF-SB01	5 / 17	NA	0.54	NA	5.11E+02	NA	NA	N	BSL
	7440-22-4	SILVER	0.097 J	0.31 J	mg/kg	AF-SB02	2 / 17	NA	0.31	NA	5.11E+02	NA	NA	N	BSL
		SODIUM	63 J	2470 =	mg/kg	AF-SB04	16 / 17	NA	2,470	NA		NA	NA	N	NSV
	7440-28-0	THALLIUM	0.78 J	1.7 J	mg/kg	AF-SB02	14 / 17	NA	1.7	NA	6.75E+00	NA	NA	N	BSL
	108-88-3	TOLUENE	0.0004 J	0.0004 J	mg/kg	AF-SB03	1 / 17	NA	4.00E-04	NA	5.20E+01	NA	NA	N	BSL
	7440-62-2	VANADIUM	36.6 J	163 =	mg/kg	AF-SB01	17 / 17	NA	183	NA	7.15E+02	NA	NA	N	BSL
	1330-20-7	XYLENES, TOTAL	0.0003 J	0.0013 J	mg/kg	AF-SB03	4 / 17	NA	0.0013	NA	4.20E+01	NA	NA	N	BSL
	7440-66-6	ZINC	24.4 J	71.6 J	mg/kg	AF-SB03	17 / 17	NA	72	NA	1.00E+04	NA	NA	N	BSL
												NA	NA		
Groundwater	7429-90-5	ALUMINUM	221 =	18800 =	µg/L	AOC-F-MW05	5 / 5	NA	18,800	NA	3.65E+03	NA	NA	Y	ASL
	7440-36-0	ANTIMONY	1.8 J	1.6 J	µg/L	AOC-F-MW04	1 / 5	NA	1.6	NA	1.46E+00	6.0	MCL	N	ASL/BMCL
	7440-39-3	BARIUM	61.2 J	141 J	µg/L	AOC-F-MW05	5 / 5	NA	141	NA	2.55E+02	2,000	MCL	N	BSL
		CALCIUM	37500 =	48000 =	µg/L	AOC-F-MW04	5 / 5	NA	48,000	NA		NA	NA	N	NSV
	18540-29-9	CHROMIUM, TOTAL	2.2 J	28.4 =	µg/L	AOC-F-MW05	5 / 5	NA	28	NA	1.09E+01	100	MCL	N	ASL/BMCL
	7440-48-4	COBALT	0.93 J	15.2 J	µg/L	AOC-F-MW05	3 / 5	NA	15	NA	7.30E+01	NA	NA	N	BSL
	7440-50-8	COPPER	2.9 J	45.8 =	µg/L	AOC-F-MW05	5 / 5	NA	46	NA	1.46E+02	1,300	MCL	N	BSL
	84-66-2	DIETHYL PHTHALATE	8 =	10 =	µg/L	AOC-F-MW02	2 / 5	NA	10	NA	2.92E+03	NA	NA	N	BSL
	7439-89-6	IRON	257 =	23900 =	µg/L	AOC-F-MW05	5 / 5	NA	23,900	NA	1.09E+03	NA	NA	Y	ASL

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC F

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
	7439-92-1	LEAD	1.2 J	3.4 =	µg/L	AOC-F-MW05	2 / 5	NA	3.4	NA		15	MCL	N	NSV
		MAGNESIUM	25400 =	38600 =	µg/L	AOC-F-MW05	5 / 5	NA	38,600	NA		NA	NA	N	NSV
	7439-96-5	MANGANESE	149 =	819 =	µg/L	AOC-F-MW05	5 / 5	NA	819	NA	8.76E+01	NA	NA	Y	ASL
	7440-02-0	NICKEL	2 J	14.8 J	µg/L	AOC-F-MW05	5 / 5	NA	15	NA	7.30E+01	100	MCL	N	BSL
		POTASSIUM	3320 J	5850 J	µg/L	AOC-F-MW05	5 / 5	NA	5,650	NA		NA	NA	N	NSV
	7782-49-2	SELENIUM	2.6 J	7.2 =	µg/L	AOC-F-MW05	4 / 5	NA	7.2	NA	1.82E+01	50	MCL	N	BSL
		SODIUM	140000 =	251000 =	µg/L	AOC-F-MW03	5 / 5	NA	251,000	NA		NA	NA	N	NSV
	7440-62-2	VANADIUM	19.4 J	83.9 =	µg/L	AOC-F-MW05	5 / 5	NA	84	NA	2.55E+01	NA	NA	Y	ASL
	7440-66-6	ZINC	2.8 J	50.3 =	µg/L	AOC-F-MW05	3 / 5	NA	50	NA	1.09E+03	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC F

Scenario Timeframe: Current and Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	7429-90-5	**ALUMINUM**	**221 =**	**18800 =**	**µg/L**	**AOC-F-MW05**	**5 / 5**	**NA**	**18,800**	**NA**	**3.65E+03**			**Y**	**ASL**
	7440-36-0	**ANTIMONY**	**1.6 J**	**1.6 J**	**µg/L**	**AOC-F-MW04**	**1 / 5**	**NA**	**1.6**	**NA**	**1.46E+00**	**6.0**	**MCL**	**N**	**ASL/BMCL**
	7440-39-3	BARIUM	81.2 J	141 J	µg/L	AOC-F-MW05	5 / 5	NA	141	NA	2.55E+02	2,000	MCL	N	BSL
		CALCIUM	37500 =	48000 =	µg/L	AOC-F-MW04	5 / 5	NA	48,000	NA				N	NSV
	18540-29-9	**CHROMIUM, TOTAL**	**2.2 J**	**28.4 =**	**µg/L**	**AOC-F-MW05**	**5 / 5**	**NA**	**28**	**NA**	**1.09E+01**	**100**	**MCL**	**N**	**ASL/BMCL**
	7440-48-4	COBALT	0.93 J	15.2 J	µg/L	AOC-F-MW05	3 / 5	NA	15	NA	7.30E+01			N	BSL
	7440-50-8	COPPER	2.9 J	45.8 =	µg/L	AOC-F-MW05	5 / 5	NA	46	NA	1.46E+02	1,300	MCL	N	BSL
	84-66-2	DIETHYL PHTHALATE	8 =	10 =	µg/L	AOC-F-MW02	2 / 5	NA	10	NA	2.92E+03			N	BSL
	7439-89-6	**IRON**	**257 =**	**23900 =**	**µg/L**	**AOC-F-MW05**	**5 / 5**	**NA**	**23,900**	**NA**	**1.09E+03**			**Y**	**ASL**
	7439-92-1	LEAD	1.2 J	3.4 =	µg/L	AOC-F-MW05	2 / 5	NA	3.4	NA		15	MCL	N	NSV
		MAGNESIUM	25400 =	38600 =	µg/L	AOC-F-MW05	5 / 5	NA	38,600	NA				N	NSV
	7439-96-5	**MANGANESE**	**149 =**	**819 =**	**µg/L**	**AOC-F-MW05**	**5 / 5**	**NA**	**819**	**NA**	**8.76E+01**			**Y**	**ASL**
	7440-02-0	NICKEL	2 J	14.8 J	µg/L	AOC-F-MW05	5 / 5	NA	15	NA	7.30E+01	100	MCL	N	BSL
		POTASSIUM	3320 J	5650 J	µg/L	AOC-F-MW05	5 / 5	NA	5,650	NA				N	NSV
	7782-49-2	SELENIUM	2.6 J	7.2 =	µg/L	AOC-F-MW05	4 / 5	NA	7.2	NA	1.82E+01	50	MCL	N	BSL
		SODIUM	140000 =	251000 =	µg/L	AOC-F-MW03	5 / 5	NA	251,000	NA				N	NSV
	7440-62-2	**VANADIUM**	**19.4 J**	**83.9 =**	**µg/L**	**AOC-F-MW05**	**5 / 5**	**NA**	**84**	**NA**	**2.55E+01**			**Y**	**ASL**
	7440-66-6	ZINC	2.8 J	50.3 =	µg/L	AOC-F-MW05	3 / 5	NA	50	NA	1.09E+03			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	NA								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	Aluminum	mg/Kg	8523.75	9409 (N)	10600	9409	mg/Kg	UCL95 (N)	1
	Iron	mg/Kg	18362.5	20522 (N)	23700	20522	mg/Kg	UCL95 (N)	1

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	Aluminum	ug/L	4337.6	7822628 (L)	18800	18.8	mg/L	Max detect	4
	Antimony	ug/L	0.88	1.16 (NP)	1.6	0.00116	mg/L	UCL95 (NP)	3
	Chromium	ug/L	9.54	167 (L)	28.4	0.0284	mg/L	Max detect	4
	Iron	ug/L	5496.2	13834094 (L)	23900	23.9	mg/L	Max detect	4
	Manganese	ug/L	273.16	6149 (L)	819	0.819	mg/L	Max detect	4
	Vanadium	ug/L	37.02	89.3 (L)	83.9	0.0839	mg/L	Max detect	4

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Groundwater	**Cw**	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Groundwater	**Cw**	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				ET	Event Duration	0.05	hr/event	g	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	5	events/day	g	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Best professional judgement, assumed to be equivalent to dermal event duration for residential adult as recommended by EPA Region 2 (five 3-min events).

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Current
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	330	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	h	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Dermal:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.3	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Aluminum	0.001		e	DAevent = Cs x CF x AF x ABS
					Arsenic	0.03		i	
					Iron	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Inhalation:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	2	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	18000	cm^2	e	
				ET	Event Duration	0.25	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(Inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.4 RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	6600	cm^2	e	
				ET	Event Duration	0.45	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 27 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

AOC F

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

AOC F

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

AOC F

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

AOC F

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

AOC F

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	2E+01	mg/L	6.6E-02	mg/kg/day				1.8E-01	mg/kg/day	1.0E+00	mg/kg/day	1.8E-01
				Antimony	1E-03	mg/L	4.1E-06	mg/kg/day				1.1E-05	mg/kg/day	4.0E-04	mg/kg/day	2.8E-02
				Chromium	3E-02	mg/L	9.9E-05	mg/kg/day				2.8E-04	mg/kg/day	3.0E-03	mg/kg/day	9.3E-02
				Iron	2E+01	mg/L	8.4E-02	mg/kg/day				2.3E-01	mg/kg/day	3.0E-01	mg/kg/day	7.8E-01
				Manganese	8E-01	mg/L	2.9E-03	mg/kg/day				8.0E-03	mg/kg/day	1.4E-01	mg/kg/day	5.7E-02
				Vanadium	8E-02	mg/L	2.9E-04	mg/kg/day				8.2E-04	mg/kg/day	7.0E-03	mg/kg/day	1.2E-01
			Exp. Route Total								0.0E+00					1.3E+00
			Dermal	Aluminum	2E+01	mg/L	5.4E-05	mg/kg/day				1.5E-04	mg/kg/day	4.0E-02	mg/kg/day	3.8E-03
				Antimony	1E-03	mg/L	3.3E-09	mg/kg/day				9.4E-09	mg/kg/day	6.0E-05	mg/kg/day	1.6E-04
				Chromium	3E-02	mg/L	1.6E-07	mg/kg/day				4.6E-07	mg/kg/day	3.9E-05	mg/kg/day	1.2E-02
				Iron	2E+01	mg/L	6.9E-05	mg/kg/day				1.9E-04	mg/kg/day	3.0E-01	mg/kg/day	6.4E-04
				Manganese	8E-01	mg/L	2.4E-06	mg/kg/day				6.6E-06	mg/kg/day	5.6E-03	mg/kg/day	1.2E-03
				Vanadium	6E-02	mg/L	2.4E-07	mg/kg/day				8.8E-07	mg/kg/day	1.8E-04	mg/kg/day	3.7E-03
			Exp. Route Total								0.0E+00					2.1E-02
		Exposure Point Total									0.0E+00					1.3E+00
	Exposure Medium Total										0.0E+00					1.3E+00
Medium Total											0.0E+00					1.3E+00
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	1.3E+00

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:	Current
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Subsurface Soil	Subsurface Soil	Ingestion	Aluminum	9E+03	mg/Kg	2.2E-04	mg/kg/day				3.0E-02	mg/kg/day	1.0E+00	mg/kg/day	0.030
				Iron	2E+04	mg/Kg	4.7E-04	mg/kg/day				6.6E-02	mg/kg/day	3.0E-01	mg/kg/day	0.221
			Exp. Route Total								0.0E+00					0.251
			Dermal	Aluminum	9E+03	mg/Kg	6.5E-07	mg/kg/day				9.1E-05	mg/kg/day	4.0E-02	mg/kg/day	0.002
				Iron	2E+04	mg/Kg	1.4E-06	mg/kg/day				2.0E-04	mg/kg/day	3.0E-01	mg/kg/day	0.001
			Exp. Route Total								0.0E+00					0.003
			Inhalation	Aluminum	9E+03	mg/Kg	9.7E-09	mg/kg/day				1.4E-06	mg/kg/day	1.4E-03	mg/kg/day	0.001
				Iron	2E+04	mg/Kg	2.1E-06	mg/kg/day				3.0E-06	mg/kg/day	N/A	N/A	#VALUE!
			Exp. Route Total								0.0E+00					0.001
		Exposure Point Total									0.0E+00					0.255
	Exposure Medium Total										0.0E+00					0.255
Medium Total											0.0E+00					0.255
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	0.255

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	2E+01	mg/L	1.8E-01	mg/kg/day				5.2E-01	mg/kg/day	1.0E+00	mg/kg/day	0.515
				Antimony	1E-03	mg/L	1.1E-05	mg/kg/day				3.2E-05	mg/kg/day	4.0E-04	mg/kg/day	0.079
				Chromium	3E-02	mg/L	2.7E-04	mg/kg/day				7.8E-04	mg/kg/day	3.0E-03	mg/kg/day	0.259
				Iron	2E+01	mg/L	2.2E-01	mg/kg/day				6.5E-01	mg/kg/day	3.0E-01	mg/kg/day	2.183
				Manganese	8E-01	mg/L	7.7E-03	mg/kg/day				2.2E-02	mg/kg/day	1.4E-01	mg/kg/day	0.160
				Vanadium	8E-02	mg/L	7.9E-04	mg/kg/day				2.3E-03	mg/kg/day	7.0E-03	mg/kg/day	0.328
			Exp. Route Total								0.0E+00					3.525
			Dermal	Aluminum	2E+01	mg/L	4.0E-04	mg/kg/day				1.2E-03	mg/kg/day	4.0E-02	mg/kg/day	0.029
				Antimony	1E-03	mg/L	2.5E-08	mg/kg/day				7.2E-08	mg/kg/day	6.0E-05	mg/kg/day	0.001
				Chromium	3E-02	mg/L	1.2E-06	mg/kg/day				3.5E-06	mg/kg/day	3.9E-05	mg/kg/day	0.090
				Iron	2E+01	mg/L	5.1E-04	mg/kg/day				1.5E-03	mg/kg/day	3.0E-01	mg/kg/day	0.005
				Manganese	8E-01	mg/L	1.7E-05	mg/kg/day				5.0E-05	mg/kg/day	5.6E-03	mg/kg/day	0.009
				Vanadium	8E-02	mg/L	1.8E-06	mg/kg/day				5.2E-06	mg/kg/day	1.6E-04	mg/kg/day	0.028
			Exp. Route Total								0.0E+00					0.162
		Exposure Point Total									0.0E+00					3.687
	Exposure Medium Total										0.0E+00					3.687
Medium Total											0.0E+00					3.687
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	3.687

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	2E+01	mg/L	1.0E-01	mg/kg/day				1.2E+00	mg/kg/day	1.0E+00	mg/kg/day	1.2E+00
				Antimony	1E-03	mg/L	6.4E-06	mg/kg/day				7.4E-05	mg/kg/day	4.0E-04	mg/kg/day	1.9E-01
				Chromium	3E-02	mg/L	1.6E-04	mg/kg/day				1.8E-03	mg/kg/day	3.0E-03	mg/kg/day	6.1E-01
				Iron	2E+01	mg/L	1.3E-01	mg/kg/day				1.5E+00	mg/kg/day	3.0E-01	mg/kg/day	5.1E+00
				Manganese	6E-01	mg/L	4.5E-03	mg/kg/day				5.2E-02	mg/kg/day	1.4E-01	mg/kg/day	3.7E-01
				Vanadium	6E-02	mg/L	4.6E-04	mg/kg/day				5.4E-03	mg/kg/day	7.0E-03	mg/kg/day	7.7E-01
			Exp. Route Total								0.0E+00					8.2E+00
			Dermal	Aluminum	2E+01	mg/L	3.1E-04	mg/kg/day				3.6E-03	mg/kg/day	4.0E-02	mg/kg/day	8.9E-02
				Antimony	1E-03	mg/L	1.9E-08	mg/kg/day				2.2E-07	mg/kg/day	8.0E-05	mg/kg/day	3.7E-03
				Chromium	3E-02	mg/L	9.2E-07	mg/kg/day				1.1E-05	mg/kg/day	3.9E-05	mg/kg/day	2.8E-01
				Iron	2E+01	mg/L	3.9E-04	mg/kg/day				4.5E-03	mg/kg/day	3.0E-01	mg/kg/day	1.5E-02
				Manganese	6E-01	mg/L	1.3E-05	mg/kg/day				1.8E-04	mg/kg/day	5.6E-03	mg/kg/day	2.8E-02
				Vanadium	6E-02	mg/L	1.4E-06	mg/kg/day				1.6E-05	mg/kg/day	1.8E-04	mg/kg/day	8.8E-02
			Exp. Route Total								0.0E+00					5.0E-01
		Exposure Point Total									0.0E+00					8.7E+00
	Exposure Medium Total										0.0E+00					8.7E+00
Medium Total											0.0E+00					8.7E+00
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	8.7E+00

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

AOC F

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.183953033	NA	0.003794031	0.187747065
			Antimony						Blood, longevity	0.028375734	NA	0.000156067	0.0285318
			Chromium						Respiratory, not specified	0.092628832	NA	0.011756736	0.104385569
			Iron						Gastrointestinal	0.779517286	NA	0.000643102	0.780160388
			Manganese						Neurological	0.057240705	NA	0.00118059	0.058421294
			Vanadium						None Specified	0.117277048	NA	0.003721291	0.120998339
		Exposure Point Total						0.00E+00					1.280244455
	Exposure Medium Total							0.00E+00					1.280244455
Medium Total								0.00E+00					1.280244455
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	1.280244455

Total Organ (Body weight) HI Across All Media =	0.187747065
Total Organ (Blood, longevity) HI Across All Media =	0.0285318
Total Organ (Respiratory, not specified) HI Across All Media =	0.104385569
Total Organ (Gastrointestinal) HI Across All Media =	0.780160388
Total Organ (Neurological) HI Across All Media =	0.058421294
Total Organ (None Specified) HI Across All Media =	0.120998339

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Current
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Subsurface Soil	Aluminum					0.00E+00	Body weight	0.03038	0.00095	0.00228	0.034
			Iron						Gastrointestinal	0.221		0.00066	0.222
			Chemical Total					0.00E+00					0.255
		Exposure Point Total						0.00E+00					0.255
	Exposure Medium Total							0.00E+00					0.255
Medium Total								0.00E+00					0.255
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	0.255

Total Organ (Body weight) HI Across All Media =	0.034
Total Organ (Gastrointestinal) HI Across All Media =	0.222

TA. .3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.515068493	NA	0.028972603	0.5440
			Antimony						Blood, longevity	0.079452055	NA	0.001191781	0.0806
			Chromium						Respiratory, not specified	0.259360731	NA	0.089778714	0.3491
			Iron						Gastrointestinal	2.182648402	NA	0.004910959	2.1876
			Manganese						Neurological	0.160273973	NA	0.009015411	0.1693
			Vanadium						None Specified	0.328375734	NA	0.028417131	0.3568
		Exposure Point Total						0.00E+00					3.6875
	Exposure Medium Total							0.00E+00					3.6875
Medium Total								0.00E+00					3.6875
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	3.6675

Total Organ (Body weight) HI Across All Media =	0.5440
Total Organ (Blood, longevity) HI Across All Media =	0.0806
Total Organ (Respiratory, not specified) HI Across All Media =	0.3491
Total Organ (Gastrointestinal) HI Across All Media =	2.1876
Total Organ (Neurological) HI Across All Media =	0.1693
Total Organ (None Specified) HI Across All Media =	0.3568

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	1.201826484	NA	0.089235616	1.2910621
			Antimony						Blood, longevity	0.185386128	NA	0.003670685	0.189058813
			Chromium						Respiratory, not specified	0.605175038	NA	0.27651844	0.881693479
			Iron						Gastrointestinal	5.092848271	NA	0.015125753	5.107972024
			Manganese						Neurological	0.373972603	NA	0.027767466	0.401740068
			Vanadium						None Specified	0.766210046	NA	0.087524763	0.853734809
		Exposure Point Total						0.00E+00					8.725261293
	Exposure Medium Total							0.00E+00					8.725261293
Medium Total								0.00E+00					8.725261293
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	8.725261293
							Sum of Residential Adult and Residential Child Risks	0.0E+00					

Total Organ (Body weight) HI Across All Media =	1.2910621
Total Organ (Blood, longevity) HI Across All Media =	0.189058813
Total Organ (Respiratory, not specified) HI Across All Media =	0.881893479
Total Organ (Gastrointestinal) HI Across All Media =	5.107972024
Total Organ (Neurological) HI Across All Media =	0.401740068
Total Organ (None Specified) HI Across All Media =	0.853734809

TAL .1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC F

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total				Receptor Risk Total					Receptor HI Total				

Total Organ 1 HI Across All Media =

Total Organ 2 HI Across All Media =

Appendix D-8
AOC K Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-8 Contents for AOC K Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 22
Table 1: Selection of Exposure Pathways	p. 2 of 22
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Groundwater)	p. 3 of 22
Table 3.1 RME: EPC Summary (Surface Soil)	p. 4 of 22
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 5 of 22
Table 3.3 RME: EPC Summary (Groundwater)	p. 6 of 22
Table 4.1 RME: Values Used for Daily Intake Calculations (Groundwater – Future Timeframe)	p. 7 of 22
Table 4.2 RME: Values Used for Daily Intake Calculations (Groundwater - Future Timeframe)	p. 8 of 22
Table 4.3 RME: Values Used for Daily Intake Calculations (Groundwater - Future Timeframe)	p. 9 of 22
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 10 of 22
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 11 of 22
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 12 of 22
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 13 of 22
Table 6.2: Cancer Toxicity Data – Inhalation	p. 14 of 22
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 15 of 22
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 16 of 22
Table 7.3 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 17 of 22
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 18 of 22
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 19 of 22
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 20 of 22
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 21 of 22
Table 10.1 RME: Risk Summary	p. 22 of 22

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	AOC K
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

AOC K

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Industrial Worker	Adult	Injestion	Quantitative	Scenario is protective of future indusrtial workers at the site.
						Dermal	Quantitative	VOCs were not detected above screening criteria in site
						Inhalation	None	groundwater. Therefore inhalation pathway is incomplete.
	Groundwater	Groundwater	Direct contact with COPCs in groundwater.	Residential	Adult	Injestion	Quantitative	This scenario represents a worst-case scenario for the
						Dermal	Quantitative	purpose of comparison. VOCs were not detected above
						Inhalation	None	screening criteria in groundwater. Therefore inhalation pathway is incomplete.
					Child	Injestion	Quantitative	This scenario represents a worst-case scenario for the
						Dermal	Quantitative	purpose of comparison. VOCs were not detected in site
						Inhalation	None	groundwater. Therefore inhalation pathway is incomplete.

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC K

Scenario Timeframe: Current and Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	7429-90-5	ALUMINUM	680 =	9100 =	µg/L	AOC-K-MW04	4 / 5	NA	9,100	NA	3.65E+03	NA	NA	Y	ASL
	7440-39-3	BARIUM	94 J	390 =	µg/L	AOC-K-MW04	5 / 5	NA	390	NA	2.55E+02	2,000	MCL	Y	ASL
	117-81-7	bis(2-ETHYLHEXYL)PHTHALATE	19 =	19 =	µg/L	AOC-K-MW05	1 / 5	NA	19	NA	4.80E+00	6.0	MCL	N	LabC
		CALCIUM	76000 =	120000 =	µg/L	AOC-K-MW01, AOC-K-MW03	5 / 5	NA	120,000	NA		NA	NA	N	NSV
	18540-29-9	CHROMIUM, TOTAL	4.8 J	19 =	µg/L	AOC-K-MW04	3 / 5	NA	19	NA	1.09E+01	100	MCL	Y	ASL
	7440-48-4	COBALT	5.4 J	23 J	µg/L	AOC-K-MW04	2 / 5	NA	23	NA	7.30E+01	NA	NA	N	BSL
	7440-50-8	COPPER	5.1 J	26 =	µg/L	AOC-K-MW04	4 / 5	NA	26	NA	1.46E+02	1,300	MCL	N	BSL
	7439-89-6	IRON	66 J	9600 =	µg/L	AOC-K-MW04	5 / 5	NA	9,600	NA	1.09E+03	NA	NA	Y	ASL
		MAGNESIUM	49000 =	76000 =	µg/L	AOC-K-MW03	5 / 5	NA	76,000	NA		NA	NA	N	NSV
	7439-96-5	MANGANESE	18 =	1300 J	µg/L	AOC-K-MW04	5 / 5	NA	1,300	NA	8.76E+01	NA	NA	Y	ASL
	7440-02-0	NICKEL	9.2 J	30 J	µg/L	AOC-K-MW04	3 / 5	NA	30	NA	7.30E+01	100	MCL	N	BSL
		POTASSIUM	5100 J	8500 J	µg/L	AOC-K-MW01	5 / 5	NA	8,500	NA		NA	NA	N	NSV
		SODIUM	160000 =	210000 =	µg/L	AOC-K-MW03	5 / 5	NA	210,000	NA		NA	NA	N	NSV
	7440-28-0	THALLIUM	8 J	9.3 J	µg/L	AOC-K-MW01	2 / 5	NA	9.3	NA	2.41E-01	2.0	MCL	Y	ASL
	108-88-3	TOLUENE	0.43 J	0.75 J	µg/L	AOC-K-MW05	3 / 5	NA	0.75	NA	7.23E+01	1,000	MCL	N	BSL
	7440-62-2	VANADIUM	6.9 J	64 =	µg/L	AOC-K-MW04	5 / 5	NA	64	NA	2.55E+01	NA	NA	Y	ASL
	7440-66-6	ZINC	22 =	28 =	µg/L	AOC-K-MW04	2 / 5	NA	28	NA	1.09E+03	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	NA								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	NA								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	Aluminum	ug/L	2547.5	15188051 (L)	9100	9.1	mg/L	Max detect	4
	Barium	ug/L	204.8	502 (L)	390	0.39	mg/L	Max detect	4
	Chromium	ug/L	3.1745	6.25 (NP)	19	0.00625	mg/L	UCL95 (NP)	3
	Iron	ug/L	3075.2	9619473 (L)	9600	9.6	mg/L	Max detect	4
	Manganese	ug/L	394	1725260 (L)	1300	1.3	mg/L	Max detect	4
	Thallium	ug/L	4.48	7.02 (NP)	9.3	0.00702	mg/L	UCL95 (NP)	3
	Vanadium	ug/L	23.18	131 (L)	64	0.064	mg/L	Max detect	4

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				ET	Event Duration	0.05	hr/event	g	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	5	events/day	g	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Best professional judgement, assumed to be equivalent to dermal event duration for residential adult as recommended by EPA Region 2 (five 3-min events).

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposura Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	2	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	18000	cm^2	e	
				ET	Event Duration	0.25	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	6600	cm^2	e	
				ET	Event Duration	0.45	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	
					Aluminum	0.001		e	DAevent(inorganics) = Cw x Kp x ET
					Antimony	0.001		e	
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 27 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

AOC K

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

AOC K

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

AOC K

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

AOC K

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

AOC K

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe:	Current
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	9E+00	mg/L	3.2E-02	mg/kg/day				8.9E-02	mg/kg/day	1.0E+00	mg/kg/day	8.9E-02
				Barium	4E-01	mg/L	1.4E-03	mg/kg/day				3.8E-03	mg/kg/day	7.0E-02	mg/kg/day	5.5E-02
				Chromium	6E-03	mg/L	2.2E-05	mg/kg/day				6.1E-05	mg/kg/day	3.0E-03	mg/kg/day	2.0E-02
				Iron	1E+01	mg/L	3.4E-02	mg/kg/day				9.4E-02	mg/kg/day	3.0E-01	mg/kg/day	3.1E-01
				Manganese	1E+00	mg/L	4.5E-03	mg/kg/day				1.3E-02	mg/kg/day	1.4E-01	mg/kg/day	9.1E-02
				Thallium	7E-03	mg/L	2.5E-05	mg/kg/day				6.9E-05	mg/kg/day	8.0E-05	mg/kg/day	8.6E-01
				Vanadium	6E-02	mg/L	2.2E-04	mg/kg/day				6.3E-04	mg/kg/day	7.0E-03	mg/kg/day	8.9E-02
			Exp. Route Total								0.0E+00					1.5E+00
			Dermal	Aluminum	9E+00	mg/L	2.6E-05	mg/kg/day				7.3E-05	mg/kg/day	4.0E-02	mg/kg/day	1.8E-03
				Barium	4E-01	mg/L	1.1E-06	mg/kg/day				3.1E-06	mg/kg/day	7.0E-02	mg/kg/day	4.5E-05
				Chromium	6E-03	mg/L	3.6E-08	mg/kg/day				1.0E-07	mg/kg/day	3.9E-05	mg/kg/day	2.6E-03
				Iron	1E+01	mg/L	2.8E-05	mg/kg/day				7.7E-05	mg/kg/day	3.0E-01	mg/kg/day	2.6E-04
				Manganese	1E+00	mg/L	3.7E-06	mg/kg/day				1.0E-05	mg/kg/day	5.6E-03	mg/kg/day	1.9E-03
				Thallium	7E-03	mg/L	2.0E-08	mg/kg/day				5.7E-08	mg/kg/day	8.0E-05	mg/kg/day	7.1E-04
				Vanadium	6E-02	mg/L	1.8E-07	mg/kg/day				5.2E-07	mg/kg/day	1.8E-04	mg/kg/day	2.8E-03
			Exp. Route Total								0.0E+00					1.0E-02
		Exposure Point Total									0.0E+00					1.5E+00
	Exposure Medium Total										0.0E+00					1.5E+00
Medium Total											0.0E+00					1.5E+00
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	1.5E+00

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	9E+00	mg/L	8.5E-02	mg/kg/day				2.5E-01	mg/kg/day	1.0E+00	mg/kg/day	2.5E-01
				Barium	4E-01	mg/L	3.7E-03	mg/kg/day				1.1E-02	mg/kg/day	7.0E-02	mg/kg/day	1.5E-01
				Chromium	6E-03	mg/L	5.9E-05	mg/kg/day				1.7E-04	mg/kg/day	3.0E-03	mg/kg/day	5.7E-02
				Iron	1E+01	mg/L	9.0E-02	mg/kg/day				2.6E-01	mg/kg/day	3.0E-01	mg/kg/day	8.8E-01
				Manganese	1E+00	mg/L	1.2E-02	mg/kg/day				3.6E-02	mg/kg/day	1.4E-01	mg/kg/day	2.5E-01
				Thallium	7E-03	mg/L	6.6E-05	mg/kg/day				1.9E-04	mg/kg/day	8.0E-05	mg/kg/day	2.4E+00
				Vanadium	6E-02	mg/L	6.0E-04	mg/kg/day				1.8E-03	mg/kg/day	7.0E-03	mg/kg/day	2.5E-01
			Exp. Route Total								0.0E+00					4.2E+00
			Dermal	Aluminum	9E+00	mg/L	1.9E-04	mg/kg/day				5.8E-04	mg/kg/day	4.0E-02	mg/kg/day	1.4E-02
				Barium	4E-01	mg/L	8.2E-06	mg/kg/day				2.4E-05	mg/kg/day	7.0E-02	mg/kg/day	3.4E-04
				Chromium	6E-03	mg/L	2.6E-07	mg/kg/day				7.7E-07	mg/kg/day	3.9E-05	mg/kg/day	2.0E-02
				Iron	1E+01	mg/L	2.0E-04	mg/kg/day				5.9E-04	mg/kg/day	3.0E-01	mg/kg/day	2.0E-03
				Manganese	1E+00	mg/L	2.7E-05	mg/kg/day				8.0E-05	mg/kg/day	5.6E-03	mg/kg/day	1.4E-02
				Thallium	7E-03	mg/L	1.5E-07	mg/kg/day				4.3E-07	mg/kg/day	8.0E-05	mg/kg/day	5.4E-03
				Vanadium	8E-02	mg/L	1.4E-06	mg/kg/day				3.9E-06	mg/kg/day	1.8E-04	mg/kg/day	2.2E-02
			Exp. Route Total								0.0E+00					7.7E-02
		Exposure Point Total									0.0E+00					4.3E+00
	Exposure Medium Total										0.0E+00					4.3E+00
Medium Total											0.0E+00					4.3E+00
									Total of Receptor Risks Across All Media		0.0E+00			Total of Receptor Hazards Across All Media		4.3E+00

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Aluminum	9E+00	mg/L	5.0E-02	mg/kg/day				5.8E-01	mg/kg/day	1.0E+00	mg/kg/day	5.8E-01
				Barium	4E-01	mg/L	2.1E-03	mg/kg/day				2.5E-02	mg/kg/day	7.0E-02	mg/kg/day	3.8E-01
				Chromium	6E-03	mg/L	3.4E-05	mg/kg/day				4.0E-04	mg/kg/day	3.0E-03	mg/kg/day	1.3E-01
				Iron	1E+01	mg/L	5.3E-02	mg/kg/day				6.1E-01	mg/kg/day	3.0E-01	mg/kg/day	2.0E+00
				Manganese	1E+00	mg/L	7.1E-03	mg/kg/day				8.3E-02	mg/kg/day	1.4E-01	mg/kg/day	5.9E-01
				Thallium	7E-03	mg/L	3.6E-05	mg/kg/day				4.5E-04	mg/kg/day	8.0E-05	mg/kg/day	5.6E+00
				Vanadium	6E-02	mg/L	3.5E-04	mg/kg/day				4.1E-03	mg/kg/day	7.0E-03	mg/kg/day	5.8E-01
			Exp. Route Total								0.0E+00					9.9E+00
			Dermal	Aluminum	9E+00	mg/L	1.5E-04	mg/kg/day				1.7E-03	mg/kg/day	4.0E-02	mg/kg/day	4.3E-02
				Barium	4E-01	mg/L	6.3E-06	mg/kg/day				7.4E-05	mg/kg/day	7.0E-02	mg/kg/day	1.1E-03
				Chromium	8E-03	mg/L	2.0E-07	mg/kg/day				2.4E-06	mg/kg/day	3.9E-05	mg/kg/day	6.1E-02
				Iron	1E+01	mg/L	1.6E-04	mg/kg/day				1.8E-03	mg/kg/day	3.0E-01	mg/kg/day	6.1E-03
				Manganese	1E+00	mg/L	2.1E-05	mg/kg/day				2.5E-04	mg/kg/day	5.6E-03	mg/kg/day	4.4E-02
				Thallium	7E-03	mg/L	1.1E-07	mg/kg/day				1.3E-06	mg/kg/day	6.0E-05	mg/kg/day	1.7E-02
				Vanadium	6E-02	mg/L	1.0E-06	mg/kg/day				1.2E-05	mg/kg/day	1.8E-04	mg/kg/day	6.7E-02
			Exp. Route Total								0.0E+00					2.4E-01
		Exposure Point Total									0.0E+00					1.0E+01
	Exposure Medium Total										0.0E+00					1.0E+01
Medium Total											0.0E+00					1.0E+01
										Total of Receptor Risks Across All Media	0.0E+00				Total of Receptor Hazards Across All Media	1.0E+01

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

AOC K

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				Cancer Risk
					Value	Units		Intake/Activity		CSF		
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe: Current
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.089041096	NA	0.001836473	0.09
			Barium						Cardiovascular	0.054514957	NA	4.49748E-05	0.05
			Chromium						Respiratory, not specified	0.020384866	NA	0.00258731	0.02
			Iron						Gastrointestinal	0.313111546	NA	0.000258317	0.31
			Manganese						Neurological	0.090858261	NA	0.001873952	0.09
			Thallium						Hair loss, liver	0.858610568	NA	0.000708354	0.86
			Vanadium						None Specified	0.089460442	NA	0.002838649	0.09
		Exposure Point Total						0.00E+00					1.53
	Exposure Medium Total							0.00E+00					1.53
Medium Total								0.00E+00					1.53
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	1.53

Total Organ (Body weight) HI Across All Media =	0.09
Total Organ (Cardiovascular) HI Across All Media =	0.05
Total Organ (Respiratory, not specified) HI Across All Media =	0.02
Total Organ (Gastrointestinal) HI Across All Media =	0.31
Total Organ (Neurological) HI Across All Media =	0.09
Total Organ (Hair loss, liver) HI Across All Media =	0.86
Total Organ (None Specified) HI Across All Media =	0.09

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.249315068	NA	0.014023973	0.263
			Barium						Cardiovascular	0.152641879	NA	0.000343444	0.153
			Chromium						Respiratory, not specified	0.057077626	NA	0.01975764	0.077
			Iron						Gastrointestinal	0.876712329	NA	0.001972803	0.679
			Manganese						Neurological	0.254403131	NA	0.014310176	0.269
			Thallium						Hair loss, liver	2.404109589	NA	0.005409247	2.410
			Vanadium						None Specified	0.250489237	NA	0.021676953	0.272
		Exposure Point Total						0.00E+00					4.322
	Exposure Medium Total							0.00E+00					4.322
Medium Total								0.00E+00					4.322
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	4.322

Total Organ (Body weight) HI Across All Media =	0.263
Total Organ (Cardiovascular) HI Across All Media =	0.153
Total Organ (Respiretory, not specified) HI Across All Media =	0.077
Total Organ (Gastrointestinal) HI Across All Media =	0.879
Total Organ (Neurological) HI Across All Media =	0.269
Total Organ (Hair loss, liver) HI Across All Media =	2.410
Total Organ (None Specified) HI Across All Media =	0.272

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC K

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (8 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Aluminum						Body weight	0.58173516	NA	0.043193836	0.624928995
			Barium						Cardiovascular	0.356184384	NA	0.001057808	0.357222192
			Chromium						Respiratory, not specified	0.133181126	NA	0.06085353	0.194034656
			Iron						Gastrointestinal	2.0456621	NA	0.006075616	2.051737717
			Manganese						Neurological	0.593607306	NA	0.044075342	0.637682648
			Thallium						Hair loss, liver	5.609589041	NA	0.016660479	5.626249521
			Vanadium						None Specified	0.584474886	NA	0.066765016	0.651239902
		Exposure Point Total						0.00E+00					10.14309563
	Exposure Medium Total							0.00E+00					10.14309563
Medium Total								0.00E+00					10.14309563
Receptor Total							Receptor Risk Total	0.00E+00				Receptor HI Total	10.14309563
							Sum of Residential Adult and Residential Child Risks	0.0E+00					

Total Organ (Body weight) HI Across All Media =	0.624928995
Total Organ (Cardiovascular) HI Across All Media =	0.357222192
Total Organ (Respiratory, not specified) HI Across All Media =	0.194034656
Total Organ (Gastrointestinal) HI Across All Media =	2.051737717
Total Organ (Neurological) HI Across All Media =	0.637682648
Total Organ (Hair loss, liver) HI Across All Media =	5.626249521
Total Organ (None Specified) HI Across All Media =	0.651239902

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
AOC K

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =
Total Organ 2 HI Across All Media =

Appendix D-9
AOC L Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-9 Contents for AOC L Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 35
Table 1: Selection of Exposure Pathways	p. 2 of 35
Table 2.1: Occurrence, Distribution, and Selection of COPCs (Surface Soil)	p. 3 of 35
Table 2.2: Occurrence, Distribution, and Selection of COPCs (Subsurface Soil)	p. 4 of 35
Table 3.1 RME: EPC Summary (Surface Soil)	p. 5 of 35
Table 3.2 RME: EPC Summary (Subsurface Soil)	p. 6 of 35
Table 3.3 RME: EPC Summary (Groundwater)	p. 7 of 35
Table 4.1 RME: Values Used for Daily Intake Calculations (Surface Soil – Current Timeframe)	p. 8 of 35
Table 4.2 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 9 of 35
Table 4.3 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 10 of 35
Table 4.4 RME: Values Used for Daily Intake Calculations (Surface Soil - Current Timeframe)	p. 11 of 35
Table 4.5 RME: Values Used for Daily Intake Calculations (Subsurface Soil - Current Timeframe)	p. 12 of 35
Table 4.6 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 13 of 35
Table 4.7 RME: Values Used for Daily Intake Calculations (Surface Soil - Future Timeframe)	p. 14 of 35
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 15 of 35
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 16 of 35
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 17 of 35
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 18 of 35
Table 6.2: Cancer Toxicity Data – Inhalation	p. 19 of 35
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Maintenance Worker – Adult)	p. 20 of 35
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 21 of 35
Table 7.3 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Adult)	p. 22 of 35
Table 7.4 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Recreational – Child)	p. 23 of 35
Table 7.5 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Construction Worker – Adult)	p. 24 of 35

Appendix D-9 Contents for AOC L Risk Assessment Tables

Table No.	Page No.
Table 7.6 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 25 of 35
Table 7.7 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 26 of 35
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 27 of 35
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Maintenance Worker – Adult)	p. 28 of 35
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 29 of 35
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Adult)	p. 30 of 35
Table 9.4 RME: Summary of Receptor Risks and Hazards for COPCs (Recreational – Child)	p. 31 of 35
Table 9.5 RME: Summary of Receptor Risks and Hazards for COPCs (Construction Worker – Adult)	p. 32 of 35
Table 9.6 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 33 of 35
Table 9.7 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 34 of 35
Table 10.1 RME: Risk Summary	p. 35 of 35

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	AOC L
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

AOC L

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	Direct contact with COPCs in site soil.	Maintenance Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of workers in the area involved in lawn mowing activities.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Recreational	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of current occasional trespasser and future recreational site users.
	Soil	Subsurface Soil	Direct contact with COPCs in site soil.	Construction Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of utility workers and construction workers where excavations are possible.
Future	Soil	Surface Soil	Direct contact with COPCs in site soil.	Industrial Worker	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Scenario is protective of future indusrtial workers at the site.
	Soil	Surface Soil	Direct contact with COPCs in site soil.	Residential	Adult	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison
					Child	Injestion Dermal Inhalation	Quantitative Quantitative Quantitative	Although the site topography is unsuitable for residential development, this represents a worst-case scenario for the purpose of comparison

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC L

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Surface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Surface Soil		2-HEXANONE	0.00087 J	0.0012 J	mg/kg	AOCLSB004	2 / 4	NA	0.0012	NA				N	NSV
	7429-90-5	**ALUMINUM**	**6350 =**	**9150 =**	**mg/kg**	**AOCLSB002**	**4 / 4**	**NA**	**9,150**	**NA**	**7.61E+03**			**Y**	**ASL**
	7440-36-0	ANTIMONY	0.5 J	0.71 J	mg/kg	AOCLSB002	4 / 4	NA	0.71	NA	3.13E+00			N	BSL
	7440-38-2	**ARSENIC**	**0.46 J**	**1 J**	**mg/kg**	**AOCLSB001**	**3 / 4**	**NA**	**1.0**	**NA**	**3.90E-01**			**Y**	**ASL**
	7440-39-3	BARIUM	40 J	113 =	mg/kg	AOCLSB001	4 / 4	NA	113	NA	5.37E+02			N	BSL
	7440-41-7	BERYLLIUM	0.11 J	0.14 J	mg/kg	AOCLSB004	4 / 4	NA	0.14	NA	1.54E+01			N	BSL
		CALCIUM	4300 =	36500 =	mg/kg	AOCLSB001	4 / 4	NA	36,500	NA				N	NSV
	18540-29-9	CHROMIUM, TOTAL	7.3 =	11 =	mg/kg	AOCLSB002	4 / 4	NA	11	NA	3.01E+01			Y	BSL
	7440-48-4	COBALT	5.3 J	8.1 J	mg/kg	AOCLSB002	4 / 4	NA	8.1	NA	9.03E+02			N	BSL
	7440-50-8	COPPER	18 =	34 =	mg/kg	AOCLSB002	4 / 4	NA	34	NA	3.13E+02			N	BSL
	7439-89-6	**IRON**	**12600 =**	**17700 =**	**mg/kg**	**AOCLSB002**	**4 / 4**	**NA**	**17,700**	**NA**	**2.35E+03**			**Y**	**ASL**
	7439-92-1	LEAD	7.8 =	9.9 =	mg/kg	AOCLSB001	4 / 4	NA	9.9	NA	4.00E+02			N	BSL
		MAGNESIUM	1750 =	3430 =	mg/kg	AOCLSB002	4 / 4	NA	3,430	NA				N	NSV
	7439-96-5	**MANGANESE**	**332 =**	**472 =**	**mg/kg**	**AOCLSB003**	**4 / 4**	**NA**	**472**	**NA**	**1.76E+02**			**Y**	**ASL**
	7487-94-7	MERCURY	0.033 J	0.071 =	mg/kg	AOCLSB001	4 / 4	NA	0.071	NA	2.35E+00			N	BSL
	7440-02-0	NICKEL	3.4 J	7.2 J	mg/kg	AOCLSB002	4 / 4	NA	7.2	NA	1.56E+02			N	BSL
	72-55-9	p,p'-DDE	0.0016 J	0.0023 J	mg/kg	AOCLSB004	2 / 4	NA	0.0023	NA	1.72E+00			N	BSL
	50-29-3	p,p'-DDT	0.0012 J	0.0091 =	mg/kg	AOCLSB002	2 / 4	NA	0.0091	NA	1.72E+00			N	BSL
		POTASSIUM	849 J	1350 =	mg/kg	AOCLSB002	4 / 4	NA	1,350	NA				N	NSV
	7782-49-2	SELENIUM	0.78 J	1.2 J	mg/kg	AOCLSB002	4 / 4	NA	1.2	NA	3.91E+01			N	BSL
		SODIUM	61 J	275 J	mg/kg	AOCLSB001	4 / 4	NA	275	NA				N	NSV
	7440-62-2	VANADIUM	36 =	51 =	mg/kg	AOCLSB002	4 / 4	NA	51	NA	5.47E+01			N	BSL
	7440-66-6	ZINC	54 =	82 =	mg/kg	AOCLSB001	4 / 4	NA	82	NA	2.35E+03			N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value ara from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

AOC L

Scenario Timeframe: Current and Future
Medium: Soil
Exposure Medium: Subsurface Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifiar) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Subsurface Soil	7429-90-5	ALUMINUM	1970 =	6980 =	mg/kg	AOCLSB003	4 / 4	NA	6,980	NA	1.00E+04	NA	NA	N	BSL
	7440-36-0	ANTIMONY	0.3 J	0.71 J	mg/kg	AOCLSB001	4 / 4	NA	0.71	NA	4.09E+01	NA	NA	N	BSL
	7440-38-2	**ARSENIC**	**1.4 J**	**1.7 J**	**mg/kg**	**AOCLSB002**	**3 / 4**	**NA**	**1.7**	**NA**	**1.59E+00**	**NA**	**NA**	**Y**	**ASL**
	7440-39-3	BARIUM	27 J	57 =	mg/kg	AOCLSB003	4 / 4	NA	57	NA	6.66E+03	NA	NA	N	BSL
	7440-41-7	BERYLLIUM	0.13 J	0.31 J	mg/kg	AOCLSB002	4 / 4	NA	0.31	NA	1.94E+03	NA	NA	N	BSL
	7440-43-9	CADMIUM	0.049 J	0.13 J	mg/kg	AOCLSB002	2 / 4	NA	0.13	NA	4.51E+01	NA	NA	N	BSL
		CALCIUM	2230 =	185000 =	mg/kg	AOCLSB001	4 / 4	NA	185,000	NA	NA	NA	NA	N	NSV
	18540-29-9	CHROMIUM, TOTAL	6.4 =	9 =	mg/kg	AOCLSB001	4 / 4	NA	9.0	NA	6.40E+01	NA	NA	N	BSL
	7440-48-4	COBALT	1.5 J	5.2 J	mg/kg	AOCLSB003	4 / 4	NA	5.2	NA	1.92E+03	NA	NA	N	BSL
	7440-50-8	COPPER	3.7 J	18 =	mg/kg	AOCLSB003	4 / 4	NA	18	NA	4.09E+03	NA	NA	N	BSL
	100-41-4	ETHYLBENZENE	0.002 J	0.002 J	mg/kg	AOCLSB003	1 / 4	NA	0.0020	NA	1.95E+01	NA	NA	N	BSL
	7439-89-6	**IRON**	**5100 =**	**12500 =**	**mg/kg**	**AOCLSB003**	**4 / 4**	**NA**	**12,500**	**NA**	**1.00E+04**	**NA**	**NA**	**Y**	**ASL**
	7439-92-1	LEAD	0.9 =	5.2 =	mg/kg	AOCLSB004	4 / 4	NA	5.2	NA	7.50E+02	NA	NA	N	BSL
	1330-20-7	M,P-XYLENE (SUM OF ISOMERS)	0.009 J	0.009 J	mg/kg	AOCLSB003	1 / 4	NA	0.0090	NA	4.20E+01	NA	NA	N	BSL
		MAGNESIUM	1940 =	9460 =	mg/kg	AOCLSB002	4 / 4	NA	9,460	NA	NA	NA	NA	N	NSV
	7439-96-5	MANGANESE	87 =	324 =	mg/kg	AOCLSB003	4 / 4	NA	324	NA	1.95E+03	NA	NA	N	BSL
	7487-94-7	MERCURY	0.006 J	0.1 =	mg/kg	AOCLSB004	4 / 4	NA	0.10	NA	3.07E+01	NA	NA	N	BSL
	7440-02-0	NICKEL	1.2 J	3.5 J	mg/kg	AOCLSB003	4 / 4	NA	3.5	NA	2.04E+03	NA	NA	N	BSL
	1330-20-7	O-XYLENE (1,2-DIMETHYLBENZENE	0.0031 J	0.0031 J	mg/kg	AOCLSB003	1 / 4	NA	0.0031	NA	4.20E+01	NA	NA	N	BSL
		POTASSIUM	328 J	920 J	mg/kg	AOCLSB004	4 / 4	NA	920	NA	NA	NA	NA	N	NSV
	7782-49-2	SELENIUM	0.79 J	0.79 J	mg/kg	AOCLSB003	1 / 4	NA	0.79	NA	5.11E+02	NA	NA	N	BSL
		SODIUM	130 J	1480 =	mg/kg	AOCLSB001	4 / 4	NA	1,460	NA		NA	NA	N	NSV
	7440-62-2	VANADIUM	21 =	35 =	mg/kg	AOCLSB003	4 / 4	NA	35	NA	7.15E+02	NA	NA	N	BSL
	1330-20-7	XYLENES, TOTAL	0.012 =	0.012 =	mg/kg	AOCLSB003	1 / 4	NA	0.012	NA	4.20E+01	NA	NA	N	BSL
	7440-66-6	ZINC	6.6 =	39 =	mg/kg	AOCLSB004	4 / 4	NA	39	NA	1.00E+04	NA	NA	N	BSL

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.

= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.

BSL - below screening level.

NSV - Screening level not available.

BMCL - below maximum contaminant level (MCL, National Drinking Watar Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Current/Future
Medium:	Surface Soil
Exposure Medium:	Surface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Surface Soil	Aluminum	mg/Kg	7747.5	9156 (N)	9150	9150	mg/Kg	Max Detect	4
	Arsenic	mg/Kg	0.53375	9.1 (L)	1	1	mg/Kg	Max Detect	4
	Iron	mg/Kg	14550	17806 (L)	17700	17700	mg/Kg	Max Detect	4
	Manganese	mg/Kg	397	481 (N)	472	472	mg/Kg	Max Detect	4

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Current/Future
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Subsurface Soil	Arsenic	mg/Kg	0.861875	1.28 (N)	1.7	1.28	mg/Kg	UCL95 (N)	1
	Iron	mg/Kg	11596.25	14303 (N)	17700	14303	mg/Kg	UCL95 (N)	1

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	NA								

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Maintenance Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Maintenance Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Maintenance Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	52	day/year	once/week	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Inhalation:	Industrial Worker	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	e	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	a	
				FI	Fraction ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Recreational	Adult	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.4.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
AOC L

Scenario Timeframe: Current
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	a	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Recreational	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	104	day/year	g	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.
[b]Exposure Factors Handbook, Volume I,May 1989.
[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.
[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.
[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.
[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.
[g]Assumed recreational visit to the site is two days per week, spending entire outing at the site.
[h]Recommended by EPA Region 2
[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.
NA = Not applicable or not svailable.
RME = Reasonable Maximum Exposure Concentration
Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.5.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Current
Medium: Subsurface Soil
Exposure Medium: Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	330	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	h	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Dermal:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.3	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Aluminum	0.001		e	
					Arsenic	0.03		i	DAevent = Cs x CF x AF x ABS
					Iron	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		
Inhalation:	Construction Worker	Adult	Subsurface Soil	**Cs**	Concentration in soil	Table 3.2	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	250	day/year	once/week	
				ED	Exposure Duration	0.5	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	183	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TA. +.6.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	100	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	5700	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.07	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Inhalation:	Residential	Adult	Surface Soil	**Cs**	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.7.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
AOC L

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Surface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x IR x FI x EF x ED x CF / BW x AT
				IR	Ingestion Rate	200	mg/day	c	
				FI	Fraction Ingested	1	unitless	assumed	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	c	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	2800	cm^2	e	
				AF	Soil-Skin Adherence Factor	0.2	mg/cm^2-event	e	
				ABS	Absorption Factor	chemical specific	unitless		DAevent = Absorbed Dose per event
					Benzo(a)pyrene	0.13		e	
					Aluminum	0.001		i	DAevent = Cs x CF x AF x ABS
					Antimony	0.001		i	
					Arsenic	0.03		e	
					Chromium	0.001		i	
					Iron	0.001		i	
					Manganese	0.001		i	
					Thallium	0.001		i	
					Vanadium	0.001		i	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				CF	Conversion Factor	1.00E-06	kg/mg		
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Inhalation:	Residential	Child (6 years)	Surface Soil	Cs	Concentration in soil	Table 3.1	mg/kg		CDI = Cs x [(1/PEF)+(1/VF)] x IR x EF x ED / BW x AT
				PEF	Particulate Emission Factor	1.36E+09	m^3/kg	c	
				VF	Volatilization Factor	chemical specific	m^3/kg	d	
				IR	Inhalation Rate	20	m^3/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.
[b]Exposure Factors Handbook, Volume I,May 1989.
[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.
[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.
[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.
[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.
[g]Assumed
[h]Recommended by EPA Region 2
[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.
NA = Not applicable or not available.
RME = Reasonable Maximum Exposure Concentration
Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

AOC L

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	6.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

AOC L

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

AOC L

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

AOC L

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

AOC L

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Current
Receptor Population:	Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	9E+03	mg/Kg	6.7E-04	mg/kg/day				1.9E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0019
				Arsenic	1E+00	mg/Kg	7.3E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.1E-07	2.0E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0007
				Iron	2E+04	mg/Kg	1.3E-03	mg/kg/day				3.6E-03	mg/kg/day	3.0E-01	mg/kg/day	0.0120
				Manganese	5E+02	mg/Kg	3.4E-05	mg/kg/day				9.6E-05	mg/kg/day	1.4E-01	mg/kg/day	0.0007
			Exp. Route Total								1.1E-07					0.0152
			Dermal	Aluminum	9E+03	mg/Kg	4.4E-08	mg/kg/day				1.2E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0003
				Arsenic	1E+00	mg/Kg	1.4E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.2E-08	4.0E-08	mg/kg/day	3.0E-04	mg/kg/day	0.0001
				Iron	2E+04	mg/Kg	6.5E-06	mg/kg/day				2.4E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0001
				Manganese	5E+02	mg/Kg	2.3E-07	mg/kg/day				6.3E-07	mg/kg/day	5.6E-03	mg/kg/day	0.0001
			Exp. Route Total								2.2E-08					0.0006
			Inhalation	Aluminum	9E+03	mg/Kg	9.8E-08	mg/kg/day				2.7E-07	mg/kg/day	1.4E-03	mg/kg/day	0.0002
				Arsenic	1E+00	mg/Kg	1.1E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.6E-10	3.0E-11	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	1.9E-07	mg/kg/day				5.3E-07	mg/kg/day			
				Manganese	5E+02	mg/Kg	5.0E-09	mg/kg/day				1.4E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0010
			Exp. Route Total								1.6E-10					0.0012
		Exposure Point Total									1.3E-07					0.0170
	Exposure Medium Total										1.3E-07					0.0170
Medium Total											1.3E-07					0.0170
										Total of Receptor Risks Across All Media	1.3E-07				Total of Receptor Hazards Across All Media	0.0170

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Future
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	9E+03	mg/Kg	3.2E-03	mg/kg/day				9.0E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0090
				Arsenic	1E+00	mg/Kg	3.5E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	5.2E-07	9.8E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0033
				Iron	2E+04	mg/Kg	6.2E-03	mg/kg/day				1.7E-02	mg/kg/day	3.0E-01	mg/kg/day	0.0577
				Manganese	5E+02	mg/Kg	1.6E-04	mg/kg/day				4.6E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0033
			Exp. Route Total								5.2E-07					0.0732
			Dermal	Aluminum	9E+03	mg/Kg	2.1E-05	mg/kg/day				5.9E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0015
				Arsenic	1E+00	mg/Kg	6.9E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.0E-07	1.9E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0006
				Iron	2E+04	mg/Kg	4.1E-05	mg/kg/day				1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0004
				Manganese	5E+02	mg/Kg	1.1E-06	mg/kg/day				3.0E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0005
			Exp. Route Total								1.0E-07					0.0030
			Inhalation	Aluminum	9E+03	mg/Kg	4.7E-07	mg/kg/day				1.3E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0009
				Arsenic	1E+00	mg/Kg	5.1E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	7.7E-10	1.4E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	9.1E-07	mg/kg/day				2.5E-06	mg/kg/day			
				Manganese	5E+02	mg/Kg	2.4E-06	mg/kg/day				8.8E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0048
			Exp. Route Total								7.7E-10					0.0057
		Exposure Point Total									6.3E-07					0.0820
	Exposure Medium Total										6.3E-07					0.0820
Medium Total											6.3E-07					0.0820
										Total of Receptor Risks Across All Media	6.3E-07				Total of Receptor Hazards Across All Media	0.0820

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	9E+03	mg/Kg	1.3E-03	mg/kg/day				3.7E-03	mg/kg/day	1.0E+00	mg/kg/day	0.0037
				Arsenic	1E+00	mg/Kg	1.4E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	2.1E-07	4.1E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0014
				Iron	2E+04	mg/Kg	2.5E-03	mg/kg/day				7.2E-03	mg/kg/day	3.0E-01	mg/kg/day	0.0240
				Manganese	5E+02	mg/Kg	6.6E-05	mg/kg/day				1.9E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0014
			Exp. Route Total								2.1E-07					0.0305
			Dermal	Aluminum	9E+03	mg/Kg	1.5E-05	mg/kg/day				4.2E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0011
				Arsenic	1E+00	mg/Kg	4.8E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	7.2E-08	1.4E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0005
				Iron	2E+04	mg/Kg	2.8E-05	mg/kg/day				8.2E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0003
				Manganese	5E+02	mg/Kg	7.5E-07	mg/kg/day				2.2E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0004
			Exp. Route Total								7.2E-06					0.0022
			Inhalation	Aluminum	9E+03	mg/Kg	1.9E-07	mg/kg/day				5.5E-07	mg/kg/day	1.4E-03	mg/kg/day	0.0004
				Arsenic	1E+00	mg/Kg	2.1E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	3.1E-10	6.0E-11	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	3.6E-07	mg/kg/day				1.1E-06	mg/kg/day			
				Manganese	5E+02	mg/Kg	9.7E-09	mg/kg/day				2.8E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0020
			Exp. Route Total								3.1E-10					0.0024
		Exposure Point Total									2.8E-07					0.0350
	Exposure Medium Total										2.8E-07					0.0350
Medium Total											2.8E-07					0.0350
										Total of Receptor Risks Across All Media	2.8E-07				Total of Receptor Hazards Across All Media	0.0350

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Current
Receptor Population:	Recreational
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	9E+03	mg/Kg	3.0E-03	mg/kg/day				3.5E-02	mg/kg/day	1.0E+00	mg/kg/day	0.0348
				Arsenic	1E+00	mg/Kg	3.3E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.9E-07	3.8E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0127
				Iron	2E+04	mg/Kg	5.8E-03	mg/kg/day				8.7E-02	mg/kg/day	3.0E-01	mg/kg/day	0.2241
				Manganese	5E+02	mg/Kg	1.5E-04	mg/kg/day				1.8E-03	mg/kg/day	1.4E-01	mg/kg/day	0.0128
			Exp. Route Total								4.9E-07					0.2844
			Dermal	Aluminum	9E+03	mg/Kg	8.3E-06	mg/kg/day				9.7E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0024
				Arsenic	1E+00	mg/Kg	2.7E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.1E-08	3.2E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0011
				Iron	2E+04	mg/Kg	1.6E-05	mg/kg/day				1.9E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0006
				Manganese	5E+02	mg/Kg	4.3E-07	mg/kg/day				5.0E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0009
			Exp. Route Total								4.1E-06					0.0050
			Inhalation	Aluminum	9E+03	mg/Kg	2.2E-07	mg/kg/day				2.6E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0018
				Arsenic	1E+00	mg/Kg	2.4E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	3.6E-10	2.8E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	4.2E-07	mg/kg/day				4.9E-06	mg/kg/day			
				Manganese	5E+02	mg/Kg	1.1E-08	mg/kg/day				1.3E-07	mg/kg/day	1.4E-05	mg/kg/day	0.0092
			Exp. Route Total								3.6E-10					0.0110
		Exposure Point Total									5.3E-07					0.3004
	Exposure Medium Total										5.3E-07					0.3004
Medium Total											5.3E-07					0.3004
										Total of Receptor Risks Across All Media	5.3E-07				Total of Receptor Hazards Across All Media	0.3004

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Current
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Subsurface Soil	Subsurface Soil		Arsenic	1E+00	mg/Kg	3.0E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.4E-08	4.1E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0138
				Iron	1E+04	mg/Kg	3.3E-04	mg/kg/day				4.6E-02	mg/kg/day	3.0E-01	mg/kg/day	0.1539
			Exp. Route Total								4.4E-08					0.1677
			Dermal	Arsenic	1E+00	mg/Kg	2.7E-09	mg/kg/day	1.5E+00	(mg/kg/day)-1	4.0E-09	3.7E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0012
				Iron	1E+04	mg/Kg	9.9E-07	mg/kg/day				1.4E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0005
			Exp. Route Total								4.0E-09					0.0017
			Inhalation	Arsenic	1E+00	mg/Kg	1.3E-12	mg/kg/day	1.5E+01	(mg/kg/day)-1	2.0E-11	1.8E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	1E+04	mg/Kg	1.5E-06	mg/kg/day				2.1E-06	mg/kg/day	N/A	N/A	#VALUE!
			Exp. Route Total								2.0E-11					0.0000
		Exposure Point Total									4.8E-08					0.1694
	Exposure Medium Total										4.8E-08					0.1694
Medium Total											4.8E-08					0.1694
										Total of Receptor Risks Across All Media	4.8E-08				Total of Receptor Hazards Across All Media	0.1694

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	9E+03	mg/Kg	4.3E-03	mg/kg/day				1.3E-02	mg/kg/day	1.0E+00	mg/kg/day	0.0125
				Arsenic	1E+00	mg/Kg	4.7E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	7.0E-07	1.4E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0046
				Iron	2E+04	mg/Kg	8.3E-03	mg/kg/day				2.4E-02	mg/kg/day	3.0E-01	mg/kg/day	0.0808
				Manganese	5E+02	mg/Kg	2.2E-04	mg/kg/day				6.5E-04	mg/kg/day	1.4E-01	mg/kg/day	0.0046
			Exp. Route Total								7.0E-07					0.1025
			Dermal	Aluminum	9E+03	mg/Kg	1.7E-05	mg/kg/day				5.0E-05	mg/kg/day	4.0E-02	mg/kg/day	0.0013
				Arsenic	1E+00	mg/Kg	5.6E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	6.4E-08	1.6E-07	mg/kg/day	3.0E-04	mg/kg/day	0.0005
				Iron	2E+04	mg/Kg	3.3E-05	mg/kg/day				9.7E-05	mg/kg/day	3.0E-01	mg/kg/day	0.0003
				Manganese	5E+02	mg/Kg	8.8E-07	mg/kg/day				2.8E-06	mg/kg/day	5.6E-03	mg/kg/day	0.0005
			Exp. Route Total								8.4E-08					0.0026
			Inhalation	Aluminum	9E+03	mg/Kg	6.3E-07	mg/kg/day				1.8E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0013
				Arsenic	1E+00	mg/Kg	6.9E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.0E-09	2.0E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	1.2E-08	mg/kg/day				3.8E-06	mg/kg/day			
				Manganese	5E+02	mg/Kg	3.3E-08	mg/kg/day				9.5E-08	mg/kg/day	1.4E-05	mg/kg/day	0.0067
			Exp. Route Total								1.0E-09					0.0079
		Exposure Point Total									7.9E-07					0.1131
	Exposure Medium Total										7.9E-07					0.1131
Medium Total											7.9E-07					0.1131
										Total of Receptor Risks Across All Media	7.9E-07				Total of Receptor Hazards Across All Media	0.1131

TABLE 7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (6 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Surface Soil	Surface Soil	Ingestion	Aluminum	9E+03	mg/Kg	1.0E-02	mg/kg/day				1.2E-01	mg/kg/day	1.0E+00	mg/kg/day	0.1170
				Arsenic	1E+00	mg/Kg	1.1E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.6E-06	1.3E-05	mg/kg/day	3.0E-04	mg/kg/day	0.0426
				Iron	2E+04	mg/Kg	1.9E-02	mg/kg/day				2.3E-01	mg/kg/day	3.0E-01	mg/kg/day	0.7543
				Manganese	5E+02	mg/Kg	5.2E-04	mg/kg/day				6.0E-03	mg/kg/day	1.4E-01	mg/kg/day	0.0431
			Exp. Route Total								1.6E-06					0.9570
			Dermal	Aluminum	9E+03	mg/Kg	2.8E-05	mg/kg/day				3.3E-04	mg/kg/day	4.0E-02	mg/kg/day	0.0082
				Arsenic	1E+00	mg/Kg	9.2E-06	mg/kg/day	1.5E+00	(mg/kg/day)-1	1.4E-07	1.1E-06	mg/kg/day	3.0E-04	mg/kg/day	0.0036
				Iron	2E+04	mg/Kg	5.4E-05	mg/kg/day				6.3E-04	mg/kg/day	3.0E-01	mg/kg/day	0.0021
				Manganese	5E+02	mg/Kg	1.4E-06	mg/kg/day				1.7E-05	mg/kg/day	5.6E-03	mg/kg/day	0.0030
			Exp. Route Total								1.4E-07					0.0169
			Inhalation	Aluminum	9E+03	mg/Kg	7.4E-07	mg/kg/day				6.6E-06	mg/kg/day	1.4E-03	mg/kg/day	0.0060
				Arsenic	1E+00	mg/Kg	8.1E-11	mg/kg/day	1.5E+01	(mg/kg/day)-1	1.2E-09	9.4E-10	mg/kg/day	2.9E-04	mg/kg/day	0.0000
				Iron	2E+04	mg/Kg	1.4E-06	mg/kg/day				1.7E-05	mg/kg/day			
				Manganese	5E+02	mg/Kg	3.8E-06	mg/kg/day				4.4E-07	mg/kg/day	1.4E-05	mg/kg/day	0.0311
			Exp. Route Total								1.2E-09					0.0371
		Exposure Point Total									1.8E-06					1.0110
	Exposure Medium Total										1.8E-06					1.0110
Medium Total											1.8E-06					1.0110
										Total of Receptor Risks Across All Media	1.8E-06				Total of Receptor Hazards Across All Media	1.0110

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

AOC L

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				Cancer Risk
					Value	Units		Intake/Activity		CSF		
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Current
Receptor Population: Maintenance Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.001862231	0.000191509	0.000307268	0.002361008
			Arsenic	1.09E-07	1.60E-10	2.16E-08	NA	1.31E-07	Skin	0.000678408	1.05017E-07	0.000134325	0.000812838
			Iron						Gastrointestinal	0.012007828	0	7.92517E-05	0.012087079
			Manganese						Neurological	0.000686162	0.000988583	0.000113217	0.001787962
			Chemical Total					1.31E-07					0.017048887
		Exposure Point Total						1.31E-07					0.017048887
	Exposure Medium Total							1.31E-07					0.017048887
Medium Total								1.31E-07					0.017048887
Receptor Total							Receptor Risk Total	1.31E-07				Receptor HI Total	0.017048887

Total Organ (Body weight) HI Across All Media =	0.002361008
Total Organ (Skin) HI Across All Media =	0.000812838
Total Organ (Gastrointestinal) HI Across All Media =	0.012087079
Total Organ (Neurological) HI Across All Media =	0.001787982

TAbL_ 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.008953033	0.000920715	0.00147725	0.011350999
			Arsenic	5.24E-07	7.71E-10	1.04E-07	NA	6.29E-07	Skin	0.003261579	5.04888E-07	0.000645793	0.003907876
			Iron						Gastrointestinal	0.057729941	0	0.000381018	0.058110959
			Manganese						Neurological	0.003298854	0.004752805	0.000544311	0.008595969
			Chemical Total					6.29E-07					0.081965803
		Exposure Point Total						6.29E-07					0.081965803
	Exposure Medium Total							6.29E-07					0.081965803
Medium Total								6.29E-07					0.081965803
Receptor Total							Receptor Risk Total	8.29E-07				Receptor HI Total	0.081965803

Total Organ (Body weight) HI Across All Media =	0.011350999
Total Organ (Skin) HI Across All Media =	0.003907876
Total Organ (Gastrointestinal) HI Across All Media =	0.058110959
Total Organ (Neurological) HI Across All Media =	0.008595969

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum	2.09E-07	3.08E-10	7.16E-08	NA	2.81E-07	Body weight	0.003724462	0.000383017	0.001061472	0.005168951
			Arsenic						Skin	0.001356817	2.10034E-07	0.000464031	0.001821058
			Iron						Gastrointestinal	0.024015656	0	0.000273778	0.024289434
			Manganese						Neurological	0.001372323	0.001977167	0.000391112	0.003740602
			Chemical Total					2.81E-07					0.035020045
		Exposure Point Total						2.81E-07					0.035020045
	Exposure Medium Total							2.81E-07					0.035020045
Medium Total								2.81E-07					0.035020045
Receptor Total							Receptor Risk Total	2.81E-07				Receptor HI Total	0.035020045

Total Organ (Body weight) HI Across All Media =	0.005168951
Total Organ (Skin) HI Across All Media =	0.001821058
Total Organ (Gastrointestinal) HI Across All Media =	0.024289434
Total Organ (Neurological) HI Across All Media =	0.003740602

TABLE 5.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Current
Receptor Population: Recreational
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum	4.88E-07	3.59E-10	4.10E-08	NA	5.30E-07	Body weight	0.034761644	0.001787415	0.002433315	0.038982374
			Arsenic						Skin	0.012663623	9.80157E-07	0.001063744	0.013728347
			Iron						Gastrointestinal	0.224146119	0	0.000627609	0.224773728
			Manganese						Neurological	0.01280635	0.009226778	0.000696584	0.022931712
			Chemical Total					5.30E-07					0.300416161
		Exposure Point Total						5.30E-07					0.300416161
	Exposure Medium Total							5.30E-07					0.300416161
Medium Total								5.30E-07					0.300416161
Receptor Total							Receptor Risk Total	5.30E-07				Receptor HI Total	0.300416161

Total Organ (Body weight) HI Across All Media =	0.038982374
Total Organ (Skin) HI Across All Media =	0.013728347
Total Organ (Gastrointestinal) HI Across All Media =	0.224773728
Total Organ (Neurological) HI Across All Media =	0.022931712

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Current
Receptor Population: Construction Worker
Recsptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Subsurface Soil	Subsurface Soil	Arsenic	4.43E-08	1.97E-11	3.99E-09	NA	4.83E-08	Skin	0.013776908	6.46257E-07	0.001239922	0.0150
			Iron						Gastrointestinal	0.153946184		0.000461839	0.1544
			Chemical Total					4.83E-08					0.1694
		Exposure Point Total						4.83E-08					0.1694
	Exposure Medium Total							4.83E-08					0.1694
Medium Total								4.83E-08					0.1694
Receptor Total							Receptor Risk Total	4.83E-08				Receptor HI Total	0.1694

Total Organ (Skin) HI Across All Media =	0.0150
Total Organ (Gastrointestinal) HI Across All Media =	0.1544

TAB_ _.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum						Body weight	0.01253	0.00129	0.00125	0.0151
			Arsenic	7.05E-07	1.04E-09	8.43E-08	NA	7.90E-07	Skin	0.00457	0.00000	0.00055	0.0051
			Iron						Gastrointestinal	0.08082	0.00000	0.00032	0.0811
			Manganese						Neurological	0.00462	0.00665	0.00046	0.0117
			Chemical Total					7.90E-07					0.1131
		Exposure Point Total						7.90E-07					0.1131
	Exposure Medium Total							7.90E-07					0.1131
Medium Total								7.90E-07					0.1131
Receptor Total							Receptor Risk Total	7.90E-07				Receptor HI Total	0.1131

Total Organ (Body weight) HI Across All Media =	0.0151
Total Organ (Skin) HI Across All Media =	0.0051
Total Organ (Gastrointestinal) HI Across All Media =	0.0811
Total Organ (Neurological) HI Across All Media =	0.0117

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinoganic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Surface Soil	Surface Soil	Aluminum	1.64E-06	1.21E-09	1.38E-07	NA	1.78E-06	Body weight	0.1170	0.0060	0.0082	0.1312
			Arsenic						Skin	0.0426	0.0000	0.0036	0.0462
			Iron						Gastrointestinal	0.7543	0.0000	0.0021	0.7565
			Manganese						Neurological	0.0431	0.0311	0.0030	0.0772
			Chemical Total					1.78E-06					1.0110
		Exposure Point Total						1.78E-06					1.0110
	Exposure Medium Total							1.78E-06					1.0110
Medium Total								1.78E-06					1.0110
Receptor Total							Receptor Risk Total	1.78E-06				Receptor HI Total	1.0110
							Sum of Residential Adult and Residential Child Risks	2.6E-06					

Total Organ (Body weight) HI Across All Media =	0.1312
Total Organ (Skin) HI Across All Media =	0.0462
Total Organ (Gastrointestinal) HI Across All Media =	0.7565
Total Organ (Neurological) HI Across All Media =	0.0772

TAL .1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

AOC L

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total				Receptor Risk Total					Receptor HI Total				

Total Organ 1 HI Across All Media =

Total Organ 2 HI Across All Media =

Appendix D-10
Combined Groundwater Risk Assessment Tables
(Formatted According to EPA RAGS Part D Guidance)

Appendix D-10 Contents for Combined Groundwater Risk Assessment Tables

Table No.	Page No.
Table 0: Site Risk Assessment Identification Information	p. 1 of 21
Table 1: Selection of Exposure Pathways	p. 2 of 21
Table 2.1: Occurrence, Distribution, and Selection of Chemicals of Potential Concern (Soil and Groundwater)	p. 3 of 21
Table 3.1 RME: Exposure Point Concentration Summary (Groundwater)	p. 4 of 21
Table 4.1 RME: Values Used for Daily Intake Calculations (Groundwater – Current Timeframe)	p. 5 of 21
Table 4.2 RME: Values Used for Daily Intake Calculations (Groundwater - Future Timeframe)	p. 6 of 21
Table 4.3 RME: Values Used for Daily Intake Calculations (Groundwater - Future Timeframe)	p. 7 of 21
Table 5.1: Non-cancer Toxicity Data – Oral/Dermal	p. 9 of 21
Table 5.2: Non-cancer Toxicity Data – Inhalation	p. 10 of 21
Table 5.3: Non-cancer Toxicity Data – Special Case Chemicals	p. 11 of 21
Table 6.1: Cancer Toxicity Data – Oral/Dermal	p. 12 of 21
Table 6.2: Cancer Toxicity Data – Inhalation	p. 13 of 21
Table 7.1 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Industrial Worker – Adult)	p. 14 of 21
Table 7.2 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Adult)	p. 15 of 21
Table 7.3 RME: Calculation of Chemical Cancer Risks and Non-Cancer Hazards (Residential – Child)	p. 16 of 21
Table 8.1 RME: Calculation of Radiation Cancer Risks	p. 17 of 21
Table 9.1 RME: Summary of Receptor Risks and Hazards for COPCs (Industrial Worker – Adult)	p. 18 of 21
Table 9.2 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Adult)	p. 19 of 21
Table 9.3 RME: Summary of Receptor Risks and Hazards for COPCs (Residential – Child)	p. 20 of 21
Table 10.1 RME: Risk Summary	p. 21 of 21

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:	9 NFA Sites (Combined Groundwater)
Region:	
EPA ID Number:	
State:	
Status:	
Federal Facility (Y/N):	
EPA Project Manager:	
EPA Risk Assessor:	
Prepared by (Organization):	
Prepared for (Organization):	
Document Title:	
Document Date:	
Probabilistic Risk Assessment (Y/N):	
Comments:	

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

9 NFA Sites (Combined Groundwater)

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Soil	Surface Soil	9 NFA Sites (Combined Groundwater)	Maintenance Worker	Adult	Injestion Dermal Inhalation		
				Industrial Worker	Adult	Injestion Dermal Inhalation		
				Recreational	Adult	Injestion Dermal Inhalation		
					Youth	Injestion Dermal Inhalation		
		Subsurface Soil	A Sites (Combined Groundv	Utility Worker	Adult	Injestion Dermal Inhalation		
Future	Soil	Surface Soil	9 NFA Sites (Combined Groundwater)	Residential	Adult	Injestion Dermal Inhalation		
					Child	Injestion Dermal Inhalation		
	Groundwater	Groundwater	A Sites (Combined Groundv	Residential	Adult	Injestion Dermal Inhalation		
					Child	Injestion Dermal Inhalation		

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Current and Future
Medium: Soil and Groundwater
Exposure Medium: Surface Soil, Subsurface soil, and Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Groundwater	7429-90-5	ALUMINUM	152 J	18800 =	µg/L	AOC-F-MW05	12/13	NA	18800	NA	3650	NA	NA	Y	ASL
	7440-36-0	ANTIMONY	1.5 J	2.3 J	µg/L	SWMU14-MW01	3/13	NA	2.3	NA	1.46	6	MCL	Y	BMCL
	7440-39-3	BARIUM	20.2 J	390 =	µg/L	AOC-K-MW04	1/13	NA	390	NA	255	2,000	MCL	Y	ASL
	7440-41-7	BERYLLIUM	0.31 J	0.31 J	µg/L	SWMU15-MW01	1/13	NA	0.31	NA	7.30	4.0	MCL	N	BSL
	117-81-7	bis(2-ETHYLHEXYL)PHTHALATE	19 =	19 =	µg/L	AOC-K-MW05	1/13	NA	19	NA	4.80	6	MCL	N	LabC
		CALCIUM	37500 =	120000 =	µg/L	AOC-K-MW01, A	13/13	NA	120000	NA		NA	NA	N	NSV
	18540-29-9	CHROMIUM, TOTAL	2.2 J	30.8 =	µg/L	SWMU15-MW01	12/13	NA	31	NA	10.90	100	MCL	Y	ASL
	7440-48-4	COBALT	3.3 J	23 J	µg/L	AOC-K-MW04	8/13	NA	23	NA	73.0	NA	NA	N	BSL
	7440-50-8	COPPER	2.9 J	70.1 =	µg/L	SWMU14-MW01	13/13	NA	70.1	NA	146	1,300	MCL	N	BSL
	60-57-1	DIELDRIN	0.01 J	0.01 J	µg/L	SWMU14-MW01	1/13	NA	0.01	NA	0.0042	NA	NA	Y	ASL
	84-66-2	DIETHYL PHTHALATE	8 =	10 =	µg/L	AOC-F-MW02	2/13	NA	10	NA	2920	NA	NA	N	BSL
	7439-89-6	IRON	86 J	23900 =	µg/L	AOC-F-MW05	13/13	NA	23900	NA	1090	NA	NA	Y	ASL
	7439-92-1	LEAD	1.2 J	3.4 =	µg/L	AOC-F-MW05	3/13	NA	3.4	NA		15	MCL	N	NSV
		MAGNESIUM	24800 =	76000 =	µg/L	AOC-K-MW03	13/13	NA	76000	NA		NA	NA	N	NSV
	7439-96-5	MANGANESE	18 =	1300 J	µg/L	AOC-K-MW04	13/13	NA	1300	NA	87.6	NA	NA	Y	ASL
	7440-02-0	NICKEL	1.5 J	30 J	µg/L	AOC-K-MW04	11/13	NA	30	NA	73.0	100	MCL	N	BSL
		POTASSIUM	3120 J	8500 J	µg/L	AOC-K-MW01	13/13	NA	8500	NA		NA	NA	N	NSV
	7782-49-2	SELENIUM	2.6 J	7.2 =	µg/L	AOC-F-MW05	6/13	NA	7.2	NA	18.2	50	MCL	N	BSL
		SODIUM	92500 =	251000 =	µg/L	AOC-F-MW03	13/13	NA	251000	NA		NA	NA	N	NSV
	7440-28-0	THALLIUM	8 J	9.3 J	µg/L	AOC-K-MW01	2/13	NA	9.3	NA	0.24	2	MCL	Y	ASL
	108-88-3	TOLUENE	0.43 J	0.75 J	µg/L	AOC-K-MW05	3/13	NA	0.75	NA	72.3	1,000	MCL	N	BSL
	7440-62-2	VANADIUM	6.9 J	83.9 =	µg/L	AOC-F-MW05	13/13	NA	83.9	NA	25.5	NA	NA	Y	ASL
	7440-66-6	ZINC	2.8 J	50.3 =	µg/L	AOC-F-MW05	8/13	NA	50.3	NA	1090	NA	NA	N	BSL
												NA	NA		

Footnote Instructions:

(1) J indicates the the chemical was detected. The reported concentration is estimated.
= indicates that the chemical was detected. The reported concentration is the measured concentration.

(2) Maximum detected concentration was used for screening.

(3) No chemicals were eliminated from consideration based on comparison to background concentrations.

(4) Screening Toxicity value are from the EPA Region 9 PRG table.

(5) ASL - above screening level.
BSL - below screening level.
NSV - Screening level not available.
BMCL - below maximum contaminant level (MCL, National Drinking Water Standards, EPA, 2002)

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe:	Current/Future
Medium:	Groundwater
Exposure Medium:	Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale
Groundwater	Dieldrin	ug/L	0.010	0.01 (NP)	0.01 (J)	0.00001	mg/L	Max detect	4
	Aluminum	ug/L	3667	46222 (L)	18800 (=)	18.8	mg/L	Max detect	4
	Antimony	ug/L	1.02	1.17 (NP)	1.6 (J)	0.00117	mg/L	UCL95(NP)	3
	Barium	ug/L	143	201 (L)	390 (=)	0.201	mg/L	UCL95(L)	2
	Chromium	ug/L	9.85	49.1 (L)	30.8 (=)	0.0308	mg/L	Max detect	4
	Iron	ug/L	4525	56812 (L)	23900 (=)	23.9	mg/L	Max detect	4
	Manganese	ug/L	313	1329 (L)	1300 (J)	1.3	mg/L	Max detect	4
	Thallium	ug/L	2.55	3.74 (NP)	9.3 (J)	0.0037	mg/L	UCL95(NP)	3
	Vanadium	ug/L	30.2	47.4 (L)	83.9 (=)	0.047	mg/L	UCL95(L)	2

95% UCL" term calculated using 1/2 the reporting limit for non-detect values.

(1) Distribution codes for the "95% UCL" term.

N - normal

L - lognormal

NP - non-parametric (bootstrap)

NC - 95% UCL not calculated (too few samples).

NA - not applicable.

(2) Codes used for the "EPC Statistic".

N - normal

L - lognormal

NP - non-parametric (bootstrap)

1 - Shapiro-Wilk W-Test indicates that the data are normally distributed.

2 - Shapiro-Wilk W-Test indicates that the data are log-normally distributed.

3 - Shapiro-Wilk W-Test indicates that the data are neither normally nor log-normally (NP) distributed.

4 - 95% UCL exceeds the maximum detected concentration. Therefore, the maximum concentration is used as the EPC.

5 - 95% UCL not calculated due to too few samples. Therefore, the maximum concentration is used as the EPC.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		
Dermal:	Industrial Worker	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA / BW x AT
				SA	Surface Area	3300	cm^2	e	
				ET	Event Duration	0.05	hr/event	g	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	DAevent(inorganics) = Cw x Kp x ET
					Aluminum	0.001		e	DAevent(dieldrin) = Cw x 7.9×10^{-9}
					Antimony	0.001		e	(Exhibit B-3)
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	5	events/day	g	
				EF	Exposure Frequency	250	day/year	a	
				ED	Exposure Duration	25	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	9,125	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Best professional judgement, assumed to be equivalent to dermal event duration for residential adult as recommended by EPA Region 2 (five 3-min events).

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i] Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	2	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		
Dermal:	Residential	Adult	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA x CF / BW x AT
				SA	Surface Area	18000	cm^2	e	
				ET	Event Duration	0.25	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	DAevant(inorgenics) = Cw x Kp x ET
					Aluminum	0.001		e	DAevent(dieldrin) = Cw x 7.9×10^{-3}
					Antimony	0.001		e	(Exhibit B-3)
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	24	year	a	
				BW	Body Weight	70.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	8,760	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 15 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)
Ingestion:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = Cw x IR x EF x ED / BW x AT
				IR	Ingestion Rate	1	L/day	a	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		
Dermal:	Residential	Child (6 years)	Groundwater	Cw	Concentration in groundwater	Table 3.3	mg/L		CDI = DAevent x EV x ED x EF x SA x CF / BW x AT
				SA	Surface Area	6600	cm^2	e	
				ET	Event Duration	0.45	hr/event	e	
				Kp	Absorption Factor	chemical specific	cm/hr		DAevent = Absorbed Dose per event
					Dieldrin	0.000079	(DAevent)	e	DAevent(inorganics) = Cw x Kp x ET
					Aluminum	0.001		e	DAevent(dieldrin) = Cw x 7.9×10^{-9}
					Antimony	0.001		e	(Exhibit B-3)
					Barium	0.001		e	
					Chromium	0.002		e	
					Iron	0.001		e	
					Manganese	0.001		e	
					Thallium	0.001		e	
					Vanadium	0.001		e	
				EV	Events Frequency	1	events/day	e	
				EF	Exposure Frequency	350	day/year	a	
				ED	Exposure Duration	6	year	a	
				BW	Body Weight	15.0	kg	a	
				CF	Conversion Factor	0.001	L/cm^3		
				AT_c	Averaging Time - Carcinogenic	25,550	day		
				AT_n	Averaging Time - Non-carcinogenic	2,190	day		

References:

[a]EPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.

[b]Exposure Factors Handbook, Volume I,May 1989.

[c]Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4, March 24, 2001.

[d]Volatilization factor (VF) was considered insignificant as all COPCs were non-VOCs.

[e]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim, September 2001.

[f]Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) Interin Final, December 1989.

[g]Assumed

[h]Recommended by EPA Region 2: Represents 27 min/shower as a conservative exposure time.

[i]Supplemental Guidance to RAGS: Region 4 Bulletins, Human Health Risk Assessment, http://WWW.epa.gov/region04/wastepgs/oftecser/otsguid.htm. May 1999.

NA = Not applicable or not available.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)

RME = Reasonable Maximum Exposure Concentration

Assumed - best professional judgment used based on an anticipated receptor behavior.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

9 NFA Sites (Combined Groundwater)

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (4)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	5.0E-05	mg/kg/day	1.0.E+00	5.0.E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum(2)	Chronic	1.0E+00	mg/kg/day	4.0.E-02	4.0.E-02	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	4.0E-04	mg/kg/day	1.5.E-01	6.0.E-05	mg/kg/day	Blood, longevity	1000/1	IRIS	04/23/03
Arsenic	Chronic	3.0E-04	mg/kg/day	9.5.E-01	3.0.E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	7.0E-02	mg/kg/day	1.0.E+00	7.0.E-02	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(3)	Chronic	3.0E-03	mg/kg/day	1.3.E-02	3.9.E-05	mg/kg/day	Respiratory, not specified	300/3	IRIS	04/23/03
Iron	Chronic	3.0E-01	mg/kg/day	1.0.E+00	3.0.E-01	mg/kg/day	Gastrointestinal	1/1	NCEA	11/14/01
Manganese	Chronic	1.4E-01	mg/kg/day	4.0.E-02	5.6.E-03	mg/kg/day	Neurological	1/1	IRIS	04/23/03
Thallium	Chronic	8.0E-05	mg/kg/day	1.0.E+00	8.0.E-05	mg/kg/day	Hair loss, liver	3000/1	IRIS	04/23/03
Vanadium	Chronic	7.0E-03	mg/kg/day	2.6.E-02	1.82.E-04	mg/kg/day	None Specified	100/1	HEAST	11/00/1995

Footnote:

(1) The ABS_{GI} are obtained from RAGS Part E (2002), unless specified otherwise

(2) The aluminum ABSGI was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

(3) An RfD value for hexavalemnt chromium was used for a conservative risk evaluation

(4) Absorbed RfD for Dermal = Oral RfD X Oral Absorption efficiency

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

9 NFA Sites (Combined Groundwater)

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Dieldrin	Chronic	N/A	N/A	5.00E-05	mg/kg/day	Liver	100/1	IRIS	04/23/03
Aluminum	Chronic	5E-03	N/A	1.43E-03	mg/kg/day	Body weight	100	NCEA	07/26/01
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	N/A	N/A	2.85E-04	mg/kg/day	Skin	3/1	IRIS	04/23/03
Barium	Chronic	N/A	N/A	1.43E-04	mg/kg/day	Cardiovascular	3/1	IRIS	04/23/03
Chromium(2)	Chronic	8E-06	mg/m3	2.29E-06	mg/kg/day	Respiratory (CrVI)	300/3	IRIS	04/23/03
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5E-05	mg/m3	1.43E-05	mg/kg/day	Neurological	1000/1	IRIS	04/23/03
Thallium	Chronic	N/A	N/A	8.00E-05	mg/kg/day	Hair loss (alopacea), lacrimation, and exophthalmos	3000/1	IRIS	04/23/03
Vanadium	Chronic	N/A	N/A	1.82E-04	mg/kg/day	None specified	100/1	HEAST	11/00/1995

Footnote:

(1) Extrapolated RfD for inorganic chemicals = (RfC X Inhalation rate (20 m3/day))/(Body weight, 70 Kg) **or** = Oral RfD X ABS_{GI} (see Table 5.1 for ABS_{GI} and Oral RfD)

(2) - An RfD value for hexavalent chromium is used for comparison with total chromium concentration for a conservative risk estimation

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

9 NFA Sites (Combined Groundwater)

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

9 NFA Sites (Combined Groundwater)

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (2)	Absorbed Cancer Slope Factor for Dermal (1)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	0.58-0.89	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Dieldrin	1.6E+01	$(mg/kg/day)^{-1}$	N/A	1.6E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic (3)	1.5E+00	$(mg/kg/day)^{-1}$	9.5E-01	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

Footnote:

(1) Dermal Cancer Slope Factor = Oral Slope factor / Oral abroption efficiency (ABS_{GI}), if ABSGI is <0.5, if ABSGI >0.5, Dermal RfD = Oral RfD as suggested in RAGS Part E

(2) - Obtained from RAGS Part E, unless otherwise noted

(3) The arsenic ABS_{GI} was obtained from ATSDR toxicity rpofile for Aluminum, ATSDR, 2000

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

9 NFA Sites (Combined Groundwater)

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
Benzo(a)pyrene	N/A	N/A	N/A	N/A	B2	IRIS	04/23/2003
Dieldrin	4.60E-03	$(ug/m3)^{-1}$	1.61E+01	$(mg/kg/day)^{-1}$	B2	IRIS	04/23/2003
Arsenic	4.29E-03	$(ug/m3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	04/23/2003

(1) Inhalation Cancer Slope Factor = Unit risk x Body weight (70kg) x 1/(20 m3/day X0.001 mg/ug)

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe:	Current
Receptor Population:	Industrial Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	1E-05	mg/L	3.5E-08	mg/kg/day	1.6E+01	(mg/kg/day)-1	5.6E-07	9.8E-08	mg/kg/day	5.0E-05	mg/kg/day	2.0E-03
				Aluminum	2E+01	mg/L	6.8E-02	mg/kg/day				1.6E-01	mg/kg/day	1.0E+00	mg/kg/day	1.8E-01
				Antimony	1E-03	mg/L	4.1E-06	mg/kg/day				1.1E-05	mg/kg/day	4.0E-04	mg/kg/day	2.9E-02
				Barium	2E-01	mg/L	7.0E-04	mg/kg/day				2.0E-03	mg/kg/day	7.0E-02	mg/kg/day	2.8E-02
				Chromium	3E-02	mg/L	1.1E-04	mg/kg/day				3.0E-04	mg/kg/day	3.0E-03	mg/kg/day	1.0E-01
				Iron	2E+01	mg/L	8.4E-02	mg/kg/day				2.3E-01	mg/kg/day	3.0E-01	mg/kg/day	7.8E-01
				Manganese	1E+00	mg/L	4.5E-03	mg/kg/day				1.3E-02	mg/kg/day	1.4E-01	mg/kg/day	9.1E-02
				Thallium	4E-03	mg/L	1.3E-05	mg/kg/day				3.7E-05	mg/kg/day	8.0E-05	mg/kg/day	4.8E-01
				Vanadium	5E-02	mg/L	1.7E-04	mg/kg/day				4.6E-04	mg/kg/day	7.0E-03	mg/kg/day	6.6E-02
			Exp. Route Total								5.6E-07					1.7E+00
			Dermal	Dieldrin	1E-05	mg/L	4.6E-11	mg/kg/day	1.6E+01	(mg/kg/day)-1	7.3E-10	1.3E-10	mg/kg/day	5.0E-05	mg/kg/day	2.6E-06
				Aluminum	2E+01	mg/L	5.4E-05	mg/kg/day				1.5E-04	mg/kg/day	4.0E-02	mg/kg/day	3.8E-03
				Antimony	1E-03	mg/L	3.4E-09	mg/kg/day				9.4E-09	mg/kg/day	6.0E-05	mg/kg/day	1.6E-04
				Barium	2E-01	mg/L	5.8E-07	mg/kg/day				1.6E-06	mg/kg/day	7.0E-02	mg/kg/day	2.3E-05
				Chromium	3E-02	mg/L	1.8E-07	mg/kg/day				5.0E-07	mg/kg/day	3.9E-05	mg/kg/day	1.3E-02
				Iron	2E+01	mg/L	6.9E-05	mg/kg/day				1.9E-04	mg/kg/day	3.0E-01	mg/kg/day	6.4E-04
				Manganese	1E+00	mg/L	3.7E-06	mg/kg/day				1.0E-05	mg/kg/day	5.6E-03	mg/kg/day	1.9E-03
				Thallium	4E-03	mg/L	1.1E-08	mg/kg/day				3.0E-08	mg/kg/day	8.0E-05	mg/kg/day	3.8E-04
				Vanadium	5E-02	mg/L	1.4E-07	mg/kg/day				3.8E-07	mg/kg/day	1.8E-04	mg/kg/day	2.1E-03
			Exp. Route Total								7.3E-10					2.2E-02
		Exposure Point Total									5.6E-07					1.8E+00
	Exposure Medium Total										5.6E-07					1.8E+00
Medium Total											5.6E-07					1.8E+00
										Total of Receptor Risks Across All Media	5.6E-07				Total of Receptor Hazards Across All Media	1.8E+00

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	1E-05	mg/L	9.4E-08	mg/kg/day	1.6E+01	(mg/kg/day)-1	1.5E-06	2.7E-07	mg/kg/day	5.0E-05	mg/kg/day	0.005
				Aluminum	2E+01	mg/L	1.6E-01	mg/kg/day				5.2E-01	mg/kg/day	1.0E+00	mg/kg/day	0.515
				Antimony	1E-03	mg/L	1.1E-05	mg/kg/day				3.2E-05	mg/kg/day	4.0E-04	mg/kg/day	0.080
				Barium	2E-01	mg/L	1.9E-03	mg/kg/day				5.5E-03	mg/kg/day	7.0E-02	mg/kg/day	0.079
				Chromium	3E-02	mg/L	2.9E-04	mg/kg/day				8.4E-04	mg/kg/day	3.0E-03	mg/kg/day	0.281
				Iron	2E+01	mg/L	2.2E-01	mg/kg/day				6.5E-01	mg/kg/day	3.0E-01	mg/kg/day	2.183
				Manganese	1E+00	mg/L	1.2E-02	mg/kg/day				3.6E-02	mg/kg/day	1.4E-01	mg/kg/day	0.254
				Thallium	4E-03	mg/L	3.5E-05	mg/kg/day				1.0E-04	mg/kg/day	8.0E-05	mg/kg/day	1.281
				Vanadium	5E-02	mg/L	4.4E-04	mg/kg/day				1.3E-03	mg/kg/day	7.0E-03	mg/kg/day	0.185
			Exp. Route Total								1.5E-06					4.859
			Dermal	Dieldrin	1E-05	mg/L	6.7E-11	mg/kg/day	1.6E+01	(mg/kg/day)-1	1.1E-09	1.9E-10	mg/kg/day	5.0E-05	mg/kg/day	0.000
				Aluminum	2E+01	mg/L	4.0E-04	mg/kg/day				1.2E-03	mg/kg/day	4.0E-02	mg/kg/day	0.029
				Antimony	1E-03	mg/L	2.5E-08	mg/kg/day				7.2E-08	mg/kg/day	6.0E-05	mg/kg/day	0.001
				Barium	2E-01	mg/L	4.2E-06	mg/kg/day				1.2E-05	mg/kg/day	7.0E-02	mg/kg/day	0.000
				Chromium	3E-02	mg/L	1.3E-06	mg/kg/day				3.8E-06	mg/kg/day	3.9E-05	mg/kg/day	0.097
				Iron	2E+01	mg/L	5.1E-04	mg/kg/day				1.5E-03	mg/kg/day	3.0E-01	mg/kg/day	0.005
				Manganese	1E+00	mg/L	2.7E-05	mg/kg/day				8.0E-05	mg/kg/day	5.6E-03	mg/kg/day	0.014
				Thallium	4E-03	mg/L	7.9E-08	mg/kg/day				2.3E-07	mg/kg/day	8.0E-05	mg/kg/day	0.003
				Vanadium	5E-02	mg/L	1.0E-06	mg/kg/day				2.9E-06	mg/kg/day	1.8E-04	mg/kg/day	0.016
			Exp. Route Total								1.1E-09					0.166
		Exposure Point Total									1.5E-06					5.024
	Exposure Medium Total										1.5E-06					5.024
Medium Total											1.5E-06					5.024
										Total of Receptor Risks Across All Media	1.5E-06				Total of Receptor Hazards Across All Media	5.024

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe:	Future
Receptor Population:	Residential
Receptor Age:	Child (8 years)

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Groundwater	Ingestion	Dieldrin	1E-05	mg/L	5.5E-08	mg/kg/day	1.6E+01	(mg/kg/day)-1	8.8E-07	6.4E-07	mg/kg/day	5.0E-05	mg/kg/day	0.013
				Aluminum	2E+01	mg/L	1.0E-01	mg/kg/day				1.2E+00	mg/kg/day	1.0E+00	mg/kg/day	1.202
				Antimony	1E-03	mg/L	8.4E-06	mg/kg/day				7.5E-05	mg/kg/day	4.0E-04	mg/kg/day	0.186
				Barium	2E-01	mg/L	1.1E-03	mg/kg/day				1.3E-02	mg/kg/day	7.0E-02	mg/kg/day	0.184
				Chromium	3E-02	mg/L	1.7E-04	mg/kg/day				2.0E-03	mg/kg/day	3.0E-03	mg/kg/day	0.656
				Iron	2E+01	mg/L	1.3E-01	mg/kg/day				1.5E+00	mg/kg/day	3.0E-01	mg/kg/day	5.093
				Manganese	1E+00	mg/L	7.1E-03	mg/kg/day				8.3E-02	mg/kg/day	1.4E-01	mg/kg/day	0.594
				Thallium	4E-03	mg/L	2.1E-05	mg/kg/day				2.4E-04	mg/kg/day	8.0E-05	mg/kg/day	2.990
				Vanadium	5E-02	mg/L	2.6E-04	mg/kg/day				3.0E-03	mg/kg/day	7.0E-03	mg/kg/day	0.433
			Exp. Route Total								8.8E-07					11.337
			Dermal	Dieldrin	1E-05	mg/L	2.9E-11	mg/kg/day	1.6E+01	(mg/kg/day)-1	4.6E-10	3.3E-10	mg/kg/day	5.0E-05	mg/kg/day	0.000
				Aluminum	2E+01	mg/L	3.1E-04	mg/kg/day				3.6E-03	mg/kg/day	4.0E-02	mg/kg/day	0.089
				Antimony	1E-03	mg/L	1.9E-08	mg/kg/day				2.2E-07	mg/kg/day	6.0E-05	mg/kg/day	0.004
				Barium	2E-01	mg/L	3.3E-06	mg/kg/day				3.8E-05	mg/kg/day	7.0E-02	mg/kg/day	0.001
				Chromium	3E-02	mg/L	1.0E-06	mg/kg/day				1.2E-05	mg/kg/day	3.9E-05	mg/kg/day	0.300
				Iron	2E+01	mg/L	3.9E-04	mg/kg/day				4.5E-03	mg/kg/day	3.0E-01	mg/kg/day	0.015
				Manganesa	1E+00	mg/L	2.1E-05	mg/kg/day				2.5E-04	mg/kg/day	5.6E-03	mg/kg/day	0.044
				Thallium	4E-03	mg/L	8.1E-08	mg/kg/day				7.1E-07	mg/kg/day	8.0E-05	mg/kg/day	0.009
				Vanadium	5E-02	mg/L	7.7E-07	mg/kg/day				9.0E-06	mg/kg/day	1.8E-04	mg/kg/day	0.049
			Exp. Route Total								4.8E-10					0.511
		Exposure Point Total									8.8E-07					11.8
	Exposure Medium Total										8.8E-07					11.8
Medium Total											8.8E-07					11.8
										Total of Receptor Risks Across All Media	8.8E-07				Total of Receptor Hazards Across All Media	11.8

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

9 NFA Sites (Combined Groundwater)

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				Cancer Risk
					Value	Units		Intake/Activity		CSF		
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Current
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Dieldrin	5.6E-07	NA	4.6E-10	NA	5.6E-07	Liver	0.001956947	NA	2.55088E-06	0.001959498
			Aluminum						Body weight	0.183953033	NA	0.003794031	0.187747065
			Antimony						Blood, longevity	0.02850798	NA	0.000156794	0.028664773
			Barium						Cardiovascular	0.028101835	NA	2.3184E-05	0.028125019
			Chromium						Respiratory, not specified	0.100456621	NA	0.012750263	0.113206884
			Iron						Gastrointestinal	0.779517286	NA	0.000643102	0.780160388
			Manganese						Neurological	0.090858261	NA	0.001873952	0.092732213
			Thallium						Hair loss, liver	0.457606283	NA	0.000377525	0.457983808
			Vanadium						None Specified	0.066201148	NA	0.002100613	0.068301761
		Exposure Point Total						5.60E-07					1.75888141
	Exposure Medium Total							5.60E-07					1.75888141
Medium Total								5.60E-07					1.75888141
Receptor Total							Receptor Risk Total	5.60E-07				Receptor HI Total	1.75888141

Total Organ (Liver) HI Across All Media =	0.001959498
Total Organ (Body weight) HI Across All Media =	0.187747065
Total Organ (Blood, longevity) HI Across All Media =	0.028664773
Total Organ (Cardiovascular) HI Across All Media =	0.028125019
Total Organ (Respiratory, not specified) HI Across All Media =	0.113206884
Total Organ (Gastrointestinal) HI Across All Media =	0.780160388
Total Organ (Neurological) HI Across All Media =	0.092732213
Total Organ (Hair loss, liver) HI Across All Media =	0.457983808
Total Organ (None Specified) HI Across All Media =	0.068301761

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Dieldrin	1.5E-06	NA	4.6E-10	NA	1.5E-06	Liver	0.005479452	NA	3.89589E-06	0.005483348
			Aluminum						Body weight	0.515068493	NA	0.028972603	0.544041096
			Antimony						Blood, longevity	0.079822343	NA	0.001197335	0.081019678
			Barium						Cardiovascular	0.078685138	NA	0.000177042	0.07886218
			Chromium						Respiratory, not specified	0.281278539	NA	0.097365648	0.378644187
			Iron						Gastrointestinal	2.182648402	NA	0.004910959	2.187559361
			Manganese						Neurological	0.254403131	NA	0.014310176	0.268713307
			Thallium						Hair loss, liver	1.281297593	NA	0.00288292	1.284180512
			Vanadium						None Specified	0.185363213	NA	0.016041047	0.201404261
		Exposure Point Total						1.50E-06					5.029907929
	Exposure Medium Total							1.50E-06					5.029907929
Medium Total								1.50E-06					5.029907929
Receptor Total							Receptor Risk Total	1.50E-06				Receptor HI Total	5.029907929

Total Organ (Liver) HI Across All Media =	0.005483348
Total Organ (Body weight) HI Across All Media =	0.544041096
Total Organ (Blood, longevity) HI Across All Media =	0.081019678
Total Organ (Cardiovascular) HI Across All Media =	0.07886218
Total Organ (Respiratory, not specified) HI Across All Media =	0.378644187
Total Organ (Gastrointestinal) HI Across All Media =	2.187559361
Total Organ (Neurological) HI Across All Media =	0.268713307
Total Organ (Hair loss, liver) HI Across All Media =	1.284180512
Total Organ (None Specified) HI Across All Media =	0.201404261

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

9 NFA Sites (Combined Groundwater)

Scenario Timeframe: Future
Receptor Population: Residential
Receptor Age: Child (6 years)

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Groundwater	Dieldrin	8.8E-07	NA	4.6E-10	NA	8.8E-07	Liver	0.012785388	NA	6.6663E-06	0.012792054
			Aluminum						Body weight	1.201826484	NA	0.089235616	1.2910621
			Antimony						Blood, longevity	0.186252133	NA	0.003687792	0.189939926
			Barium						Cardiovascular	0.183598655	NA	0.000545288	0.184143943
			Chromium						Respiratory, not specified	0.856316591	NA	0.299886196	0.956202787
			Iron						Gastrointestinal	5.092846271	NA	0.015125753	5.107972024
			Manganese						Neurological	0.593607306	NA	0.044075342	0.637682648
			Thallium						Hair loss, liver	2.989694383	NA	0.008879392	2.998573775
			Vanadium						None Specified	0.432514164	NA	0.049406426	0.48192059
		Exposure Point Total						8.77E-07					11.86028985
	Exposure Medium Total							8.77E-07					11.86028985
Medium Total								8.77E-07					11.86028985
Receptor Total							Receptor Risk Total	8.77E-07				Receptor HI Total	11.86028985
							Sum of Residential Adult and Residential Child Risks	2.4E-06					

Total Organ (Liver) HI Across All Media =	0.012792054
Total Organ (Body weight) HI Across All Media =	1.2910621
Total Organ (Blood, longevity) HI Across All Media =	0.189939926
Total Organ (Cardiovascular) HI Across All Media =	0.184143943
Total Organ (Respiratory, not specified) HI Across All Media =	0.956202787
Total Organ (Gastrointestinal) HI Across All Media =	5.107972024
Total Organ (Neurological) HI Across All Media =	0.637682648
Total Organ (Hair loss, liver) HI Across All Media =	2.998573775
Total Organ (None Specified) HI Across All Media =	0.48192059

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
9 NFA Sites (Combined Groundwater)

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =
Total Organ 2 HI Across All Media =

Appendix E
Detailed Risk Assessments for Each Site

APPENDIX E-1

Introduction

The evaluation conducted for this No Further Action (NFA) Report incorporated previous data from the Expanded Preliminary Assessment/Site Investigation – Phase I (PA/SI) (October 2000), which have been rescreened against the EPA Region IX Preliminary Remediation Goals (PRGs) from October 2002. The groundwater data were screened against tap water PRGs for chemical of potential concern (COPC) selection. The latest MCLs (2002 update) were included for comparison purposes only. Section 1.0 of the report includes the general approach to the site evaluations and the risk assessment. The majority of the site-specific data and risk analysis-related text is presented in the site-specific discussions in this report. Some of the technical details of the risk assessment are presented in this appendix, resulting in some of the information being repetitive in order to make it a more comprehensive presentation for the risk assessment.

E-1.1 Risk-Based Criteria Screening Procedure

E-1.1.1 Data Analysis and COPC Selection

The screening evaluation of the data for each site is based upon validated analytical results obtained from previous investigations conducted from April through December 2000. For the initial PA/SI and Expanded PA/SI report (October 2000, November 2002), analytical results were screened to Environmental Protection Agency (EPA) Region III Risked Based Criteria (RBCs). For the Phase II PA/SI for seven sites report (November 2002), the analytical results were screened to EPA Region IX PRGs.

Concentrations of detected chemicals at each site were compared to the following screening criteria: October 2002 EPA Region IX screening criteria for each matrix: residential and industrial risk-based concentrations PRGs and leachability criteria for soil (SSLD20); subsurface soil samples were screened against industrial PRGs, and SSL values; tap water PRGs; and drinking water Maximum Contaminant Levels (MCLs) for groundwater. The PRGs for the non-carcinogenic chemicals were divided by 10 to represent a hazard index (HI) level of 0.1. Following EPA Guidance, the nutritionally essential elements calcium, magnesium, potassium, and sodium were not included as COPCs as they do not have toxicity criteria.

Any constituents with concentrations below the screening criteria were eliminated. Any constituents with concentrations above the screening criteria were retained as chemicals of potential concern (COPCs). All identified COPCs were evaluated through a human risk evaluation at each of the 9 sites as per the EPA guidance in *Risk Assessment Guidance for Superfund; Volume 1, Human Health Evaluation Manual (Parts A)* (EPA 1989) and other relevant EPA guidance. All the risk estimations were presented in tables formatted according to the RAGS Part D as suggested by EPA and EQB during review of the draft NFA report. Although several of the inorganic chemicals occur in environmental media under background conditions, no chemicals were dropped based on occurrence in the

background as recommended by the reviewing agencies/teams for the former Naval Ammunition Support Detachment (NASD). Thus, some of the COPCs identified are not specific to the site activities. Such chemicals are further discussed in Appendix E as part of an uncertainty analysis. The final site NFA recommendation was based on this screening analysis, results of the risk assessment, as well as a comparison with the background levels as appropriate for the inorganic chemicals.

E-1.1.2 Risk Assessment

A human health risk assessment was conducted at the former NASD, Vieques Island, following EPA guidance listed below. The risk calculations were presented in RAG Part D format. EPA's intent in preparing a standardized risk table format was to reduce the amount of documentation in addition to maintaining consistent reporting format between different sites. The risk assessment conducted assesses the potential adverse effects to human health under both current and future land-use conditions. The results of this risk assessment are used as the basis for the NFA recommendations at the end of each section.

The risk assessment used methods recommended by the EPA guidance listed below and other applicable regional EPA (Region 2) guidance:

- EPA, 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual (Part A)*. EPA/540/1-89/002.
- EPA, 1990. *Guidance for Data Usability in Risk Assessment*. EPA/540/G-90/008.
- EPA, 1991. *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors"*. OSWER Directive 9285.6-03.
- EPA, 1997. *Exposure Factors Handbook*. EPA/600/P-95/002Fa.
- EPA, 2001. *Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual* (Part E Supplemental Guidance for Dermal Risk Assessment) Interim.
- EPA, 2001. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft*, OSWER 9355.4.

The human health risk assessment included the following major components in the evaluation process:

- Identification of COPCs
- Exposure assessment
- Toxicity assessment
- Risk characterization

A conceptual site model (CSM) was developed to present an overview of site conditions and to identify potential migration pathways, receptors, and exposure routes. This serves as the basis for the exposure pathway evaluations in the focused human health risk assessment as presented in site-specific discussion sections.

Identification of COPCs

Existing analytical data from each of the sites were evaluated for a quantitative risk assessment. Data are in electronic format and have undergone a data quality evaluation process. The screening evaluation for COPC identification included chemicals that are a direct exposure concern and chemicals that may be a concern for migration to groundwater.

Sampled media include surface soils, subsurface soils, and groundwater. Some of the soils collected from drainage ditch sites (e.g., the quebrada) are identified as sediment, however because these are not wet most of the year, they were treated as soils. The following sources were used to obtain the health-based screening criteria:

- Surface soil results were screened against human health direct exposure RBC for soils selected from the EPA Region IX PRG table (October, 2002). Noncarcinogenic RBC values were reduced by a factor of 10 (HI = 0.1) to account for the potential presence of multiple chemicals.
- Subsurface soil up to 10 ft below surface were screened against industrial PRGs.
- Surface and subsurface soils were screened against soil-to-groundwater protection risk-based criteria, which were the generic SSL values at a Dilution Attenuation Factor (DAF) of 20 from Appendix A of *EPA Soil Screening Guidance: Technical Background Document* (1996). Several of the inorganic chemicals did not have SSL values from EPA, however most of these have PRGs.
- Groundwater samples were screened against tap water PRGs for groundwater, and the MCL from the National Primary Drinking Water Standards (2002) was used for comparison purpose. No site chemicals exceeded the MCLs.

The COPCs selected for site surface and subsurface soils and groundwater by comparing the maximum detected concentration with screening criteria and are provided in Appendices C and D for all 9 sites. Individual sample detections were also screened against criteria and the results are included in Appendix B. Total chromium results were compared against hexavalent chromium criteria, which is a conservative evaluation for potential exposure related toxicity.

Commonly encountered lab contaminants (methylene chloride, bis [2-ethylhexyl] phthalate, etc.) that are detected in similar concentrations in the QA/QC samples and are not associated with site activities were not included as COPC following EPA guidance for dealing with common laboratory contaminants (EPA, 1989).

E-1.1.3 Exposure Assessment

An exposure assessment was used to evaluate the potential exposure of the site media to the human receptors identified based on current or anticipated future land use at a site. The exposure assessment included potential exposure pathways for human receptors, potential routes of exposure, exposure factors assumed, and exposure concentrations estimated for exposure.

Potentially Exposed Populations

The former NASD, Vieques Island, is currently an inactive facility. Following the transfer of the property to the Commonwealth of Puerto Rico, land use and potentially exposed populations are likely change. Therefore, unrestricted land use was assumed for each of the sites, which is the most conservatively protective assumption available for risk assessment. There are no current human receptors based on permitted activities on this access-restricted area of the former NASD. Based on anticipated future land use considerations, the following potentially exposed populations were identified:

- Maintenance workers
- Construction workers
- Recreational receptors (adult and child)
- Industrial workers
- Residential receptors (adult and child)

Other potentially exposed populations could occur; however, their likely exposure will be lower than those listed above. If these listed receptors are protected, all other potentially exposed populations will also be protected.

Maintenance Worker

Currently there are no human receptors within any of the 9 sites. A limited number of personnel are currently employed to supervise the former NASD area, and none of these employees have duties within the sites. There is no mowing type of maintenance occurring within the 10 site areas evaluated in this report. Therefore this exposure pathway under current conditions is incomplete. In the future, when the property is transferred, activities may include mowing and facilities maintenance. Based on the likely occupational duties, it was assumed that a maintenance worker would have the potential for direct or indirect contact with surface soils at each of the sites. The maintenance workers are not likely to use site groundwater; therefore, this pathway was not evaluated for a maintenance worker scenario.

Construction Worker

A future construction worker scenario was evaluated for subsurface soil exposure at various sites where COPCs were identified in subsurface soil. The subsurface soil COPCs were selected by comparing detected concentrations in samples collected up to 10 ft below land surface (ft bls) against industrial PRG values from EPA Region 9 PRG tables. The typical construction work is assumed to last for 6 months, for every day without any weekends off, resulting in an exposure frequency (EF) of 183 days, and exposure duration (ED) of 0.5 yr. The soil ingestion rate for a construction worker is 330 mg/day, which is higher than any other worker scenario. All other EFs are similar to those of an industrial worker scenario as included in risk tables in Appendix D. Exposure point concentrations (EPCs) for a construction worker were calculated by combining surface and subsurface soil, as construction activities tend to mix both of these layers of soils. Subsurface soil COPCs were identified only at some of the nine sites included in this report, and a construction worker exposure was evaluated for these sites. Exposures to site groundwater are not expected for this scenario as typical construction depths (6 to 10 ft bls) will not encounter groundwater at the site, as it is deeper at greater than 40 ft bls, depending on the location.

Recreational Users

Following the transfer of ownership of the former NASD facility to the Commonwealth of Puerto Rico, some of these sites may be used for recreational purposes, where recreational receptors may use the site for hiking, picnicking, and other outdoor activities. Recreational receptors were be assumed to have direct contact with site soils. Recreational users are not expected to have exposure to site groundwater, as such a pathway is incomplete. Therefore, exposure to this site was assumed to occur via surface soil while using the site for recreational purpose. Though each site is too small to spend an entire recreational time during an outing, such a scenario was assumed as a conservatively protective pathway evaluation.

Industrial Worker

This scenario was evaluated assuming a site would be converted into a future industrial facility where a worker spends his/her entire workday at the site in direct contact with soils. Depending on site-specific conditions, future development of some of these sites could potentially allow for light industrial/commercial use, which would bring industrial workers into contact with site media. Industrial workers were also assumed to be exposed to site groundwater as a potential potable water source.

Residential Receptors

In order to offer the most flexible future land use for each site, future residential land use was considered to occur where site-specific conditions permit. Future residents were assumed to have direct contact with surface soils and use site groundwater as their potable source. Several of the sites are drainage areas that are not conducive for use as residential lots. However, this scenario was evaluated to provide the most conservatively protective risk estimation. If the risks for this scenario are within acceptable limits, the site can be used for unrestricted land use.

Exposure Route Factors

The exposure factors used for intake and risk estimates at each site for each receptor identified are listed in Appendix D, and site-specific risk estimation tables are also included in this appendix.

Surface Soil Ingestion

Ingestion exposures to surface soil was evaluated for the appropriate receptors and media identified in the site-specific CSM. Ingestion intake of soil or sediment for a worker was assumed to be 50 milligrams (mg)/day, a default exposure factor from EPA (1997b). Incidental ingestion of soil or sediment by a recreational adult or youth is 100 mg/day each. For residential receptors, incidental ingestion of soil by an adult is 100 mg/day and 200 mg/day for a child.

Subsurface Soil Ingestion

The soil ingestion rate for a construction worker is 330 mg/day, which is higher than any other worker scenario. For EPCs both surface and subsurface soils are assumed to be available.

Groundwater Ingestion

Ingestion of groundwater by a worker was assumed to be 1 liter (L)/day. Ingestion for a residential adult and child was assumed to be 2 L/day and 1 L/day, respectively.

Surface Soil Dermal Contact

Skin surface area available for contact was estimated using best professional judgement using current practice from EPA guidance. The latest RAGS Part E guidance from EPA includes the dermal exposure factors that were used in this risk assessment.

Groundwater Dermal Contact

Residential receptors were assumed to have dermal contact with groundwater. Dermal contact was assumed to occur through showering/bathing times were selected as listed in the latest EPA guidance for dermal pathway.

Surface Soil Inhalation

Inhalation of dust from surface soils was assumed to occur for workers, recreational users, and residential receptors. For workers, the default inhalation rate is 20 cubic meters/8-hour workday. For smaller sites, time spent within the site is expected to be less than 8 hours, and the inhalation rate was modified by a site-specific factor to account for the reduced onsite exposure, if appropriate. The inhalation rate for recreational receptors is 20 cubic meters/day for adults and youths. Inhalation rates for residential adults is 20 cubic meters/day and is 15 cubic meters/day for children.

The default particulate emission factor (PEF) of 1.32E+9 cubic meters/kilogram from *EPA Supplement to Soil Screening Guidance: Technical Background* (2001) was used to estimate the dust inhalation rate for non-volatile chemicals. No VOC COPCs were identified in the site soils.

Groundwater Inhalation

This pathway was determined to be not applicable to any of the 9 sites, or sitewide groundwater, as none had VOC contamination in the groundwater.

Chemical Specific Factors

Dermal absorption factors (ABS_{dermal}) and permeability constants (PC or Kp) were obtained from the draft dermal guidance on the website as previously listed above.

Exposure Quantitation

Intake Estimates

For each receptor identified in the exposure assessment as having a complete exposure pathway, chemical- and media-specific intakes, known as chronic daily intakes (CDI), were estimated using the appropriate exposure factors and assumptions. The exposure assumptions used for the scenarios identified above are listed in detail in Appendix D in RAGS Part D table format.

Chronic exposure (represented by CDI) is expressed in terms of milligrams of chemicals contacting the body/kilogram of body weight/day (mg/kg/day). For the exposure routes to be evaluated, the following generic equation was applied:

$$Exposure(mg/kg/day) = \frac{CxIRxEDxEF}{BWxAT}$$

Where:

C = concentration of chemical in medium or EPC

IR = Intake or ingestion rate
EF = Exposure frequency
ED = Exposure duration
BW = Body weight
AT = Averaging time (period over which exposure is averaged)

Appendix D includes tables of exposure factors for the anticipated receptors, exposure routes, and exposure pathways.

Exposure Point Concentration

The EPC is the reasonable upper-bound estimate of the mean concentration that is contacted over the exposure period. The EPC is recommended by EPA to be the 95-percent upper confidence limit UCL_{95} on the arithmetic average (EPA, 1989).

The UCL_{95} was calculated using site data. In estimating the UCL_{95}, one-half the detection limit was assumed for non-detects. The process of UCL_{95} estimation following EPA recommended procedures is presented in Appendix D. If sample sizes were small, the UCL_{95} defaulted to the maximum detected concentration as the EPC.

E-1.1.4 Toxicity Assessment

The human health risk assessment includes a toxicity assessment section that compiles the toxicity criteria for use in cancer risk and HI estimates. The toxicity criteria were obtained from the following sources in that order:

- The Integrated Risk Information System (IRIS), a database available on the EPA website. IRIS, prepared and maintained by EPA, is an electronic database (http://www.epa.gov/iris/) containing health risk and EPA regulatory information regarding specific chemicals, and
- Interim toxicity criteria were obtained from EPA Region 2 which obtained them from National Center for Environmental Assessment (NCEA) and the toxicity profiles for these interim values are included an appendix (Appendix G) to this report.
- The Health Effects Assessment Summary Tables (HEAST), provided by EPA Office of Solid Waste and Emergency Response (OSWER) (EPA, 1997c), which compiles toxicity values published in various health effects documents issued by EPA.

The primary source of toxicity values was the EPA IRIS database. If a toxicity value was not available from IRIS, then the latest available HEAST value was used. For some chemicals, IRIS and HEAST do not provide toxicity values. As a result, provisional toxicity values provided by the EPA Superfund Technical Support Center were used. The toxicity values that were used for the chemicals identified as COPCs are provided in Appendix D.

E-1.1.5 Risk Characterization

The exposure and toxicity information from the previous sections were integrated in this section to estimate the potential risks and HI. The estimated ELCR and HI represent the site being investigated for site-specific risk management decisions. The cumulative risks and HIs were compared against the acceptable risk ranges. For the purposes of regulatory decision-making, the EPA recommends an acceptable risk range of 1E-4 to 1E-6 (1 to 100 in a million).

Typically, results falling within or below this range are considered a reasonable basis for NFA, depending on the degree of conservatism and uncertainty associated with the estimates. Likewise, a total HI of 1.0 is typically considered to be an acceptable exposure level below which no adverse non-carcinogenic effects are expected to occur. Any HOI values above 1.0 are evaluated if a target organ specific HI is greater than 1.0, if it is less than 1.0, no adverse effects are anticipated. The conservative nature of the analysis and the uncertainty inherent in the risk assessment was considered when interpreting results.

The risk estimations include several exposure pathway assumptions, exposure factors, EPC estimations, site conditions, and receptor behavior. Since all these are assumed numbers, there is an inherent uncertainty associated with these hypothetical scenarios, as well as practical limitations to obtaining true value versus an assumed value. Also, inclusion of chemicals that occur in background conditions attributes risks to a site, even though these chemicals are not likely to be specific to the site. The toxicity factors supplied by EPA incorporates several extrapolation methods that are ridden with inherent uncertainty and tends to include conservatively protective assumptions during such extrapolations. Such uncertainty in toxicity factors is not addressed in this assessment, as EPA sources provide adequate documentation of such uncertainty.

APPENDIX E-2

Site-Specific Risk Assessment for SWMU 5 – Former IRFNA/MAF-4 Disposal Site

E-2.1 Risk Assessment

This section details the potential risks associated with exposure to chemicals detected in surface soils at SWMU 05. Results of the samples collected as part of the PA/SI sampling effort were evaluated as part of this risk assessment. The risk assessment was conducted according to the existing EPA guidance manual and latest exposure assumptions from Exposure Factors Handbook and several other references listed earlier in the introduction section.

E-2.1.1 Screening Evaluation of COPCs

The maximum concentrations of detected chemicals in surface soils were compared to the residential land-use risk-based screening criteria for soil obtained from the EPA Region 9 PRG table and the generic SSL values for leachability contained in the EPA soils screening guidance manual. Chemicals exceeding any of their respective screening criteria were selected as COPCs and were included in the quantitative risk assessment for SWMU 05. Table 2-1 provides a summary of COPCs for SWMU 05.

Four surface soil and four subsurface soil samples were collected and analyzed for VOCs, SVOCs, and explosives. In surface soils, benzo(a)pyrene exceeded the residential PRG in two of four surface soil samples, therefore was selected as the COPC.

There were no COPCs identified for subsurface soil, based on comparisons with SSLs. Two chemicals were detected in subsurface soils that did not have generic SSL criteria (see Appendix D). Diethyl phthalate and methyl ethyl ketone were detected in subsurface soil at estimated concentrations below the reporting limit. These chemicals are common laboratory contaminants and were not considered to be COPCs for leachability concerns.

E-2.1.2 Exposure Assessment

This site is located in a controlled access area and is currently limited to authorized personnel only. As briefly discussed earlier, under current conditions, maintenance workers and authorized site visitors (contractors, security personnel) are the only expected human receptors for SWMU 05. Construction worker exposure is considered ot be incomplete for this site due to absence of COPCs in subsurface soil.

Occasional visitors to the site are likely to be protected from exposure, since their exposure would be lower than exposure to maintenance workers, who are assumed to have direct contact with surface soils during routine maintenance activities.

Maintenance worker exposures are expected to occur from contact with surface soils during routine maintenance activities such as grass cutting and weed control to maintain the storm water flow in the quebrada. On the basis of the assumed occupational duties, a maintenance worker spends an 8-hour workday, once per week (with 2 weeks vacation/year), for 25 years at this site. This is a small site, so the 8-hour exposure workday is a conservative assessment of potential exposure. Exposure to maintenance workers was assumed to occur via incidental ingestion, dermal contact on the exposed skin of the face, hands, and forearms, and inhalation of entrained surface soil particles (dust).

Future land-use evaluation included exposure evaluation to recreational, industrial, or residential use. Recreational receptors evaluated include adults and children (ages up to 6 years old), who would visit the site for outdoor activities such as hiking, picnicking, walking, etc. Recreational users are assumed to have direct contact with surface soils during such activities. It is also assumed that such receptors would frequent the site approximately every other weekend (104 days/year), for 24 years (adult) or 6 years (children). Exposure was evaluated for incidental ingestion, dermal exposure, and inhalation of particulates.

A future industrial scenario evaluated a worker spending an 8-hour workday, 250 days per year, for 25 years at the drainage ditch site. An industrial worker's exposure to surface soil was assumed to occur via ingestion, skin contact, and inhalation of particulates.

Though this site cannot be considered for a residential scenario, it was evaluated as a potential exposure pathway for comparison purposes. Residential receptors evaluated include adults and children. Contact with surface soils is assumed to occur for 350 days per year for 24 years (adult) or 6 years (child). For carcinogenic chemicals, exposure is age-adjusted for the adult scenario to reflect exposure for 6 years as a child, and 24 years as an adult. Residents would be exposed to surface soils via ingestion, dermal contact, and inhalation.

Appendix D-1 summarizes the exposure pathways for SWMU 5, and complete exposure factor assumptions can be found as footnotes to these tables.

EPCs for surface soils were calculated following EPA guidelines, as detailed in Appendix H. EPCs for surface soils were 95 percent UCL of the mean or maximum detected concentration, depending on the number of samples and the underlying data distribution of the chemical. Appendix D-1 provides the EPC for surface soil COPCs. Due to the limited number of samples, the maximum detected BEQ concentration was the EPC.

E-2.1.3 Toxicity Assessment

Chronic toxicity factors were used in the risk calculations as the exposure scenarios are assumed to be long term. Appendix D-1presents the available toxicity factors for the COPCs for SWMU 05.

Current toxicity factors were available from IRIS for benzo[a]pyrene.

E-2.1.4 Risk Characterization

Appendix D-1 presented the risks estimated for benzo(a)pyrene identified as a COPC in surface soil for the receptors identified in the exposure assessment at SWMU 05. As

presented summarized in Section 2.0, cancer risk to all the receptors are well within the acceptable limits. Noncarcinogenic chemicals were not identified as COPCs.

E-2.1.5 Uncertainty Discussion

This site was the former location for the release of nitric acid and mixed amine fuel. Nitric acid and amine fuels are simple nitrogen-containing chemicals. These chemicals would be expected to volatilize or degrade relatively quickly upon release to the environment. Expected site-related chemicals would generally be expected to contain nitrogen.

Benzo(a)pyrene was detected in two of four surface soil samples collected at SWMU 05. SWMU 05 is adjacent to an asphalt road. PAHs are fairly ubiquitous and are commonly associated with asphalt surfaces and vehicle emissions.

This is a small site and the assumption that a receptor would spend an entire day within this site is questionable. It is unlikely, given the size and terrain, that an industrial or residential receptor would be present at this site. This introduces uncertainty into the exposure assessment and may overestimate the reasonable maximum exposure a receptor may receive.

The propagation of uncertainty in the COPC selection, exposure assessment, and toxicity assessment will introduce uncertainty into the risk estimates depending on the manner in which they are propagated.

E-2.2 Summary

The cancer risks are well within acceptable limits for maintenance workers, industrial workers, and recreational and residential receptors. This is the former release site for nitric acid and amine fuels. However, the only COPC for SWMU 05 is benzo(a)pyrene, which may or may not be related to site activities. Overall presence of PAHs does not present unacceptable risks to future human exposure even under the conservative exposure assumptions evaluated for risk estimations. The detected concentrations of PAHs were below method-detection limits. The low level PAHs detected do not require further action at the site.

APPENDIX E-3

Site-Specific Risk Assessment for SWMU 10 – Former Waste Paint and Solvent Disposal Ground

E-3.1 Risk Assessment

Section 1 presents the general approach to screening and risk assessment evaluations. Section 3.0 presented the SWMU 10 specific data evaluation and risk assessment comprehensively. Further technical details are included in this appendix section. This section details the potential risk associated with exposure to contaminants detected in surface and subsurface soils within SWMU 10. Results for the samples collected as part of the Expanded PA/SI sampling effort were evaluated for this risk assessment.

E-3.1.1 Selection of COPCs

The maximum concentrations of detected chemicals in the 10 surface soil samples were compared to the residential PRGs for direct exposure and leachability as described above in the introduction part of this appendix and also in Section 1.0 of the report. Chemicals exceeding any of their respective screening criteria were selected as COPCs and were included in the quantitative risk assessment for SWMU 10. Appendix D-2presents the maximum concentration comparison with screening criteria and the COPCs identified. Four chemicals were detected at SWMU 10 for which there are no RBCs available: calcium, magnesium, potassium, and sodium. These common, ubiquitous elements are all nutritionally essential chemicals that occur in background soils. As agreed, the review team for this site made no comparisons with the background samples. They may not be site-related contaminants, and are not included in the risk assessment, as there are no toxicity criteria from EPA.

In surface soils, six metals – aluminum, arsenic, chromium, iron, manganese, and thallium – exceeded the screening criteria and were selected as COPCs.

In subsurface soils, only thallium exceeded the SSL. Iron was identified as a COPC for construction worker exposure. These chemicals are part of the soil mineralogy, and probably are not specific to the site.

E-3.1.2 Exposure Assessment

This site is located in the Public Works Area and is currently inactive. In the future, this site could be used for industrial purposes again, as it was in the past. Under this scenario, access would likely be limited to maintenance workers and authorized site visitors (contractors, security personnel).

Maintenance worker exposures are expected to occur from contact with surface soils during routine maintenance activities such as grass cutting and weed control. On the basis of the assumed occupational duties, a maintenance worker spends an 8-hour workday, once per week 52 days/year, for 25 years at this site. This is a small site, so the 8-hour exposure workday is a conservative assessment of potential exposure. Exposure routes evaluated included incidental ingestion, dermal contact on the exposed skin of the face, hands, and forearms, and inhalation of entrained surface soil particles. No groundwater exposures are expected for maintenance workers at SWMU 10.

Future land use is assumed to be unrestricted so all types of land use were evaluated: Recreational, industrial, and residential. Recreational use was evaluated for exposure to adults and children (ages up to 6 years old) using the site for outdoor activities such as hiking, picnicking, walking, etc. Recreational users would likely have direct contact with surface soils during such activities. It was assumed that these potential receptors would frequent the small site approximately 104 days days/year, for 24 years (adult) or 6 years. This is a conservative assumption for exposure estimations. Exposure routes evaluated include incidental ingestion, dermal exposure, and inhalation of dust particulates.

For an industrial or commercial scenario, a worker is assumed to spend an 8-hour workday, 250 days/year, for 25 years at this site. Exposure routes are similar to the receptors above: contact with surface soils via ingestion, skin contact, and inhalation of dust particulates.

It was assumed that future residential use of this site is possible. Residential receptors are expected to include adults and children and are assumed to have contact with surface soils. Contact with surface soils is assumed to occur for 350 days/year for 24 years (adult) or 6 years (child). For carcinogenic chemicals, exposure is age-adjusted for the adult scenario to reflect exposure for 6 years as a child and 24 years as an adult. Routes of exposure evaluated included ingestion, dermal contact, and inhalation. Appendix D-2 summarizes the exposure pathways for SWMU 10, and complete exposure factor assumptions can be found in the appendix.

EPCs for surface soils and groundwater were calculated following EPA guidelines, as detailed in Appendix H. EPCs used for risk assessment are included in Appendix D-2. These values were used for dose (intake) estimations of the exposure receptors identified above.

E-3.1.3 Toxicity Assessment

Chronic toxicity factors were used in the risk calculations as the exposure scenarios are assumed to be long-term. Appendix D-2 presents the available toxicity factors for the COPCs of SWMU 10.

Current toxicity factors were available from IRIS for arsenic, manganese, and thallium. The toxicity factors for aluminum and iron are provisional factors obtained from the NCEA, obtained by EPA Region 2. Documentation for these factors can be found in Appendix G.

Surrogate values were utilized for thallium's toxicity assessment. The toxicity values for thallium carbonate were used as surrogate values for thallium, which is generally found in combination with other elements including oxygen, sulfur, and halogens. Thallium's toxicity is generally equivalent, regardless of its form. Therefore, this assumption does not contribute any additional uncertainty in this risk assessment.

E-3.1.4 Risk Characterization

Appendix D-2 presents the risk characterization summary for the quantitatively evaluated receptors at SWMU 10. Section 3.0 presents the receptor specific discussion on the carcinogenic risks and noncarcinogenic hazard indices, as well as a comparison with the background values. Therefore, this information is not repeated here.

E-3.1.5 Uncertainty Discussion

It is suspected that waste paint and solvents were released at this site beginning in the mid-1970s. However, the chemicals detected above criteria at this site are probably not site related given the known history. The detected chemicals are all inorganic metals, which are common and ubiquitous in most soils, and it is uncertain whether they should be considered site related. For this risk assessment, established background concentrations were not available for screening metals. It should be noted that maximum detected concentrations in surface soils for aluminum, iron, and manganese falls within the range of background samples presented in the draft background investigation report for NASD, Vieques Island (CH2M HILL, 2001) (Appendix I). Including metals as surface soil COPCs represents a conservative choice with a relatively large level of uncertainty, due to the lack of site-related release and concentrations within the range of background samples. The arsenic maximum detected concentration at 6.4 mg/kg is greater than the maximum reported background arsenic concentration of 2.2 mg/kg.

Five metals detected in subsurface soil did not have a generic SSL screening value available. All five metals were detected within the range of Vieques Island background concentrations (see Section 3.0). There is no site-related release of inorganic metals. Thus, the uncertainty associated with excluding these chemicals as subsurface COPCs is low.

This is a small site and the assumption that a receptor, such as a worker, recreational visitor, or a resident would spend an entire day completely within it is a very conservative assumption for potential exposures. This assumption introduces some uncertainty in the exposure assumptions for receptors at this site and may overestimate the reasonable maximum exposure a receptor may receive.

Using provisional toxicity values that do not have the same level of rigorous peer review as the other toxicity values listed in IRIS or HEAST may introduce additional uncertainty into the toxicity assumptions behind the values. The uncertainty in the provisional toxicity values for iron may be of particular significance, since iron is a major contributor to noncarcinogenic risk associated with SWMU 10.

This site has multiple COPCs. The assumption that carcinogenicity and health hazard effects are additive across chemicals and pathways introduces uncertainty and does not account for any synergistic or antagonistic effects. In addition, the propagation of uncertainty in the other steps such as COPC selection, exposure assessment, and toxicity assessment will introduce uncertainty into the risk estimates depending on the manner in which they are propagated.

E-3.2 Summary

The waste paint and solvents at SWMU 10 have been removed from the storage shed for disposal at NSRR. As recommended in the Expanded PA/SI (e.g., "Hazardous Waste Storage Accumulation", "Flammable") were installed at SWMU 10. The signs will remain until the CERCLA process is completed for the surrounding area. The sampling analysis results of the 10 surface soil and 10 subsurface soil samples from around the building at SWMU 10 did not detect any paint-specific contaminants. No organic chemicals were detected above screening criteria for direct exposure or leachability to groundwater. The inorganic chemicals detected were also commonly found as part of natural mineralogy of soils. Any chemical detected above a screening value was evaluated for potential exposure related health effects and leachability to groundwater. Nearby downgradient well from AOC C did not have any organic chemicals or inorganic chemicals typically expected for paints (e.g., lead and chromium).

There is no historical evidence to suggest any activities at this site would have resulted in the release of metals to surface soils. Iron concentrations in surface soils are within the range of background soil iron concentrations for NASD and may be the result of magnetite soil formations reported for Vieques Island soils and rocks.

APPENDIX E-4

Site-Specific Risk Assessment for SWMU 14 – Former Wash Rack

E-4.1 Risk Assessment

Sections 1.0 and 4.0 present the general approach to risk assessment and site-specific data evaluation and risk assessment discussions. This section includes some of the technical details of the potential risk associated with exposure to contaminants detected in surface soil, subsurface soil and groundwater at SWMU 14. Results of the samples collected during the Expanded PA/SI sampling effort were evaluated as part of this risk assessment.

E-4.1.1 Selection of COPCs

The maximum concentrations of detected chemicals in surface soils were compared to the residential land-use risk-based screening criteria for soil obtained from the EPA Region 9 PRG table and the generic SSL values (see Appendix I) for leachability contained in the EPA soils screening guidance. For groundwater, maximum detected concentrations were compared to the latest updates to the EPA Region 9 tap water PRGs for COPC selection and a comparison with the federal MCL for a reference. Appendix D-3 summarize COPCs for SWMU 14.

In surface soils, seven metals – aluminum, arsenic, total chromium, iron, manganese, thallium, and vanadium – exceeded the screening criteria and were selected as COPCs. In subsurface soil aluminum and iron exceeded the industrial PRG values. In groundwater, manganese, and dieldrin were selected as COPCs.

E-4.1.2 Exposure Assessment

This site is currently inactive, with no maintenance or any other activities. In the future, most likely it will continue being used for industrial purposes, which may include exposure to maintenance workers and authorized site visitors (contractors, security personnel). The exposure to a maintenance worker is likely to be higher than to other types of receptors visiting the site. Thus, protective concentrations for maintenance workers will protect other populations, who have lower exposures.

Maintenance workers providing grass cutting or mowing services to the site may come in contact with surface soils during these routine activities. At this site, workers are assumed to spend an 8-hour workday, once per week 52 days/year, for 25 years. This is a small site so the 8-hour exposure workday is assumed to provide a conservative assessment of site exposure. Exposure would be expected to occur via incidental ingestion, dermal contact on the exposed skin of the face, hands, and forearms, and inhalation of entrained surface soil particles. No exposure to groundwater is expected, as site water is not in use currently, and maintenance activities will not involve exposure to groundwater at SWMU 14.

Future land use is assumed to be unrestricted, which could result in exposure to recreational, industrial, or residential receptors. Recreational exposure was evaluated for adults and children (up to 6 years old) using the site for outdoor activities such as hiking, picnicking, walking, etc. Recreational users were assumed to have direct contact with surface soils during these activities. It was assumed that receptors would frequent the site approximately every weekend for both days off resulting in an exposure frequency of 104 days/year, for 24 years (adult) or 6 years (youth). Exposure would occur via incidental ingestion, dermal exposure, and inhalation of particulates. This was a conservative assumption considering the site is not a very attractive area, and the site is too small for a receptor to spend an entire outing in this location. These factors result in a conservatively protective exposure assumption.

A future industrial worker was assumed to spend an entire work day in this area, coming in contact with surface soil and using site groundwater (using default exposure assumptions provided by EPA and listed in Appendix D-3). Residential receptors evaluated for exposure include adults and children assumed to have contact with surface soils and using site groundwater as a potable source. Exposure assumptions were the default values provided by EPA and listed in Appendix D-3.

EPCs for surface soils and groundwater were calculated following EPA guidelines, as detailed in Appendix H. The EPCs for a subsurface soil excavation worker scenario included surface and subsurface soils combined, as these workers activities tend to mix the soils. Appendix D-3 provides the EPC for surface soil, subsurface soil and groundwater, which often is the maximum detected concentration. The downgradient well, MW-02, was taken to represent the groundwater EPC.

E-4.1.3 Toxicity Assessment

Chronic toxicity factors were used in the risk calculations, as recommended by EPA for long-term exposures such as those assumed in this risk assessment. RAGS Part D format tables in Appendix D-3 include the toxicity factors for the COPCs at SWMU 14.

E-4.1.4 Risk Characterization

Appendix D-3 presents the risk characterization summary for the quantitatively evaluated receptors at SWMU 14. Section 4.0 presents the receptor specific cancer risk and hazard index results for the scenarios evaluated for SWMU 14. Also, a comparison of site COPC concentrations against background levels are also included in Section 4.0. Therefore, this discussion is not repeated here. However an uncertainty discussion is included below.

E-4.1.5 Uncertainty Discussion

The COPCs selected are all inorganic chemicals that also occur in the natural mineralogy of soils. These chemicals are not likely related to site activities. Established background concentrations were not used for comparison with site chemicals. However, it should be noted that for aluminum, iron, manganese, and vanadium, the maximum detected concentrations in surface soils is within the range of background samples presented in the Phase II PA/SI for seven sites for NASD, Vieques Island (CH2M HILL, November 2002). In addition, all these chemicals fall within the range of background concentrations for NASD soils and have no site-related historical use. In groundwater, antimony and manganese fall

within the range of background concentrations presented in the draft report. Given the site history and concentrations of metals in site and background soils, inclusion of these chemicals in assessing potential exposure-related risks from site operations adds conservative bias to the estimated risks from site media.

Chromium detected in the site was compared against hexavalent chromium PRG for a conservative selection of COPCs.

At SWMU 14, dieldrin was detected in a single well – SWMU14-MW01 – near its detection limits; subsurface soils had no detectable dieldrin. Dieldrin is an organo-chlorine pesticide that may have been a sampling/analytical artifact, as the DQE included its detection in some of the blank samples during Phase II PA/SI. Its detection in the groundwater should be considered anomalous.

Inorganic metal COPCs in groundwater were mostly in the upgradient well at SWMU 14. Unfiltered metal samples were used to select groundwater for COPCs. Unfiltered metal concentrations were approximately one to three orders of magnitude higher in the up-gradient well. However, dissolved metals concentrations between the two wells were similar, except for manganese. This suggests that there may have been turbidity/suspended particulate presence in SWMU14-MW02 that resulted in high metals concentrations. During PA/SI it was reported that it was difficult to obtain clear samples due to poor water yield at this site and all other sites within the former NASD. Groundwater at the site is greater than 40 ft below surface and soils are mostly clays with low permeability. Therefore any soil contamination to impact groundwater has very low potential particularly when no organic (e.g. volatile organic chemicals) are present in soil. Overall, metals detected in groundwater are common to all groundwater, and are likely to result from background concentrations; they are not site related, which introduces uncertainty in site-specific risk estimations.

This is a small site. Therefore, it is questionable whether a receptor, particularly a worker, would spend an entire day within this site. Specifically, this assumption may overestimate the RME a receptor may receive.

The uncertainty associated with toxicity values is in the methodology that EPA follows in extrapolating animal data to human toxicity. A detailed description of uncertainties and limitations of toxicity assessments can be found in EPA databases available on web sites. Some of the risk drivers at this site (e.g., iron and manganese) are also nutritionally essential elements, without which deficiencies will result.

This site has multiple COPCs. The assumption that carcinogenicity and health hazard effects are additive across chemicals and pathways introduces uncertainty and does not account for synergistic or antagonistic effects. In addition, the propagation of uncertainty in the other steps such as COPC selection, exposure assessment, and toxicity assessment introduces uncertainty into the risk estimates depending on the manner in which they are propagated.

E-4.2 Summary

The cancer risks and health hazard effects are within acceptable limits for most of the potentially exposed receptors evaluated in the risk assessment, with the exception of non-cancer HI to a worker and a residential receptor from site drinking water. The elevated HI is

due to presence of inorganic chemicals in groundwater and soil at the site, indicating it is not specific to SWMU 14 operations. There is no historical evidence indicating that the site had any metal releases as part of its operations. The natural rock formations on the island are known to have magnetite, which is rich in iron ore (see Section 1.0) and may play a role in the contribution of iron to soils and groundwater.

Metals concentrations in surface soils are within the range of concentrations found across presumably uncontaminated areas of the former NASD and may be the result of a ubiquitous presence of this and other inorganic metals in Vieques Island soils and groundwater. Appendix B provides a detailed examination of dissolved and unfiltered metal concentrations in both wells and supports the hypothesis that metals in groundwater are related to the natural soil mineralogy. Therefore, any elevated health hazard that may be present in SWMU 14 soils and groundwater due to metals is not specific to this site.

APPENDIX E-5

Site-Specific Risk Assessment for SWMU 15 – Former Waste Transportation Vehicle Parking Area

E-5.1 Risk Assessment

Sections 1.0 and 5.0 present the general approach to risk assessment and site-specific data evaluation and risk assessment discussions. This section includes some of the technical details of the potential risk associated with exposure to contaminants detected in surface soils and groundwater at SWMU 15. The maximum concentrations of detected chemical concentrations were compared to the residential PRG and the generic SSL values for leachability. Groundwater maximum-detected concentrations were compared to tap water PRGs. Chemicals exceeding any of their respective screening criteria were selected as COPCs and were included in the quantitative risk assessment for SWMU 15. Appendix D-4 present the COPC selection for soil and groundwater, respectively, for SWMU 15.

E-5.1.1 Screening Evaluation of COPCs

Several organic VOCs were found near detection limits, at concentrations similar to other surface soil data across NASD, but none exceeded the screening criteria. Reported low levels are suspected to be due to lowered detection limits, and/or artifacts of sampling/analysis methods. Some of the detected chemicals are constituents of plastics and solvents used for sample extractions/equipment cleaning (e.g., phthalates, 2-hexanone), and are considered common laboratory contaminants. All these chemicals were detected at similar concentrations in several of the blanks as reported in PA/SI reports and summarized in Section 1.0. In surface soils, aluminum, arsenic, chromium, iron, manganese, thallium, vanadium, and one PAH constituent and benzo(a)pyrene [a SVOC]) exceeded the screening criteria and were selected as COPCs. In groundwater, aluminum, antimony, chromium, iron, manganese, and vanadium exceeded screening criteria and were selected as COPCs (see Appendix D-4).

E-5.1.2 Exposure Assessment

This site, along with all the others within the Main Operation Area, is inactive and access to this gated area is mostly limited to authorized personnel, (contractors and security personnel).

If the site becomes active in the future , it will likely be mowed and maintained as part of the facility maintenance. Workers will have equal access to SWMUs 14, 15, AOCs C and E, and since all these sites are located within a 1-to-2-acre area, exposure is likely to be uniform and divided between the sites. However, to make it easier to manage, conservative estimation of potential risk at each site was evaluated separately assuming a worker and

other potential receptors would spend their entire exposure duration in each of the areas. The site maintenance worker exposure assumptions were included in Appendix D-4, and Section 1.

Potential future exposures were also evaluated for an industrial worker, recreational visitors (adults and children), and residents (adults and children). Exposure media for industrial workers and residents include soil and groundwater, whereas for recreational visitors, exposures are to surface soil only. Exposure assumptions for all these receptors were conservative values, as discussed in Section 5.0 and Appendix D-4.

E-5.1.2.2 Exposure Point Concentrations

EPCs for surface soils and groundwater were calculated following EPA guidelines, as detailed in Appendix H. Appendix D-4 provides the EPC for surface soil COPCs. Due to the limited detection (2 of 16 samples), the maximum detected benzo(a)pyrene concentration in surface soil was used as the EPC. Since a single sample was collected from this new well, the only detected groundwater concentration was used as the EPC.

E-5.1.3 Toxicity Assessment

Appendix D-4presents the toxicity factors for the SWMU 15 COPCs selected from EPA IRIS and interim toxicity values from NCEA. When multiple toxicity values are available for different valence states of a chemical (e.g., chromium VI) value is used for total chromium in groundwater.

E-5.1.4 Risk Characterization

Appendix D-4 presents the risk characterization summary for the quantitatively evaluated receptors at SWMU 15. Section 5.0 presents the receptor specific cancer risk and hazard index results for the scenarios evaluated for SWMU 15. Also a comparison of site COPC concentration against background levels are also included in Section 5.0. Therefore this discussion is not repeated here. However an uncertainty discussion is included below.

E-5.1.5 Uncertainty Discussion

A systematic sampling of site surface area did not indicate contamination by a suspected Napalm release. Only inorganic chemicals, which are common and ubiquitous in most soils, were detected above screening criteria. However, maximum detected concentrations of aluminum, chromium, iron, manganese, and vanadium in surface soils are within the range of background samples presented in the draft background investigation report for NASD, Vieques Island (CH2M HILL, 2001) (Table 5-8). Arsenic at the maximum detected concentration of 4.8 mg/kg is higher than the maximum background concentration for NASD. However, maximum concentration is only about two times that of background maximum, and a total of two of 16 samples exceeded the background maximum concentration. Thallium at 0.85 mg/kg at SWMU 15 is similar to other NASD sites. However, higher-than-maximum background levels of 0.67 mg/kg were found at NASD. At these low detection concentrations, the actual concentration present is uncertain as analytical results are within the instrument detection limit capabilities, and are referred to as "noise range." Overall, none of these detected inorganic chemicals suggest a site-related release or source area of contamination.

In groundwater, all of the COPCs, antimony, chromium, iron, manganese, and vanadium, are within the range of background concentrations presented in the draft report (see Section 5.0).

Benzo(a)pyrene was detected in two of 16 surface soil samples collected at SWMU 15. PAHs are ubiquitous in urban and developed areas. Potential PAH sources include burned oils leaking from parked trucks (such releases are not regulated under RCRA or CERCLA), asphalt material used for paving roads and parking lots, car and truck emissions, and natural plant materials. The presence of benzo(a)pyrene may not be related to a suspected Napalm release and detected concentrations are within detection limit range: They will likely reduce with time due to degradation.

This is a small site and all exposure assumptions are conservative for exposure assessment, thus introducing a higher level of uncertainty in risk evaluations. This is the typical practice when future land use is unknown for properties being transferred. It provides maximum flexibility for future use of the sites.

There is a high levels of uncertainty associated with reference toxicity value estimates, and EPA databases document the extrapolation -related uncertainties.

The uncertainty associated with risk characterization is same as that identified in earlier steps of the RA process.

E-5.2 Summary

The human health risks were estimated assuming future unrestricted and industrial land use. All the carcinogenic risks were within acceptable limit ranges between 1 to 100 in a million (10-6 to 10-4) levels. The HI was above a value of 1.0, for a future residential child consuming soils at an ingestion rate of 200 mg/day, and drinking groundwater from shallow aquifer at 1 L/day, exclusively from SWMU 15 area. The estimated HI greater than 1.0 is primarily due to iron in the soil and groundwater. Iron is also an essential nutrient. The range of iron levels in both soil and groundwater are well within the background ranges reported in the investigation report (CH2M HILL, June 2001). The natural rock and soil mineralogy of Vieques is reported to contain iron enriched ores such as magnetite, which is suspected in elevated iron across the Island, although overall levels are not too different from ranges reported for mainland United States. As recommended in the Phase I PA/SI, a chain-link fence and signs were installed around SWMU 15. The fence and signs will remain until the CERCLA process is complete for the surrounding area.

Based on this investigation, absence of human health risks indicates that a restriction of access is not warranted. No further investigation or remedial action for the soils or groundwater is necessary to protect human health or the environment, based on an analysis of available soil and groundwater sample results and pertinent information for the site. Therefore, the selected remedial alternative for the soils and groundwater at the site is NFA. No additional sampling or monitoring of the soils or groundwater is necessary because the conditions at the site are protective of human health and the environment. No further groundwater monitoring will be required under CERCLA as a result of the NFA alternative.

APPENDIX E-6

Site-Specific Risk Assessment for AOC B-Former Wastewater Treatment Plant

E-6.1 Risk Assessment

Sections 1.0 and 6.0 present the general approach to risk assessment and site-specific data evaluation and risk assessment discussions. This section includes some of the technical details of the potential risk associated with exposure to contaminants detected in surface soils and groundwater at AOC B. This section details the potential risks associated with exposure to contaminants detected in surface soil and subsurface soil samples from AOC B.

E-6.1.1 Selection of COPCs

The maximum concentrations of detected chemicals in surface soils were compared to the PRG-residential criteria for surface soil, industrial PRGs for subsurface soil from the EPA Region 9 PRG table and the generic SSL values (DAF=20) for leachability from EPA soils screening guidance as included in Appendix D-5. Subsurface soils were screened against the industrial PRGs and generic SSLs. Chemicals exceeding their respective screening criteria in surface soils were selected as COPCs and were included in the quantitative risk assessment for AOC B. Appendices B and C present all the data for the wastewater treatment plant (WWTP). Appendix D-5 Tables 2.1 and 2.2 COPCs selection for surface and subsurface soil at AOC B.

One standing water sample did not have any chemical concentrations above criteria. Low levels (near detection limits) of methyl ethyl ketone (MEK, or 2-butanone) and methyl isobutyl ketone (MIBK) were detected at concentrations ranging between 0.0028 mg/kg and 0.01 mg/kg in surface soil sample sand, and 0.01 and 0.042 mg/kg in three of 16 subsurface soils samples. These chemicals are volatile and easily dissolve in water but do not readily attach to soils. Ketones, such as 2-butanone, and MEK, are recognized by EPA as common laboratory contaminant s found in the methanol used to decontaminate sampling equipment in the field. Thus, equipment decontamination could sometimes introduce ketones during sampling, and typically QA/QC samples are used to check for such occurrences in the blanks. Given its unlikely persistence in soil media and its potential presence as a sampling/analytical artifact, it is unlikely that this chemical is site related and is not considered to be a COPC for site soils. The detected concentrations in surface soil are much lower than PRG levels. The PA/SI report appendices include the DQEs for the data which included detection of all these chemicals at low levels in several of the blanks, as summarized in Section 1.0.

In surface soils, aluminum, arsenic, iron, manganese, thallium, and vanadium were detected and selected as COPCs. Aluminum, and iron were identified as COPCs for subsurface soils.

E-6.1.2 Exposure Assessment

This site is located in the Public Works Area and access is currently limited to authorized personnel only. If the site is used as an industrial facility in the future, it may continue to serve as the WWTP. Under this scenario, workers cutting weeds along the lagoon edges may be exposed to surface soil. Any other occasional visitors or trespassers will have lesser exposure, thus, the maintenance worker scenario is protective of other potential receptors to the WWTP. Exposure assumptions are similar to the maintenance scenario at other NFA sites, and Appendix D-5 includes the exposure factors used to estimate intake. The site is a wastewaster lagoon, and is unlikely to be used for anything else. However, it was evaluated as an industrial facility and residential lot to assess the risks under the most conservative exposure conditions as described in Section 1.

A recreational visitor/trespasser was evaluated for public interest, as discussions with Navy Staff indicated that Island residents occasionally enter the restricted areas of NASD. The recreational visitor scenario included adults and child (ages 0 to 6 years old). Exposure routes evaluated included incidental ingestion, dermal exposure, and inhalation of particulates.

The assumptions used for a future industrial worker were the default assumptions recommended by EPA, and were also used for the residential adult and child scenario. Table 1 of Appendix D-5 summarizes the exposure pathways evaluated for AOC B, and complete exposure factor assumptions can be found in Appendix D-5.

EPCs for surface soils and groundwater were calculated following EPA guidelines, as detailed in Tables 3.1 and 3.2 of Appendix D-5. EPCs for surface soils were the 95 percent UCL of the mean or the maximum-detected concentration.

E-6.1.3 Toxicity Assessment

Chronic toxicity factors were used in the risk calculations, as recommended by EPA for comparisons, and assumes exposures to be long term. Appendix D-5 presents the toxicity factors for the COPCs for AOC B.

E-6.1.4 Risk Characterization

Appendix D-5 presents the risk characterization summary for the quantitatively evaluated receptors at AOC B. Section 6.0 presents the receptor specific cancer risk and hazard index results for the scenarios evaluated for AOC B. Also a comparison of site COPC concentration against background levels are also included in Section 6.0. Therefore this discussion is not repeated here. However an uncertainty discussion is included below.

E-6.1.5 Uncertainty Discussion

The chemicals detected above criteria are all inorganic chemicals that occur in soils as part of the natural mineralogy. All the COPCs identified in site soils have concentration ranges that are within the range of background samples presented in the draft Soil, Groundwater, Surface Water, and Sediment Background Investigation Report, USNASD, Vieques Island (CH2M HILL, June 2001) (Appendix I).

For some of the inorganic chemicals, there are no generic SSLs. However, these chemicals were detected within the range of background concentrations (see Section 6.0) for soils at NASD. They are not from site activities, thus do not present a threat of migration to groundwater. Despite a lack of quantitative screening values, because they do not represent site-specific contamination, and are probably part of the soil mineralogy, there is no significance in the absence of SSL values.

The site is an old wastewater lagoon, and assumption of residential use is overly conservative. Any alteration to the land use may involve elimination of this low lying area. Therefore, exposure evaluations represent overly conservative assumptions for the risk estimations.

The uncertainty associated with extrapolation of toxicity from animal data to humans is described in the EPA databases. Additionally, most of the inorganic chemicals, particularly iron, are also essential nutrients, introducing additional uncertainty to the toxicity assumptions. Additionally, all toxicity studies are based on exposure to the pure form of the inorganic, and bioavailability limitations from exposures to soil minerals are not part of the toxicity assessments, which adds additional uncertainly to these toxicity factors.

The propagation of uncertainty in the other steps such as COPC selection, exposure assessment, and toxicity assessment will introduce uncertainty into the risk estimates.

E-6.2 Summary

There is no site-specific hazardous waste identifiable by extensive sampling conducted at AOC B (16 each, surface and subsurface soils samples collected). Detected chemicals were screened against criteria as described in Sections 1.0 and 6.0 to determine nature and extent. Only chemicals identified as COPCs were inorganic chemicals, which are also known to occur in soil mineralogy. All these chemicals were within the range of concentrations found in the background soils for NASD.

The risk assessment concluded that exposure to the potential receptor populations (maintenance workers, industrial workers, and recreational visitors) does not present excessive health risks. Exposures to residential adults do not present risks above acceptable limits. The HI for a child from iron levels is slightly above a value of 1.0. However, there is uncertainty in the assumption that levels of inorganic metals at this site are associated with site-related activities. All the COPCs, including iron and arsenic concentrations in surface soils, are within the range of concentrations found across background areas of NASD, suggesting detected inorganic chemicals could result from the mineral content of soils.

Since no contamination is identified specific to the WWTP operations at AOC B, no further actions are recommended for AOC B. No additional sampling or monitoring of the soil will be necessary because the conditions at the site are protective of human health and the environment.

APPENDIX E-7

Site-Specific Risk Assessment for AOC C-Drainage Ditch at Former Transportation Shop

E-7.1 Risk Assessment

E-7.1.1 Screening Evaluation of COPCs

Sections 1.0 and 7.0 present the general approach to risk assessment and site-specific data evaluation and risk assessment discussions. This section includes some of the technical details of the potential risk associated with exposure to contaminants detected in surface soils and groundwater at AOC C. The maximum concentrations of detected chemicals in surface soils were compared to the residential PRGs and the generic SSL values. For groundwater, maximum detected concentrations were compared to tap water PRGs. Chemicals exceeding any of their respective screening criteria were selected as COPCs and were included in the quantitative risk assessment for AOC C. Appendix D-6 provides the selection of COPCs for AOC C.

In surface soils, seven metals exceeded the screening criteria. Aluminum, arsenic, iron, manganese, thallium, and vanadium were selected as COPCs. In subsurface soil, aluminum and iron were identified as COPCs.

In groundwater, four metals exceeded screening criteria. Aluminum, iron, manganese, and vanadium were selected as COPCs.

E-7.1.2 Exposure Assessment

Future land use is assumed to be unrestricted, and includes the presence of maintenance workers, recreational visitors, industrial workers, and residential receptors .

This site is located in the Public Works Area and access is currently limited to authorized site visitors (contractors, security personnel). Since the NASD is inactive, a routine maintenance is not occurring at the present time. The exposure assessment for a maintenance worker scenario is considered to be protective of any other potential current receptor. Maintenance workers would be expected to have direct contact with surface soils during routine maintenance activities such as grass cutting and weed control. On the basis of occupational duties, it is assumed that a maintenance worker spends an 8-hour workday, once per week 52 days/year, for 25 years at this site. This is a small site and the 8-hour exposure workday is a conservative assessment of site exposure. Exposure to maintenance workers would be expected to occur via incidental ingestion, dermal contact on the exposed skin of the face, hands, and forearms, and inhalation of entrained surface soil particles. No groundwater exposures are expected for a maintenance worker.

Recreational use would include adults and children (ages 0 to 6 years old), whose exposure duration is assumed as every other weekend for 24 years (adults) and 6 years (child).

Exposures were assumed to occur through ingestion, dermal exposure, and inhalation of particulates from the ditches. Appendix D-6 includes exposure assumptions for each of the exposure population per medium.

An industrial worker would be expected to spend an 8 hour workday, 250 days/year, for 25 years at this site. These worker are assumed to have contact with site soils, as well as use groundwater to drink while at work. Exposure routes are similar to those of other receptors: ingestion, skin contact, and inhalation of particulates. Potable water use would include drinking 1 liter/day, dermal contact for 10 minutes per day due to washing hands at work, for example, and potentially exposing hands, forearms, and face. No inhalation exposure is expected from the inorganic COPC identified in site groundwater.

A residential scenario was evaluated for this ditch, though it is not applicable to this site, as a conservative (worst-case) scenario. This scenario included evaluation of adult and child exposures using the default exposure assumptions for the available exposure factors. Other factors that did not have default values are assumed conservatively (e.g., skin surface area). Exposures are assumed to occur through ingestion, dermal contact, and inhalation of dust-borne COPCs. Groundwater potable water use was assumed to occur by drinking 2 liters/day (adults) or 1 liter/day (children). Appendix D-6 summarizes the exposure pathways evaluated for AOC C, and pathways included for risk assessment and exposure factor assumptions are shown in Appendix D-6.

EPCs for surface soils and groundwater were calculated following EPA guidelines, as detailed in Appendix D-6. Appendix D-6 provides the EPC for surface soil, subsurface soil and groundwater COPCs. The 95 percent UCL was taken as the EPC for all surface soil COPCs. For groundwater, due to the limited number of samples (N = 1), the maximum detected concentration was taken as the EPC.

E-7.1.3 Toxicity Assessment

Appendix D-6 presents the available toxicity factors for the COPCs for AOC C. Toxicity profiles for COPCs with provisional toxicity factors can be found in Appendix G.

E-7.1.4 Risk Characterization

Appendix D-6 presents the risk characterization summary for the quantitatively evaluated receptors at AOC C. Section 7.0 presents the receptor specific cancer risk and hazard index results for the scenarios evaluated for AOC C. Also a comparison of site COPC concentration against background levels are also included in Section 7.0. Therefore this discussion is not repeated here. However an uncertainty discussion is included below.

E-7.1.5 Uncertainty Discussion

Oil sheen observed in the ditch was suspected to be from the vehicle maintenance area. Expected contaminants from the vehicle shop are petroleum hydrocarbons from motor oils, , degreasers, and waste oils. None of these were detected above criteria. The selected COPCs are all inorganic metals, which are common and ubiquitous in most soils. It is likely that the inorganic metals at this site are not site-related. Established background concentrations were not available for screening inorganic metals for this risk assessment. Thus none are site-specific. Section 7.0 presents a comparison of background metals versus AOC C metals

in a table at the end of the section. One of the surface soil manganese concentrations is above background levels. However, detected maximum concentration 1,200 mg/kg is slightly higher than maximum background level of 966 mg/kg. In groundwater, three of the four inorganic chemicals – aluminum, iron, and vanadium -- were within the range of background concentrations, whereas manganese at the maximum concentration is above that presented in the draft report. Aluminum, cobalt, copper, iron, and manganese were detected within the range of Vieques Island background concentrations (see Section 7.0), where as maximum detected thallium level (1.9 mg/kg) was higher than the maximum background level (0.67 mg/kg). However, surface soil sample form the same location did not have thallium above background. At these low levels, metals concentration levels are highly uncertain, as they are within instrument detection capability limits. There is no site-related release of inorganic metals.

This is a small drainage ditch , and the exposure scenarios assuming a person living on site is not applicable. However, it was included for comparison during site management. Several of the exposure assumptions such as a worker spending an entire day within this site may overestimate the RME.

The uncertainty associated with toxicity criteria is fully characterized and reported by EPA in their databases.

This site has multiple COPCs. The assumption that carcinogenicity and health hazard effects are additive across chemicals and pathways introduces uncertainty. Much of the additional uncertainty stems from exposure and toxicity assessment steps as briefly discussed above.

E-7.4 Summary

The cancer risks and health hazard effects for AOC C are within acceptable limits for maintenance workers, industrial workers, and recreational receptors. The cancer risk for residential receptors is within acceptable limits and the HI exceeds one, primarily due to iron in soil and groundwater. However, there is no evidence of site-related releases of iron. There is no contamination specific to past operations at AOC C, resulting in an NFA recommendation for AOC C.

None of the surface soil or subsurface soil samples had organic chemicals above screening criteria for direct exposure (i.e., PRGs) or leachability (i.e., SSLs). Some of the inorganic chemicals were above screening criteria and were included as COPCs for risk assessment. The cancer risks and health hazard effects for AOC C are within acceptable limits for maintenance workers, industrial workers, recreational receptors. The cancer risk for residential receptors is within acceptable limits and the HI exceeds one, primarily due to iron in soil and groundwater, which corresponds to background levels. However, there is no evidence of site-related releases of iron at this site; iron risks are not considered to be site related. No additional sampling or monitoring of the soil or groundwater will be necessary because the conditions at the site are protective of human health and the environment.

APPENDIX E-8

Site-Specific Risk Assessment for AOC F-Former UIC Septic Tank

E-8.1 Risk Assessment

Sections 1.0 and 8.0 present the general approach to risk assessment and site-specific data evaluation and risk assessment discussions. This section includes some of the technical details of the potential risk associated with exposure to contaminants detected in surface soils and groundwater at AOC F. This section details the potential risk associated with exposure to contaminants detected in groundwater within AOC F.

E-8.3.1 Screening Evaluation of COPCs

Appendix D-7 provides a selection of COPCs for AOC F. The direct exposure to the subsurface soil was assumed for construction worker. Therefore, the only medium of interest in this human health risk assessment is the groundwater where five metals exceeded screening criteria. Aluminum and iron were selected as COPCs for subsurface soil and six metals were selected as COPCs for groundwater.

E-8.1.2 Exposure Assessment

There is no direct exposure to groundwater within NASD at the present time, and such exposure is unlikely in the future as the shallow groundwater above the granite rock identified within 50 bls at NASD is of poor yield and water has high turbidity. However, for conservative risk evaluation proposes, groundwater COPCs are evaluated for direct exposure to industrial workers and residential adults and children. Appendix D-7 summarizes the exposure pathways and exposure factors assumptions for AOC F and complete exposure factor assumptions can be found in Appendix D.

EPCs for groundwater were calculated following EPA guidelines, as detailed in Appendix H. The EPCs are included in Appendix D-7. EPCs for groundwater were 95 percent UCL of the mean for these ubiquitous (5 detects out of 5 samples) inorganic chemicals reported in all samples, with the exception of antimony, reported in 1 out of 5 samples.

E-8.1.3 Toxicity Assessment

Chronic toxicity factors selected from EPA's IRIS and HEAST tables are Included in Table 8-5 for the COPCs in groundwater at AOC F.

E-8.1.4 Risk Characterization

Appendix D-7 presents the risk characterization summary for the quantitatively evaluated receptors at AOC F. Section 8.0 presents the receptor specific cancer risk and hazard index results for the scenarios evaluated for AOC F. Also a comparison of site COPC concentration

against background levels are also included in Section 8.0. Therefore this discussion is not repeated here. However an uncertainty discussion is included below.

E-8.1.5 Uncertainty Discussion

There are additional site-specific sources of uncertainty for this risk assessment.

This site was the former UIC Septic System serving the Enlisted Men's Club, and expected releases are domestic wastes and water. No direct exposure is expected from this site as any leaks from this buried old tank would occur to soils deeper than typical excavation depths of up to 6 ft bls. The detected chemicals in subsurface soils and groundwater are all inorganic metals, which are common and ubiquitous in most soils. In subsurface soils, thallium is reported at a maximum concentration of 1.7 J mg/kg and there is significant uncertainty relating to its presence of "true" concentration. A comparison of subsurface soil inorganic chemicals with the detected background concentrations for Vieques Island soils (CH2M HILL, 2001) are included in Table 8-7.

Metals detected in groundwater above screening criteria (antimony, iron, and manganese) are within the range of groundwater background concentrations for NASD area of Vieques Island (see Table 8-8).

Aluminum, cobalt, copper, iron, and manganese do not have generic SSL screening values and were not selected as COPCs. The average detected concentrations of these chemicals is within the range of detected background concentrations in Vieques Island soils. Although there is some uncertainty associated with the exclusion of these chemicals as leachability COPCs, the site history does not suggest a past release and the background data does not indicate elevated levels of these metals, minimizing the uncertainty in this decision.

None of the reported subsurface soil and groundwater COPCs are specific to AOC F operations. All other steps of Risk Assessment Exposure assumption for potable use of groundwater in a septic drain field area is unrealistic. However, there is a conservative assumption with high uncertainty of such occurrence.

No additional uncertainty is identified with toxicity assessment and risk characterization steps.

E-8.2 Summary

There is no exposure to the site under current conditions due to lack of contamination at the surface and absence of human activity in the area. Future altered land use is assumed to expose users to the groundwater from this site. However, this is unlikely due to the known presence of a septic system in this area, and shallow groundwater does not provide adequate yield to become a productive supply well for domestic use. Such use was evaluated for conservative risk assessment purposes.

There were no carcinogenic COPCs in groundwater. Therefore, a cancer risk is not estimated. The health hazard effects are within acceptable limits for a future worker using groundwater for potable use while at work. The hazard index for a residential adult and a child is slightly above a target HI of 1.0, due to iron in the groundwater. There is site-related release of metals to site media, including groundwater. Iron concentrations in groundwater

are within the range of concentrations found across presumably uncontaminated areas of NASD and may be the result of a ubiquitous presence of iron in Vieques Island soils and lithological features in which groundwater is occurring. The inclusion of iron and other inorganic metals as COPCs for this site is a conservative action towards protecting public health under worst-case exposure assumptions. Therefore, any elevated health hazard that may be present in AOC F groundwater due to iron should be compared with background conditions. No site-specific elevated hazards are occurring due to the septic system.

APPENDIX E-9

Site-Specific Risk Assessment for AOC K - Former Water Well

E-9.1 Risk Assessment

Sections 1.0 and 9.0 present the general approach to risk assessment and site-specific data evaluation and risk assessment discussions. This section includes some of the technical details of the potential risk associated with exposure to contaminants detected in surface soils and groundwater at AOC K. This section details the potential risk associated with use of groundwater from wells located within the area of the former water supply well at AOC K. Two wells are located upgradient of the former well and three wells are directly downgradient.

E-9.1.1 Screening Evaluation of COPCs

For groundwater, maximum detected concentrations were compared to the EPA Region 9 tap water PRGs. Chemicals exceeding any of their respective screening criteria were selected as COPCs. Table 2 of Appendix D-8 provides a summary of COPCs for AOC K.

B2EHP was detected above the Region 9 Tap Water PRG and MCL in one sample. B2EHP is a common laboratory contaminant with no site-related history at AOC K. It was also detected in the blank samples as reported in the DQE and summarized in section 1.0. Due to the low level detection (1 out of 5 samples), infrequent detection, and its presence as a common laboratory contaminant, B2EHP was not considered a COPC for groundwater, following EPA guidance for treatment of detections in blanks.

E-9.1.2 Exposure Assessment

The site is a well, and the media of interest is groundwater although no groundwater use is in the area nor a current complete exposure pathway for AOC K. There is currently no potable water use at this site. Shallow groundwater is not suitable for potable use.

Though site groundwater is unlikely to be used for potable purposes in the future, due to water being supplied to the Island by Puerto Rico, it is assumed that industrial workers and residential adults and children would be exposed to site groundwater during potable use.

Table 9-2 summarizes the exposure pathways for AOC K and complete exposure factor assumptions can be found in Appendix D.

EPCs for groundwater were calculated following EPA guidelines using the methodology, as outlined in Section 1.0 and detailed in Appendix H. Table 3 of Appendix D-8 provides the EPC for groundwater COPCs.

E-9.1.3 Toxicity Assessment

Tables 5s and 6s of Appendix D-8 presents the toxicity factors for the COPCs for AOC K along with the sources of the toxicity factors. None of the COPCs identified for the five wells included carcinogenic chemicals, therefore, only reference doses (RfD) are provided in the table.

E-9.1.4 Risk Characterization

Tables 7s and 9s in Appendix D-8 the risk characterization summary for the quantitatively evaluated receptors at AOC K. Section 9.0 presents the receptor specific cancer risk and hazard index results for the scenarios evaluated for AOC K. Also a comparison of site COPC concentration against background levels are also included in Section 9.0. Therefore this discussion is not repeated here. However an uncertainty discussion is included below.

E-9.1.5 Uncertainty Discussion

The site is an old water supply well and was identified initially for further investigation due to presence of a low-level single detection of benzene. Resampling of the old well, and sampling of the newly installed wells, did not identify any of the suspected contaminants (see Appendix F). Only inorganic chemicals were detected above screening criteria. Thus, human health assessment conducted is based on non-site related chemicals.

This site contains a former potable water supply well that is no longer in use. The detected chemicals in the groundwater are all inorganic metals that are common and ubiquitous in most soils. Benzene, which was detected above the MCL during a previous sampling event by the USGS, was not detected. For the COPCs identified –aluminum, barium, iron, manganese, thallium, and vanadium – the detected concentrations in all five wells were within the range of background samples presented in the draft background investigation report for NASD, Vieques Island (CH2M HILL, 2001) (see Section 9.0). Thus, identified COPCs are not site related, and are likely from background levels.

The shallow groundwater is not likely to be used as a potable source, so exposure assumptions are conservatively protective of any future exposures. Because of this, the estimated risks are highly uncertain, as such exposure may never occur.

No new uncertainty is associated with this HHRA, and all the uncertainty associated with toxicity criteria developed by EPA are discussed in their technical documents. Five new wells were installed during PA/SI to investigate USGS-reported benzene in the old potable well. The well is no longer in use, and USGS reported benzene was not confirmed in the old well or any of the five newly installed wells. No organic chemicals were identified in the site investigation, and inorganic chemicals were detected in unfiltered groundwater samples, which were included for COPC selection. Dissolved metals were below detection limits, indicating detected total metals could be associated with suspended particulates.

There are no carcinogenic COPCs identified in the site groundwater. The target HI of 1.0 was exceeded for all the receptors (industrial and residential) due to the presence of thallium in groundwater at an average concentration of 8.7 $\mu g/L$ (in two detects out of five). Both of these detections were in the upgradient wells. Metals detected in groundwater are attributed to the high turbidity levels thus are associated with the particulates suspended

during water sampling from the wells. For a residential child, the HI exceeds the acceptable limit, primarily due to thallium and iron in groundwater. The detected thallium concentration ranges at the site were 8 $\mu g/L$ and 9.3 $\mu g/L$ compared to a range of 4.8 $\mu g/L$ to 18 $\mu g/L$ in the background wells. The site iron ranged in concentration from 86 $\mu g/L$ to 9,600 $\mu g/L$ compared to a background range of 480 $\mu g/L$ to 29,000 $\mu g/L$, indicating both these metals are from background conditions and are not specific to the site(see Table 9-6). Therefore, any elevated health hazard that may be present in AOC K groundwater due to iron or thallium is not be site related. This site should not be considered to present an excessive risk or hazard to human health. No remedial actions are needed for the site.

E-9.2 Summary

The site groundwater is free of any organic contamination and detected inorganic chemicals are same as those detected in background samples. No evidence exists to suggest that a release of hazardous materials has occurred to the groundwater as a result of site-related activities at AOC K. No further investigation or remedial action for the groundwater is necessary for the protection of human health, based on an analysis of available groundwater sample results and pertinent information for the site. Therefore, the selected remedial alternative for the groundwater at the site is NFA. No additional sampling or monitoring of the groundwater will be necessary because the conditions at the site are protective of human health and the environment. No further groundwater monitoring will be required under CERCLA as a result of the NFA alternative.

APPENDIX E-10

Site-Specific Risk Assessment for AOC L – Abandoned Septic Tank

E-10.1 Risk Assessment

The general approach used for risk assessment was discussed in Section 1.0, and Section 10.0 presents the site-specific evaluation for AOC L. During nature and extent evaluation, surface soils were identified to have inorganic chemicals identified as COPCs. These are included for direct exposure-related risk estimations. The data used in this report are same as those reported in the Phase II PA/SI report (CH2M HILL, November 2002).

E-10.1.1 Screening Evaluation of COPCs

For the COPC identification, the maximum concentrations of detected chemicals in surface soils were compared to the residential land-use risk-based screening criteria from the EPA Region 9 PRG table and the generic SSL values for leachability contained from the EPA soils screening guidance. Subsurface soil sample results were compared to the generic SSL. Chemicals exceeding any of their respective screening criteria were selected as COPCs for AOC L. Tables 2s of Appendix D-9 provide a summary of COPCs for AOC L.

In surface soils, aluminum, arsenic, iron, and manganese were selected as COPCs. The COPCs identified for subsurface soils are arsenic and iron. The uncertainty associated with those chemicals that do not have criteria is discussed further in this section.

E-10.1.2 Exposure Assessment

The site is easily accessible to personnel traveling on the main access road into NASD and to people coming to the Vieques beaches. However ,the site itself is not an attractive spot for recreational use. The site was evaluated conservatively for exposure to future recreational users, industrial workers, and residential users. Assumptions used are the default EPA exposure factors for industrial workers and residents (adult and child), as listed in Appendix D-9. Subsurface soil COPCs were evaluated for a future construction worker exposures.

In the future, if the area were mowed and maintained, direct contact with surface soils during routine maintenance activities could occur via ingestion, dermal contact, and inhalation of air-borne dust. However, the site is small and would not constitute a full day's exposure if it were maintained but the exposure factors used are conservative and the worker is assumed to spend an entire day, once a week within the site.

Table 1 of Appendix D-9 summarizes the exposure pathways for AOC L and complete exposure factor assumptions can be found in Appendix D.

The exposure point concentrations (EPCs) for surface soils were included in Tables 3s in Appendix D-9 for surface soil and subsurface soil COPCs. Due to the limited number of samples (N = 4), the maximum detected concentration was selected as the EPC for AOC L.

E-10.1.3 Toxicity Assessment

The toxicity criteria for the COPCs are included in Tables 5s and 6s in Appendix D-9, along with the source of the toxicity factor selected.

E-10.1.4 Risk Characterization

Tables 7s and 9s in Appendix D-9 present the risk characterization summary for the quantitatively evaluated receptors at AOC L. Section 10.0 presents the receptor specific cancer risk and hazard index results for the scenarios evaluated for AOC L. Also a comparison of site COPC concentration against background levels are also included in Section 10.0. Therefore this discussion is not repeated here. However an uncertainty discussion is included below.

E-10.1.5 Uncertainty Discussion

This site was used in the early 1940s possibly as septic vault. It is unknown if there was any release of hazardous waste. The chemicals detected are all inorganic metals, which are common and ubiquitous in most soils. It should be noted that the range of site concentrations are within the range of background samples, when compared to the range of background soil concentrations presented in the draft background investigation report for NASD, Vieques Island (CH2M HILL, 2001) (see Section 10.0). Similar concentrations of the same inorganic chemicals were also detected at other sites within NASD. No subsurface soil COPCs were identified, indicating subsurface soil is not contaminated at the site.

This is a small site and the assumption is questionable that a receptor, particularly a worker, would spend an entire day within this site. This introduces some uncertainty in the exposure assumptions for receptors at this site and may overestimate the reasonable maximum exposure a receptor may receive.

There is high uncertainty associated with the reference toxicity concentrations used from EPA data bases, and such uncertainty is discussed in detail in the respective EPA databases.

No additional uncertainty is associated with risk characterization of the individual components of risk assessment discussed above.

E-10.2 Summary

The cancer risks and health hazard effects are within acceptable limits for maintenance workers, industrial workers, recreational receptors, and residential receptors. Metal concentrations detected in surface soils are well within the range of concentrations found in soils across the former NASD, indicating that detected chemicals are likely from soil mineralogy of Vieques Island soils. Due to the absence of elevated health risks and lack of site-specific contamination in AOC L soils, NFA is recommended to address human health exposure risks from AOC L.

Appendix F
Analytical Resampling Data for AOC K

- CERTIFICATE OF ANALYSIS -
(HRS #E84207 and FDEP CompQap #900306)

:: Marty Clasen
CH2M Hill

PROJECT_SEQ: 2011155
PROJECT ID: Vieques NASD

PEL Lab# : 201115501
Client ID : NDE180
Matrix : Water

Collection Information:
Sample Date: 11/29/00 9:30:00 AM
ND = Less than RL

Parameter	Method	Results	Units	RL	Dilution Factor
Volatiles	SW-846 8021				
Benzene	SW-846 8021	ND	ug/L	1.0	1
Ethylbenzene	SW-846 8021	ND	ug/L	1.0	1
o-Xylene	SW-846 8021	ND	ug/L	1.0	1
p,m-Xylene	SW-846 8021	ND	ug/L	2.0	1
Toluene	SW-846 8021	ND	ug/L	1.0	1
4-Bromofluorobenzene	SW-846 8021	89.5	%	(71 - 124)	1

Brian C. Spann
Laboratory Manager

VIEQUES NASD

FIELD INVESTIGATION FOR 7 AOC SITES AT PUBLIC WORKS

CH2M HILL
Chain of Custody Form 2011-155 *GP

Generated on: 11/29/2000 1:04:23 PM

COC Number: NDE
Project: VIEQUES NASD SITE INVESTIGATION
Kit Request ID:
Project #: 160403.FI.ZZ
Laboratory Coordinator: KEVIN SANDERS
Lab: PEL Laboratories

Sample ID	Station ID	Date & Time Collected	Matrix	Number of Containers	Analysis Requested	Comments
NDE180	SUPPLY_WELL_K	11/29/00 09:30	WG	3	BTEX_W	Screen Sample; Level 3 QC not needed on Supply Well in AOC-K

01

Sampled By:	Date / Time: 11-29-00 1800		Custody Seal: Y / N	Relinquished By:	Date / Time: 11-29-00 1800
Shipped Via: UPS FedEx Hand Other (please specify):					
Received By:	Date / Time: 11/30/00 10:00	Cooler Temp:	Custody Seal: Y / N	Relinquished By:	Date / Time:
Received By:	Date / Time:	Cooler Temp:	Custody Seal: Y / N	Relinquished By:	Date / Time:

Remarks:

8208 7961 6792

Temp Rec'd 4°C
pH < 2
Due 12/1/00

rptChainOfCustody - updated 981112

Appendix G
Toxicity Profiles for Chemicals with Provisional Toxicity Factors

Superfund Technical Support Center
National Center for Environmenta
U.S. Environmental Prote
26 West Martin Luther King D
Cincinnati

Harlal Choudhury/Director, Pat Daunt/Administrator
Hotline 513-569-7300, FAX 513-569-7159, E-Mail: STSC.Superfund@epa.gov

April 21, 2003

Michael Sivak
U.S. EPA - Region II

ASSISTANCE REQUESTED: Requested toxicity information on Aluminum and Iron. *(Vieques)*

ENCLOSED INFORMATION:

Attachment 1: **Risk Assessment Issue Paper for: Evaluating the Carcinogenicity of Aluminum (CASRN 7429-90-5)**

Attachment 2: **Risk Assessment Issue Paper for: Derivation of a Provisional Inhalation RfC for Aluminum (CASRN 7429-90-5)**

Attachment 3: **Risk Assessment Issue Paper for: Derivation of a Provisional Oral RfD for Aluminum (CASRN 7429-90-5)**

Attachment 4: **Risk Assessment Issue Paper for: Evaluation of the Carcinogenicity Assessment for Iron (CASRN 7439-89-6) and Compounds**

Attachment 5: **Risk Assessment Issue Paper for: Feasibility of Deriving a Provisional RfC for Iron (CASRN 7439-89-6)and Compounds**

Attachment 6: **Risk Assessment Issue Paper for: Derivation of the Provisional RfD for Iron (CASRN 7439-89-6) and Compounds**

BE ADVISED: Unless specifically indicated to have been peer reviewed, it is to be noted that the attached Risk Assessment Issue Paper(s) have not been through the U.S. EPA's formal review process; therefore, they do not represent a U.S. EPA verified assessment.

If you have any questions regarding this transmission, please contact the STSC at (513) 569-7300.

Attachments (6)

cc: STSC files

Supported by IntelliTech Systems, Incorporated, under
U.S. Environmental Protection Agency Contract No. 68-C-01-147.

Risk Assessment Issue Paper for: Evaluating the Carcinogenicity of Aluminum (CASRN 7429-90-5)

NOTE: This provisional risk assessment paper for the carcinogenicity for Aluminum has received external peer review.

INTRODUCTION

Verified toxicity values for aluminum (Al) and its compounds are unavailable on IRIS or HEAST (U.S. EPA, 1999, 1997), except for a chronic oral RfD of 4E-4 mg/kg-day for aluminum phosphide. However, occupational guidelines and standards have been established for a number of chemical and physical forms of Al, including, from ACGIH, 8-hour TWA-TLVs of 10 mg/m^3 for the compound as a metal dust or oxide, 5 mg/m^3 as "pyro" powders or welding fumes, and 2 mg/m^3 for soluble salts or organic forms of the metal (ACGIH, 1998). From NIOSH, 10-hour TWA-RELs of 10 mg/m^3 are specified for "total" Al dust versus 5 mg/m^3 for the respirable portion (NIOSH, 1994), the institute covers all other forms of the metal by identical values to those specified by ACGIH (ACGIH, 1998). OSHA PELs for Al include an 8-hour TWA value of 15 mg/m^3 for "total" metal dust, versus 5 mg/m^3 for the respirable portion (NIOSH, 1994). The U.S. EPA's CARA list (U.S. EPA, 1994) cites a HEA for Al (U.S. EPA, 1987), and ATSDR has updated its toxicological profile of the element (ATSDR, 1998).

Research papers pertinent to the potential carcinogenic effects of Al were sought through computer searches of the HSDB, RTECS, MEDLINE, and TOXLINE (and its subfiles) databases, covering the time period 1995-1999. The literature searches were conducted in June, 1999.

REVIEW OF THE PERTINENT LITERATURE

The review by Stokinger (1981) gives an account of Al as an all-pervasive component of products that are central to the daily lives of most Americans. For example, the metal is a crucial part of manufactured products for the building, automobile, and container industries, while Al as powder or flake is a component in a number of consumer products, such as paints, fireworks, etc. Al complexes and minerals are used in the brewing and paper industries, and as coagulants for water purification. Al oxide finds application in abrasives, as a catalyst or absorbent, and as a component in fillers. Al chloride is included in cosmetic formulations such as deodorants.

Human exposure to Al arises principally from food, through its widespread use in food additives, packaging and cooking utensils, and in Al-containing medications, particularly antacid, buffered aspirin, anti-ulcer and anti-diarrheal formulations (Marquis, 1989; Lione, 1985). Pennington and Schoen (1995) estimated daily Al intakes of 0.1-0.3 mg/kg-day for infants and children 6 months-6 years of age and 0.1-0.18 mg/kg-day for older children and adults, data are in broad agreement with those of Wilhelm et al. (1995) who reported the dietary intake of Al in German children (living in the Duisberg area) as ranging from 0.008 to 0.11 mg Al/kg-day. These values are consistent with a range of 1-20 mg/day (0.014-0.3 mg/kg-day) for normal oral daily Al intake from food and water reported by other investigators (Ganrot, 1986; Iyengar et al., 1987; Wilhelm et al., 1990). However, users of Al-containing medications can ingest much larger amounts of the element, possibly

as high as 840-5000 mg/day (12-71 mg/kg-day) from antacids, 126-728 mg/day (1.8-10.4 mg/kg-day) from buffered aspirins and 828 mg/day (11.8 mg/kg-day) from anti-ulcer compounds when taken at recommended dosages (Lione, 1985).

There is a large amount of information available on the absorption, transfer from tissue to tissue and elimination of Al from the body, including data that have been amassed from studies on either human volunteers or laboratory animals. In general, the chemical appears to be poorly absorbed from the gastrointestinal tract, though the portion of the load that is retained will vary depending on the concentration, the chemical species administered, the fasting or fed state of the host, gastrointestinal pH, animal model, etc. For example, Yokel and McNamara (1988) administered single oral doses of a number of Al compounds (both water soluble and insoluble) to New Zealand white rabbits and obtained absorbed proportions of the load ranging from 0.27% to 27%. Fractional uptake of Al in humans under normal conditions (i.e., with no intake of large quantities of Al from medicine) was estimated to be 0.1-0.3% assuming an intake of 20 mg Al/day (0.3 mg Al/kg-day) and urinary excretion of 20-50 : g Al/day (0.3-0.7 : g Al/kg-day) (Ganrot, 1986). However, little information is available on the actual mechanism by which the element and its compounds are transported across the brush border. (Wilhelm et al., 1990; Lione et al., 1985).

Aluminum can also be absorbed by inhalation as indicated by age-related deposition in the lungs of the general population and exposure-related increased blood and urine concentrations in workers exposed to aluminum (Bast-Pettersen et al., 1994; Sjogren et al., 1996; Hosovski et al., 1990; Wilhelm et al., 1990; U.S. EPA, 1987). Aluminum occurs primarily in particulate form in the ambient atmosphere and as various dusts and fumes during its production and use. Common forms of inhaled aluminum include aluminum oxide (alumina; Al_2O_3), pyro powders (powder and flake aluminum treated to reduce surface oxidation), aluminum welding fume, and soluble salts (e.g., aluminum chloride and sulfate) (ACGIH, 1991).

There are a number of published reports of studies in which the carcinogenicity of aluminum compounds has been evaluated. These include oral exposure studies in which the compounds were made available to experimental animals in the drinking water or diet (Schroeder and Mitchener, 1975a,b: Oneda et al, 1994), and inhalation epidemiological studies, in which the incidence of tumor formation in persons exposed to aluminum-containing dusts and fumes in an occupational setting was compared to unexposed individuals (Spinelli et al., 1991; Theriault et al., 1984, 1990; Armstrong et al., 1986; Tremblay et al., 1995; Selden et al., 1997; Cullen et al., 1996; Dufresne et al., 1996; Ronneberg and Langmark, 1992). As discussed in the following paragraphs, solid evidence for a positive carcinogenic effect of Al has not emerged from the subject studies, thereby leaving the issue of the potential carcinogenicity of the Al compounds still in doubt.

Oral Exposure

Schroeder and Mitchener (1975a) exposed 52 Long-Evans rats/sex/group to 0 or 5 ppm Al as potassium aluminum sulfate in drinking water for life. Based on default values for drinking water consumption and body weight for this strain of rat in a chronic study (U.S. EPA, 1988), these values are equivalent to Al doses of 0.472 and 0.67 mg/kg-day, for males and females, respectively. Study endpoints included body and heart weight; serum glucose, cholesterol, and uric acid; and urinary protein, glucose, and pH. All animals were necropsied at the time of natural death, and histological examinations were carried out on heart, lung, kidney, liver, spleen and gross tumors, for approximately 50% of the animals in the group. The only remarkable finding was a significant increase ($p<0.005$) in gross tumor incidence in exposed male rats [13/25 (52%) compared to 4/26 (15%) in controls], although the tumor sites were not reported. Six of the tumors in the exposed males (46% of total) were considered malignant compared to two malignant tumors (50% of total) in the male controls. There were no significant differences in tumor incidences between exposed and control females.

In another study by the same investigators, 54 Swiss mice/sex/group were exposed to drinking water containing 0 or 5 ppm Al as aluminum potassium sulfate for life (Schroeder and Mitchener, 1975b). Based on default values for drinking water consumption and body weight for B6C3F1 mice in a chronic study (U.S. EPA, 1988), these values approximate to Al doses of 1.2 mg/kg-day in both males and females. Study endpoints included body weight, gross pathology, and some limited histology of the heart, lung, liver, kidney, and spleen. The incidences of gross tumors were 15/41 (36.6%) and 11/38 (28.9%) in exposed and control males, respectively, and 19/41 (46.3%) and 14/47 (29.8%) in exposed and control females, respectively, differences that did not achieve statistical significance by Fisher's exact test, although incidences of multiple tumors and lymphoma leukemia were considered by the authors to be significantly increased in females ($p<0.025$ and $p<0.05$, respectively). However, a definitive assessment of aluminum carcinogenicity in both this and the rat study (Schroeder and Mitchener, 1975a) is precluded by the limitations of the pathology examinations and reporting.

In a more recent study, the tumorigenic potential of aluminum potassium sulfate was assessed in B6C3F1 mice chronically exposed in the diet (Oneda et al., 1994). Sixty animals/sex/group were fed a diet containing 0, 1.0, 2.5, 5.0, or 10.0% (w/w) for 20 months. These concentrations of aluminum potassium sulfate (as the dodecahydrate) are equivalent to 0, 569, 1422, 2844, and 5687 ppm Al. Using food factors calculated with an algorithm relating food consumption to body weight (U.S. EPA, 1988) and body weight data estimated from growth curves reported by the investigators, the dosages of aluminum are estimated to be 0, 95, 237, 483, or 1024 mg Al/kg-day in males and 0, 97, 242, 512, or 1110 mg Al/kg-day in females. Clinical signs, food consumption, and body weight were evaluated weekly. Hematology, clinical chemistry, or urine endpoints were not assessed. Necropsies that included organ weight measurements and comprehensive histological examinations (including brain) were performed on all animals, including those that died during the course of the study. Survival rates were higher than control values in all treated male and female groups, ranging from 86.7-95.0% compared to 73.3% in males and 86.7-91.7% compared to 78.3% in females. No changes in food consumption were observed, but body weight gain was increased in both sexes at 95-97 and 237-242 mg Al/kg-day (weights were 10-23% higher than controls at end of study), was similar to controls in both sexes at 483-512 mg Al/kg-day, and decreased in both sexes at 1024-1110 mg Al/kg-day (11-16% lower than controls at end of study). There were no exposure-related increased incidences of tumors, other proliferative lesions, or non-neoplastic lesions. In fact, the incidence of spontaneous hepatocellular carcinomas was significantly decreased in males at 1024 mg Al/kg-day (5.5% compared to 20.5% in controls, $p<0.01$).

Inhalation Exposure

A body of epidemiological evidence has pointed to an increased incidence of cancers of various kinds in workers employed in the aluminum production industry. However, as discussed in a review by Ronneberg and Langmark (1992), the concern about potential cancer hazards in the aluminum industry has primarily arisen because of exposures to polycyclic aromatic hydrocarbons (PAHs) and coal tar pitch volatiles (CTPVs) rather than to Al *per se*. Thus, while a number of studies have provided inferential data linking occupationally exposed aluminum workers with an increased risk of developing tumors of the bladder or lung (Gibbs, 1985; Thériault et al., 1984, 1990; Armstrong et al., 1986; Spinelli et al., 1991; Pearson et al., 1993; Tremblay et al., 1995), it would be unwise to ascribe any excess tumor formation to the effects of Al in view of the concurrent exposure to well-documented carcinogenic PAHs such as benzo(a)pyrene. The issue is further complicated by the likely exposure of production workers to other substances such as fluorides, sulfur dioxide, aromatic amines and asbestos (Ronneberg and Langmark, 1992; Tremblay et al., 1995; Dufresne et al., 1996), and to the possible effects of cigarette smoking in affected individuals. Consequently, these studies have failed to provide direct evidence for the carcinogenicity of Al fumes and dusts.

WEIGHT-OF-EVIDENCE CLASSIFICATION

A considerable number of epidemiological studies have examined the incidence of excess tumor formation in persons occupationally exposed to Al in the form of dusts or fumes. In general, a body of inferential evidence exists for an increase in cancer of the bladder and lung through such occupational exposure to Al, although conclusions linking these responses to the effects of Al are confounded by attendant co-exposure to other harmful emissions such as PAHs, CTPVs, and by cigarette smoking. A 20-month exposure of B6C3F1 mice to Al potassium sulfate dodecahydrate in the diet at concentrations up to 10% w/w displayed no indication of compound-related carcinogenicity and, in general, no indication of adverse toxicological effects of any kind (Oneda et al., 1994). Similarly, the life-time exposure of Swiss mice and Long-Evans rats to 5 ppm Al as aluminum potassium sulfate in drinking water provided no convincing evidence for the carcinogenicity of Al compounds (Schroeder and Mitchener 1975a,b). Gene reversion experiments on Al compounds resulted in negative results in *S. typhimurium* (Ahn and Jeffrey, 1994). Taking all of the evidence of Al carcinogenicity together, a qualitative weight-of evidence classification of D, -not classifiable as to human carcinogenicity, is suggested, in line with the agency's guidelines for carcinogenic risk assessment (U.S. EPA, 1986). In accordance with the agency's proposed guidelines for carcinogenic risk assessment (U.S. EPA, 1996), the compound's carcinogenicity *cannot be determined* on the available evidence.

DERIVATION OF AN ORAL SLOPE FACTOR AND INHALATION UNIT RISK

Due to insufficeint data a provisional oral slope factor and inhalation unit risk could not de developed.

REFERENCES

CGIH (American Conference of Governmental Industrial Hygienists). 1991. Documentation of the threshold .mit values and biological exposure indexes, 6th ed. Cincinnati, OH. p. 46-49.

ACGIH (American Conference of Governmental Industrial Hygienists). 1998. 1998 Threshold limit values for chemical substances and physical agents and biological exposure indices. ACGIH, Cincinnati, OH.

Ahn, H-W. and E.H. Jeffery. 1994. Effect of aluminum on fluoride uptake by *Salmonella typhimurium* TA98; Implications for the Ames mutagenicity assay. J. Toxicol. Health. 41: 357-368.

Armstrong, B.G., C.G. Tremblay, D. Cyrr and G.P. Thériault. 1986. Estimating the relationship between exposure to tar volatiles and the incidence of bladder cancer in aluminum smelter workers. Scand. J. Work Env. Health. 12: 486-493

ATSDR (Agency for Toxic Substances and Disease Registry). 1998. Toxicological Profile for Aluminum. U.S. Public Health Service, Atlanta, GA.

Bast-Pettersen, R., P.A. Drablos, L.O. Goffeng, Y. Thomassen and C.G. Torres. 1994. Neuropsychological deficit among elderly workers in aluminum production. Am. J. Ind. Med. 25: 649-662.

Cullen, M.R., H. Checkoway and B.H. Alexander. 1996. Investigation of a cluster of pituitary adenomas in workers in the aluminum industry. Occup. Environ. Med. 53: 782-786.

ufresne, A., P. Loosereewanich, B. Armstrong, G. Theriault and R. Begin. 1996. Inorganic particles in the ings of five aluminum smelter workers with pleuro-pulmonary cancer. Am. Ind. Hyg. Assoc. J. 57: 370-375.

Ganrot, P.O. 1986. Metabolism and possible health effects of aluminum. Environ. Health Perspect. 65: 363-441.

Gibbs, G.W. 1985. Mortality and aluminum reduction plant workers, 1950 through 1977. J. Occup. Med. 27: 761-770.

Hosovski, E., Z. Mastelica, D. Suderic and D. Radulovic. 1990. Mental abilities of workers exposed to aluminum. Med. Lav. 81(2): 119-123.

Iyengar, G.V., J.T. Tanner, W.R. Wolf and R. Zeisler. 1987. Preparation of a mixed human diet material for the determination of nutrient elements, selected toxic elements and organic nutrients: a preliminary report. Sci. Total Environ. 61: 235-252.

Lione, A. 1985. Aluminum toxicology and the aluminum-containing medications. Pharmacol. Therap. 29: 255-285.

Marquis, J.K. 1989. Neurotoxicity of aluminum. Environmental chemistry and toxicology of aluminum. T.E. Lewis, Editor; Chelsea, Michigan, Lewis Publishers, Inc., p. 289-298.

NIOSH (National Institute for Occupational Safety and Health). 1994. Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Washington, DC.

Oneda, S., T. Takasaki, K. Kuriwaki et al. 1994. Chronic toxicity and tumorigenicity of aluminum potassium sulfate in B6C3F1 mice. In Vivo. 8: 271-278.

Pearson, R.J.C., M.C. Battigelli and J.T. Gamble. 1993. Mortality from working in the aluminum reduction industry. Environ. Res. 61: 19-24.

Pennington, J.A.T. and S.A. Schoen. 1995. Estimates of dietary exposure to aluminum. Food Addit. Contam. 12: 119-128.

Ronneberg, A. and F. Langmark. 1992. Epidemiologic evidence of cancer in aluminum reduction plant workers. Am. J. Ind. Med. 22: 573-590.

Schroeder, H.A. and M. Mitchener. 1975a. Life-term studies in rats: effects of aluminum, barium, beryllium, and tungsten. J. Nutr. 105: 421-427.

Schroeder, H.A. and M. Mitchener. 1975b. Life-term effects of mercury, methyl mercury, and nine other trace metals on mice. J. Nutr. 105: 452-458.

Selden, A.I., H.B. Westberg and O. Axelson. 1997. Cancer morbidity in workers at aluminum foundries and secondary aluminum smelters. Am. J. Ind. Med. 32: 467-477.

Sjogren, B., A. Iregren, W. Frech et al. 1996. Effects on the nervous system among welders exposed to aluminum and manganese. Occup. Environ. Med. 53: 32-40

Spinelli, J.J., P.R. Band, L.M. Svirchev and R.P. Gallagher. 1991. Mortality and cancer incidence in aluminum reduction plant workers. J. Occup. Med. 33(11): 1150-1155.

Stokinger, H.E. 1981. The Metals: Aluminum. In: Patty's Industrial Hygiene and Toxicology, Volume IIA, 3rd rev ed., G.D. Clayton and F.E. Clayton, eds. John Wiley and Sons, NY. P. 1493-1504.

Thériault, G., C. Tremblay, S. Cordier and S. Gingras. 1984. Bladder cancer in the aluminum industry. Lancet i: 949-950.

Thériault, G.P., C.G. Tremblay and B.G. Armstrong. 1990. Bladder cancer screening among primary aluminum production workers in Quebec. J. Occup. Med. 32(9): 869-872.

Tremblay, C., B. Armstrong, G. Theriault and J. Brodeur. 1995. Estimation of risk of developing bladder cancer among workers exposed to coal tar pitch volatiles in the primary aluminum industry. Am. J. Ind. Med. 27: 335-348.

U.S. EPA. 1986. Guidelines for Carcinogen Risk Assessment. Federal Register. 51(185): 33992-34003.

U.S. EPA. 1987. Health Effects Assessment for Aluminum. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of olid Waste and Emergency Response, Washington, D.C. EPA600/8-88/016.

U.S. EPA. 1988. Recommendations for and Documentation of Biological Values for Use in Risk Assessment. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. EPA/600/6-87/008. NTIS PB88-179874.

U.S. EPA. 1994. Chemical Assessments and Related Activities (CARA). Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA. 1996. Proposed Guidelines for Carcinogenic Risk Assessment. Federal Register. 61(79): 17960-18011.

U.S. EPA. 1997. Health Effects Assessment Summary Tables. FY-1997 Annual and FY-1997 Supplement. Office of Research and Development, Office of Emergency and Remedial Response, Washington, DC.

U.S. EPA. 1999. Integrated Risk Information System (IRIS). Online. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

Wilhelm, M., D.E. Jager and F.K. Ohnesorge. 1990. Aluminum toxicokinetics. Pharmacol. and Toxicol. 66: 4-9.

Wilhelm, M., I. Lombeck, B. Kouros, J. Wuthe and F-K. Ohnesorge. 1995. Duplicate study on the dietary ıtake of some metals/metalloids by German children. Part II: Aluminum, cadmium and lead. Zbl. Hyg. 197: 57-369.

Yokel, R.A. and P.J. McNamara. 1988. Influence of renal impairment, chemical form, and serum protein binding on intravenous and oral aluminum kinetics in the rabbit. Toxicol. Appl. Pharmacol. 95: 32-43.

Risk Assessment Issue Paper for:
Derivation of a Provisional Inhalation RfC for Aluminum (CASRN 7429-90-5)

NOTE: This provisional risk assessment paper for the inhalation chronic reference concentration (RfC) for Aluminum has received external peer review.

INTRODUCTION

Verified toxicity values for aluminum (Al) and its compounds are unavailable on IRIS or HEAST (U.S. EPA, 1999, 1997), except for a chronic oral RfD of 4E-4 mg/kg-day for aluminum phosphide. However, occupational guidelines and standards have been established for a number of chemical and physical forms of Al, including, from ACGIH, 8-hour TWA-TLVs of 10 mg/m^3 for the compound as a metal dust or oxide, 5 mg/m^3 as "pyro" powders or welding fumes, and 2 mg/m^3 for soluble salts or organic forms of the metal (ACGIH, 1998). From NIOSH, 10-hour TWA-RELs of 10 mg/m^3 are specified for "total" Al dust versus 5 mg/m^3 for the respirable portion (NIOSH, 1994). NIOSH covers all other forms of the metal by identical values to those specified by ACGIH (ACGIH, 1998). OSHA PELs for Al include an 8-hour TWA value of 15 mg/m^3 for "total" metal dust, versus 5 mg/m^3 for the respirable portion (NIOSH, 1994). The U.S. EPA's CARA list (U.S. EPA, 1994) cites a HEA for Al (U.S. EPA, 1987), and ATSDR has updated its toxicological profile of the element (ATSDR, 1998).

Research papers pertinent to the potential toxicological effects of Al via the inhalation route were sought through computer searches of the HSDB, RTECS, MEDLINE, and TOXLINE (and its subfiles) databases, covering the time period 1995-1999. The literature searches were conducted in June, 1999.

REVIEW OF THE PERTINENT LITERATURE

The review by Stokinger (1981) gives an account of Al as an all-pervasive component of products that are central to the daily lives of most Americans. For example, the metal is a crucial part of manufactured products for the building, automobile, and container industries, while Al as powder or flake is a component in a number of consumer products, such as paints, fireworks, etc. Al complexes and minerals are used in the brewing and paper industries, and as coagulants for water purification. Al oxide finds application in abrasives, as a catalyst or absorbent, and as a component in fillers. Aluminum chloride is included in cosmetic formulations such as deodorants.

Human exposure to Al arises principally from food, through its widespread use in food additives, packaging and cooking utensils, and in Al-containing medications, particularly antacids, buffered aspirin, anti-ulcer and anti-diarrheal formulations (Marquis, 1989; Lione, 1985). Pennington and Schoen (1995) estimated daily Al intakes of 0.1-0.3 mg/kg-day for infants and children 6 months-6 years of age and 0.1-0.18 mg/kg-day for older children and adults, based on the FDA Total Diet Study (1993) and the U.S. Department of Agriculture Nationwide Food Consumption Survey (1987-1988). These data are in broad agreement with those of Wilhelm et al. (1995) who reported the dietary intake of Al in German children (living in the Duisberg area) as ranging from 0.008 to 0.11 mg Al/kg-day. These values are consistent with a range of 1-20 mg/day (0.014-0.3 mg/kg -day) for normal oral daily Al intake from food and water reported by other investigators (Ganrot,

1986; Iyengar et al., 1987; Wilhelm et al., 1990). However, users of Al-containing medications can ingest much larger amounts of the element, possibly as high as 840-5000 mg/day (12-71 mg/kg-day) from antacids, 36-728 mg/day (1.8-10.4 mg/kg-day) from buffered aspirins and 828 mg/day (11.8 mg/kg-day) from anti-ulcer compounds when taken at recommended dosages (Lione, 1985).

There is a large amount of information available on the absorption, transfer from tissue to tissue and elimination of Al from the body, including data that have been amassed from studies on either human volunteers or laboratory animals. In general, the chemical appears to be poorly absorbed from the gastrointestinal tract, though the portion of the load that is retained will vary depending on the concentration, the chemical species administered, the fasting or fed state of the host, gastrointestinal pH, animal model, etc. For example, Yokel and McNamara (1988) administered single oral doses of a number of Al compounds (both water soluble and insoluble) to New Zealand white rabbits and obtained absorbed proportions of the load ranging from 0.27% to 27%. Fractional uptake of Al in humans under normal conditions (i.e., with no intake of large quantities of Al from medicine) was estimated to be 0.1-0.3% assuming an intake of 20 mg Al/day (0.3 mg Al/kg-day) and urinary excretion of 20-50 : g Al/day (0.3-0.7 : g Al/kg-day) (Ganrot, 1986). However, little information is available on the actual mechanism by which the element and its compounds are transported across the brush border. (Wilhelm et al., 1990; Lione, 1985).

Aluminum can also be absorbed by inhalation as indicated by age-related deposition in the lungs of the general population and exposure-related increased blood and urine concentrations in workers exposed to Al (Bast-Pettersen et al., 1994; Sjogren et al., 1996; Hosovski et al., 1990; Wilhelm et al., 1990; U.S. EPA, 1987). Aluminum occurs primarily in particulate form in the ambient atmosphere and as various dusts and fumes during its production and use. Common forms of inhaled Al include aluminum oxide (alumina; Al_2O_3), pyro powders (powder and flake Al-treated to reduce surface oxidation), Al welding fume, and soluble salts (e.g., aluminum chloride and sulfate) (ACGIH, 1998).

Neurotoxicity as a Primary Toxicological Effect of Aluminum

One of the greatest health concerns regarding Al is its neurological effects. The first evidence for Al-induced neurotoxicity in humans was seen in patients who, as a result of receiving long-term hemodialysis for chronic renal failure, developed a degenerative neurological syndrome (dialysis dementia) characterized by the gradual loss of motor, speech, and cognitive functions (Alfrey, 1993). This dementia, attributable to Al in the dialysate, is usually fatal within 6-9 months after the first clinical signs appear. In addition, many patients received high oral doses of Al to act as phosphate binders. Autopsies of these patients revealed increased concentrations of Al in the gray matter and cerebral spinal fluid (CSF) but no evidence of neurofibrillary degeneration (NFD) despite the elevated Al levels. Once the connection between Al and dialysis dementia was established, Al was removed from dialysis fluid and the incidence of dementia rapidly declined, thereby strengthening the argument that Al was a causal agent in dialysis dementia.

Amyotrophic Lateral Sclerosis (ALS) and Parkinson's Disease (PD) are other neurological diseases which have been associated with Al exposure. ALS is a progressive disease of the Central Nervous System (CNS) that is characterized by an accumulation of neurofibrillary tangles. In Guam, southern West New Guinea, and parts of Japan there is an unusually high prevalence of ALS and PD. This may be related to the natural abundance of Al coupled with the virtual lack of magnesium and calcium in the drinking water supplies and soil of these areas. In a study designed to evaluate effects of high Al and low calcium levels in the diet, much like the conditions associated with Guam and other similar areas, cynomolgus monkeys were placed on a low calcium

diet either with or without supplemental Al and manganese (Garruto et al., 1989). Chronic calcium deficiency alone produced neurodegenerative effects, although neurofibrillary changes were most frequently seen in the monkeys on a low calcium diet supplemented with Al and manganese.

Aluminum has also been implicated as having an association with Alzheimer's Disease (AD) (Ganrot, 1986). However, there is no evidence that Al plays a causative role in its development. AD is a chronic progressive disease clinically characterized by a gradual loss of cognitive functions. The pathological diagnosis of AD is based on the presence of large numbers of neuritic plaques and neurons with neurofibrillary changes. The CNS alterations in AD patients differ from those found in sensitive animals given high doses of Al. Even though increased amounts of Al are found in AD patients, there are no neurofibrillary changes like those found in rabbits treated with large amounts of Al.

A large amount of experimental information exists in reports of studies that have explored the possible relationship between occupational exposure to emissions in Al foundries, smelters, etc., with an increased incidence of diseases such as neurological diseases and/or cancer. For example, the etiological link between the increased incidence of tumors at various tissue sites and exposure to Al-based emissions has been thoroughly explored (Gibbs, 1985; Thériault et al., 1984, 1990; Armstrong et al., 1986; Spinelli et al., 1991; Pearson et al., 1993; Tremblay et al., 1995). However, it has been generally concluded that the inferential association between exposure to Al and marginally increased incidences of tumors of the bladder and/or lung are confounded because of the co-exposure of subjects in such settings to other harmful and potentially carcinogenic substances, such as polycyclic aromatic hydrocarbons (PAHs and coal tar pitch volatiles (CTPV) (Ronneberg and Langmark, 1992). However, in contrast to this vitiation of the findings of possible relationships between exposure to Al and tumor formation, any epidemiological links between exposure to Al and neurotoxicological symptoms have generally been accepted, irrespective of the presence of other compounds or harmful substances to which subjects may have been co-exposed. This is rationalized by the recognition of the body of ancillary evidence that exists for the possible neurotoxicological effects of Al (with dialysis dementia as an example), thereby justifying the assumption that, on balance, the neurological symptoms displayed by persons occupationally exposed to Al among other substances are likely to be causally linked to Al rather than to any of the other contaminants. In the paragraphs that follow, reports of studies that have explored that potential neurotoxicological effects of Al borne in dust or fumes is summarized. Where possible, those data that point to a quantitative relationship between exposure and response are emphasized.

INHALATION TOXICITY

uman Toxicity

Principal Study

Neurobehavioral effects were evaluated in a group of 87 Al foundry workers who were occupationally exposed to 4.6-11.5 mg/m^3 Al fumes and dust for a mean of 12.0 years [standard deviation (SD) 4.5 years, shortest exposure 6 years] compared to an unexposed control group (n = 60) who were matched for age, job seniority and social status to exposed subjects (Hosovski et al., 1990). It is reported that environmental Al concentrations were measured for each worker separately during the winter and summer, implying that personal sampling may have been used and that the contributing concentrations are time-weighted averages. In certain places, the number of particles ranged as high as 329-1020/cm^2 air, and dust particle sizes were #1, 1-5 and $5 microns in 65.6, 26.6, and 7.6% of the samples, respectively. Tests of psychomotor ability (simple and complex reaction time, oculomotor coordination), intellectual ability (Wechsler intelligence, performance intelligence and verbal intelligence quotients, and Wechsler subtests on information processing, memory, understanding, calculation, coding, picture completion, picture grouping, object assembling, assembling of cubes and common concepts), and cerebral damage (Bender visual motor test) were conducted. Performance of the exposed workers was found to be significantly ($p<0.02$) impaired on the complex reaction time, oculomotor coordination, memory, coding, picture completion, and object assembling tests. However, the investigators noted that the performance deficits had no clinical manifestations, and that additional studies were probably needed to confirm the possibility of cerebral damage. The study yielded a lowest available non-duration adjusted LOAEL of 4.6 mg Al/m^3 for psychomotor and cognitive impairment during repeated 8-hour occupational exposures (Hosovski et al., 1990), that could be corrected for discontinuous exposure (10 m^3/20 m^3 and 5 days/7 days) to yield a $LOAEL_{HEC}$ of 1.64 mg/m^3 Al.

Supporting Studies

Aluminum oxide powders were administered to Canadian miners (mainly underground gold and uranium miners) in known exposures as a means of prophylaxis against silicosis (Stokinger, 1981; Rifat et al., 1990). Data in which more than 42 million Al treatments (. 150,000 man-years) had been given over a period of 27 years ending in 1971 were reviewed by Stokinger (1981). The effectiveness of this treatment is uncertain but no lung damage or other ill effects (not specified) were observed. The powders (McIntyre powder) were prepared by grinding Al pellets so that 96% of the particles were #1.2 : m in diameter. During this process most of the particles became oxidized to aluminum oxide; the powder contained 85% aluminum oxide and 15% elemental Al. According to Stokinger (1981), recommended exposure concentrations were 30,000 particles of respirable size per cubic centimeter (ppcc) for 10 minutes/day or 10,000-20,000 ppcc for 20 minutes/day (total treatment days not indicated). Rifat et al. (1990) stated that the recommended exposure was to an Al dust concentration of 20,000-34,000 parts per ml air in the miners' changing rooms before each shift for 10 minutes. Stokinger (1981) reported that the 30,000 ppcc concentration corresponds to . 350 mg/m^3, which is equivalent to an 8-hour average concentration of 2 mg/m^3. Based on the Stokinger (1981) data and the fact that one unspecified study used levels 30 times higher than advised, the TLV of 10 mg/m^3 is recommended for Al dust (ACGIH, 1998).

The increasing awareness of the potential neurotoxicity of Al has resulted in a number of investigations of the incidence of neurotoxicological symptoms in Al workers. Although treatment with McIntyre powder had not produced apparent adverse effects, a neurobehavioral evaluation of male miners (261 exposed to McIntyre powder, 346 unexposed) who started working between 1940 and 1979 (additional duration data not reported) was performed in 1988-1989 (Rifat et al., 1990). There were no significant differences between exposed and unexposed miners in reported diagnoses of neurological disorder. Results of cognitive testing (Mini-Mental State Examination for general cognitive function, Ravens colored progressive matrices test for reasoning, and Symbol Digit Modalities Test for spatial perceptual accuracy and information processing), however, showed that the exposed group had significantly (p#0.001) impaired performance on at least one test, and when all test scores were summed. Also, the likelihood of scores in the impaired range increased with duration of exposure.

A neurologic syndrome was described in Al smelting plant potroom workers (White et al., 1992). Twenty-five men were evaluated for suspected work-related neurologic illness based on findings in 3 patients studied previously. The average duration of employment was 18.7 years (SD, 3.6; range, 12-23 years), 15 of the patients were working at the time of evaluation, and 10 had taken early retirement or medical leave due to workplace-related symptoms (mean length of time since exposure was 1.3 years ranging from 0.2-5 years). Quantitative exposure level data were not reported, but 21 of the workers had been employed in the potroom prior to installation of fume hoods for a mean duration of 5.3 years (range 3-7 years). Symptoms most often reported by the patients were frequent loss of balance (88%), memory loss (84%), and joint pain (84%); other symptoms included dizziness (80%), numbness (80%), parasthesias (72%), and tremor (68%). Neurologic examinations showed mild to moderate signs of lack of coordination (tremor, dyssynergy of upper extremity limb movement, or ataxia) in 84% of the patients. Neuropsychologic effects were evaluated in 21 of the patients using the Wechsler Adult Intelligence Scale-Revised (intellectual functioning), Wide Range Achievement Test-Revised (academic functioning), Halstead-Reitan Neuropsychological Test Battery (neuropsychological assessment), and Minnesota Multiphasic Personality Inventory (personality functioning). Memory function was assessed with the Wechsler Memory Scale (14 patients) and Wechsler Memory Scale-Revised (8 patients). The memory function evaluation showed mild to moderate impairment on subtests of immediate recall for verbal or visual information (70-75% of the tested patients) and delayed verbal or visual recall (50-70%). Other effects included mild or moderate impairment on Halstead-Reitan tests of abstract reasoning and flexible thinking (42% of the tested patients), memory for tactile information (53%), and sustained attention and discrimination of tonal and speech patterns (44 and 64%, respectively). On the Wechsler memory and Halstead-Reitan tests, mild and moderate impairment was defined as scores 1.5-2 and $2 standard deviations below the mean of the normal population, respectively. Most (89%) of the patients tested with the Minnesota Multiphasic Personality Inventory had abnormally elevated scores ($2 SDs above the population mean) indicative of clinical depression. Significant positive correlations were found between severity of incoordination (signs and symptoms) and degree of exposure (qualitative) before the introduction of the ventilation hoods.

White et al. (1992) noted two other studies that described neurologic problems among Al smelter workers. Thus, an evaluation of 444 electrolysis workers found neuropsychiatric changes in 123 (28%), "neurotic syndromes" in 89 (20%), and "slight pyramidal and cerebellar changes" in 39 (9%) (Langauer-Lewowicka and Braszczynska, 1983). In the second study, symptoms including mental confusion, concentration, and memory problems were described in 6 potroom workers (Cawthon, 1988).

In another study of Al production workers, neuropsychological effects were assessed in 38 elderly men who had been exposed for at least 10 years exclusively in the potroom (n=14), foundry (n=8), or other manual bor departments of the same plant (n=16, control group) (Bast-Pettersen et al., 1994). The mean ages and nployment durations of the groups were in the ranges 62.5-63.5 years and 19.2-19.6 years, respectively. The men were examined soon after or just before retirement in 1991. Limited environmental monitoring data indicates that the degree of Al exposure varied between the subgroups and over the years. Average annual total dust concentrations in the potroom were reduced significantly from 9.5 mg/m^3 in 1977 to 3.0 mg/m^3 in 1990. Aluminum levels were not specifically reported, but the average Al content in the total potroom dust was approximately 20% by weight; other constituents of the dust included fluoride and coal tar pitch components. Data from an Al uptake/excretion study of workers from the same plant indicated that the level of Al exposure was approximately eight times higher in the potroom than in the foundry (0.48 and 0.06 mg/m^3, respectively) (Drablos et al., 1992). Medical examinations (including lung function, standard laboratory tests, and serum and urine Al concentrations) and a neuropsychological test battery were performed. The battery assessed six mental functions (neuropsychiatric symptoms, motoric/sensoric, reaction time, psychomotor speed/efficiency, memory/learning, and intelligence) using a questionnaire and 15 different objective tests. Some subtle deficits were found in potroom workers that were not considered to be indicative of a significant neurological syndrome. The findings in potroom workers included a subclinical tremor as indicated by results of a static steadiness test [time scores on one of two test indices were significantly worse in comparison with the control group (84% slower, $p=0.03$)], and possible tendencies (i.e., test results that were about 1 SD below normal mean values but not statistically significant) for increased risk of impaired visuospatial organization (Block Design subtest of the Wechsler Adult Intelligence Scale) and psychomotor tempo (one Halstead ReitanTrail Making test). Although these findings were not considered to be indicative of a neurologic syndrome, it was suggested that they may be early signs of CNS impairment. Additionally, the finding of a subclinical tremor seems to be consistent with the tremor and other signs of incoordination observed in 84% of the patients in the Vhite et al. (1992) study summarized above.

Studies of Al welders are consistent with those of Al smelter workers in indicating that occupational exposure to Al can be neurotoxic. CNS function was evaluated in 17 welders who had an average of 15 years (range 5-27 years) experience, with the last 4 years exclusively with Al (Hanninen et al., 1994). Most of the welders had equipment that ventilated the welding masks but the respiratory protection was not always used. The assessment included measurements of serum and urinary Al, neuropsychological tests (simple reaction time, three tests for psychomotor speed, two tests for visual and spatial ability, four memory tests, and two verbal ability tests), a symptom questionnaire and neurological interview, quantitative electroencephalography (QEEG), and P-300 event-related auditory-evoked responses. Serum and urine Al levels were 3.5 and 8.5 times higher, respectively, than an unexposed reference population. The welders performed normally on the neuropsychological tests, although correlation analysis of test scores and exposure parameters showed weak negative associations between the four memory tests and urinary Al level, and a positive association between the variability (standard deviation) of visual reaction times and serum Al levels. Analysis of the QEEG data showed that serum Al levels were positively correlated with the amount of delta and theta activity in the brain frontal region and negatively correlated with the amount of alpha activity in the frontal region. Results of this study (disturbances of memory and attention, QEEG changes similar to those in patients with Al encephalopathy) were interpreted as consistent with known CNS effects of Al, but insufficient for establishing a definite relationship between Al exposure and effects.

In another study of Al welders, CNS evaluations were performed on 38 men who had at least 5 years exposure (mean 17.1 years), and a control group of 44 railway track welders exposed to metal fumes other than

Al (mean 13.8 years) (Sjogren et al., 1996). Limited monitoring data indicated that the median exposure to welding fumes was 10 mg/m^3 and that the Al content was 40% of the total fumes. Symptom questionnaires, psychological tests (simple reaction time, finger tapping speed and endurance, digit span, vocabulary, tracking, symbol digit coding, cylinders, olfactory threshold, and Luria-Nebraska motor scale), neurophysiological indices [electroencephalography, P-300 auditory-evoked responses, brain-stem auditory evoked responses and diadochokinesis (ability to perform rapidly alternating movements with one limb)], and blood and urine Al levels were assessed. The blood and urine Al concentrations were approximately 3 and 7 times higher in the Al welders than in the controls, but there were no clear correlations between duration of exposure to Al and concentration of Al in blood or urine. The Al welders reported more acute CNS symptoms (e.g., concentration difficulties) and had decreased motor function in five tests (finger tapping in non-dominant hand, two tasks from the Luria-Nebraska motor scale, pegboard peg movement with dominant hand, amplitude of diadochokinesis in dominant hand) when compared to the control group. Urinary Al concentration was significantly correlated with acute CNS symptoms, but not with any of the performance measures. To further study possible dose-effect relationships of Al exposure, the Al welders were combined with the control group and divided into three exposure categories according to urinary Al levels, using the 50th and 75th percentiles as category dividers. The group with the highest mean urinary Al level had significantly more acute CNS symptoms and significantly reduced performance on one of the motor function tests (a Luria-Nebraska motor scale task) when compared to the group with the lowest Al level. In an earlier study of 65 welders with $10 years exposure to Al fumes, the highest exposure category (based on exposure duration) was 2.8 times more likely than unexposed workers to have three or more neuropsychiatric symptoms (Sjogren et al., 1990).

Aluminum Toxicity in Experimental Animals

Groups of 20 weanling Fischer 344 rats/sex and 20 weanling Hartley guinea pigs/sex were exposed to 0, 0.25, 2.5 or 25 mg/m^3 aluminum chlorhydrate [$Al_2(OH)_5Cl@x(H_2O)$] for 6 hours/day, 5 days/week for 6 months (Steinhagen et al., 1978). Analysis of the aluminum chlorhydrate by the investigators showed it to contain 24.5% Al, indicating that the animals were exposed to 0, 0.061, 0.61, and 6.1 mg Al/m^3. Body weights were measured weekly for the first 8 weeks and biweekly thereafter. At the end of the exposure period, 10 animals (5/sex) of each species were sacrificed for organ weight measurements (heart, lung, liver, kidney, spleen, and brain) and histological examination of the lungs, liver, and kidney. In addition, comprehensive histological examinations were performed on animals in the control and 6.1 mg AL/m^3 groups. The remainder of the animals were used for hematology evaluation (RBC, WBC, hematocrit and hemoglobin) and Al measurements in blood and tissues. Apparent effects of Al included multifocal granulomatous pneumonia in both species at $0.61 mg Al/m^3, significantly increased absolute and relative lung weights in both species, and decreased body weight gain in rats and minimal lung edema in guinea pigs at 6.1 mg Al/m^3. The granulomatous reaction was characterized by foci of giant vacuoled particle-containing macrophages in the lungs and macrophages that did not appear to contain vacuoles or other evidence of phagocytized material in the peribronchial lymph nodes. There was a significant dose-related accumulation of Al in the lungs of both species at $0.061 mg Al/m^3. However, a NOAEL of 0.061 mg/m^3 could be identified for the onset of compound-induced histopathological effects.

In other studies, groups of 14-30 guinea pigs, rats, and hamsters were exposed to fine metallic Al powders (pyro, atomized, and flaked) at concentrations of 15, 30, 50, or 100 mg powder/m^3 air for 6 hours/day, 5 days/week for 6 months (Gross et al., 1973). Alveolar proteinosis occurred in exposed animals of all three

species after 2 months of exposure, but fibrosis or other pulmonary changes did not develop. Similarly, groups of 23 or 46 rats and 48 hamsters were exposed to undetermined concentrations of Al fumes or Al powder (20% Al, 80% $Al(OH)_3$) for morning hours only or morning and afternoon for up to 20 months (Christie et al., 1963). Effects were similar for both forms of Al in both species, including initial increased alveolar macrophage proliferation followed by nodular hyalinized areas, with development of pneumonia but no fibrosis.

Exposure to 2.18 mg Al fibers/m^3 for 6 hours/day, 5 days/week for up to 86 weeks produced slightly increased alveolar macrophages and some irritation of the nasal passages in a group of 50 Alderly Park rats (Pigott et al., 1981). Finally, a study by Drew et al. (1974) observed the development of granulomatous nodules also developed in male hamsters that were exposed to 8 mg Al/m^3 of *Alchlor* (a propylene glycol complex of aluminum-chloride-hydroxide) for 6 hours/day, 5 days/week for 20 or 30 exposures. The alterations persisted at the longest post treatment observation (6 weeks) and consistently developed at the bifurcation of the bronchioloalveolar ducts which is a likely site of particulate deposition.

DERIVATION OF A PROVISIONAL CHRONIC INHALATION RfC

As discussed earlier, unlike carcinogenicity or respiratory effects, that cannot be ascribed to Al inhalation due to the presence of other chemicals and confounding factors, Al seems to be the most likely cause for the generally and consistently reported psychomotor and cognitive effects (particularly signs of impaired coordination) in Al production workers and welders (Bast-Pettersen et al., 1994; Rifat et al., 1990; Hosovski et al., 1990; White et al., 1992; Hanninen et al., 1994; Sjogren et al., 1990, 1996). In addition, there is strong evidence that Al is neurotoxic by other routes of exposure. Thus, a degenerative neurological syndrome (dialysis dementia) has been documented in humans with chronic renal failure, apparently due to an increased exposure to Al from dialysis treatment and/or ingestion of phosphate binding agents which contain Al (Alfrey, 1993). This syndrome is characterized by gradual loss of motor, speech, and cognitive functions. Neurotoxicity, particularly neuromuscular effects such as decreased motor activity, startle responsiveness, and grip strength, has also been observed in mice following subchronic oral exposure and in the offspring of mice and rats exposed orally during gestation and/or lactation. Based on this information, as well as evidence that Al is absorbed by Al production workers and welders, the hypothesis that the occupational studies are indicative of a neurotoxic effect of Al appears to be justified. However, the only occupational study that has yielded suitable monitoring data is that of Hosovski et al. (1990), in which workers were exposed to presumed TWA concentrations of 4.6-11.5 mg Al/m^3 magnitude for an average of 12 years. Using 4.6 mg Al/m^3 as the LOAEL for psychomotor and cognitive impairment for an 8-hour occupational exposure (Hosovski et al., 1990) and corrections for discontinuous exposure (10 m^3/20 m^3 and 5 days/7 days), the $LOAEL_{HEC}$ is 1.64 mg/m^3. Applying an uncertainty factor of 300 for intrahuman variability (10), use of a LOAEL (10) and an incomplete database (3) yields a provisional RfC of

$$\mathbf{RfC = 1.64\ mg/m^3/300 = 5E\text{-}3\ mg/m^3.}$$

The lack of inhalation developmental studies may increase uncertainty in the database because oral data in animals indicate that neurotoxic and morphological developmental effects may occur at lower doses than neurotoxicity in adults. Additionally, there is uncertainty related to the lack of corroborating data on air concentrations associated with neurotoxicity. Confidence in the critical study is low to medium because only a LOAEL was identified. Confidence in the database is medium because (1) there are no corroborating data on effect levels (NOAELs and additional LOAELs), (2) no data are available for developmental neurotoxicity by the inhalation route, and (3) a well-designed two-generation reproduction study is lacking. Reflecting the low

to medium confidence in the critical study and database, there is low to medium confidence in the provisional RfC.

RISK CHARACTERIZATION

Cancer Hazard Summary There are no records for Al in the U.S. EPA's IRIS or HEAST databases (U.S. EPA, 1999, 1997), nor has the carcinogenicity of Al compounds been formally evaluated by the agency. However, a number of scientific investigations have addressed the issue of the carcinogenicity of Al, though with inconclusive results. For example, a 20-month exposure of B6C3F1 mice to aluminum potassium sulfate dodecahydrate in the diet at concentrations up to 10% w/w displayed no indication of compound-related carcinogenicity and, in general, no indication of adverse toxicological effects of any kind (Oneda et al., 1994). Similarly, the life-time exposure of Swiss mice and Long-Evans rats to 5 ppm Al as aluminum potassium sulfate in drinking water provided no convincing evidence for the carcinogenicity of Al compounds (Schroeder and Mitchener 1975a,b). A considerable number of epidemiological studies have examined the incidence of excess tumor formation in persons occupationally exposed to Al in the form of dusts or fumes. In general, a body of inferential evidence exists for an increase in cancer of the bladder and lung with occupational exposure to Al, though conclusions linking cause with effect are frequently confounded by co-exposure to other harmful emissions, cigarette smoking, and the absence of adequate reference populations. Taking all of the evidence of Al carcinogenicity together, a qualitative weight-of evidence classification of D, -not classifiable as to human carcinogenicity, is suggested, in line with the agency's guidelines for carcinogenic risk assessment (U.S. EPA, 1986). In accordance with the agency's proposed guidelines for carcinogenic risk assessment (U.S. EPA, 1996), the compound's carcinogenicity *cannot be determined* on the available evidence.

SUPPORTING INFORMATION

Human Data Occupational exposure to fumes and dusts containing Al compounds, for example, in welding shops, has provided insubstantial evidence of links to increased tumor incidence, in some studies. Overall, the links between cause and effect are considered marginal, at best, and are potentially by co-exposure to other carcinogenic substances.

Animal Data Studies of the carcinogenicity of Al compounds in experimental animals have yielded negative results.

Mutagenicity The small amount of evidence that exists on the capacity of the element to induce gene reversion in *S. typhimurium* is negative for Al compounds (Ahn and Jeffrey, 1995).

MODE OF ACTION

No data.

DISCUSSION

Epidemiological studies of metal dusts and fumes in such settings as welding shops, smelters, etc., have provided a body of evidence that suggests but does not prove that emissions containing a number of air-borne Al may be carcinogenic. However, the evidence for such a proposition is weak, yielding data on the borderline of statistical significance, if at all. There is no hard evidence for the carcinogenicity of Al compounds via the oral route.

BRIEFING SUMMARY

Routes	Class	Designation or Rationale	Dose Response
oral/inhalation	cannot be determined	not applicable	no data

Basis for classification/dose response

1. **Human data:** Insufficient evidence in epidemiological/occupational exposure studies.

2. **Animal data:** Existing evidence is largely negative for Al's carcinogenicity.

3. **Structural analogue data:** None.

4. **Other key data:** Available mutagenicity data are negative for Al compounds.

5. **Mode of action:** No data.

6. **Hazard classification/uncertainties:** The chosen weight-of-evidence descriptors are based on a lack of sufficiently hard evidence for the carcinogenicity of Al compounds. Positive evidence of non-carcinogenicity is also lacking.

7. **Dose response:** Not applicable

REFERENCES

ACGIH (American Conference of Governmental Industrial Hygienists). 1998. 1998 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. ACGIH, Cincinnati, OH.

Ahn, H-W. and E.H. Jeffrey. 1995. Effect of aluminum on fluoride uptake by Salmonella typhimurium TA98: Implications for the Ames mutagenicity assay. J. Toxicol. Environ. Health 41: 357-368.

Alfrey, A.C. 1993. Aluminum toxicity in patients with chronic renal failure. Ther. Drug. Monit. 15: 593-597.
Armstrong, B.G., C.G. Tremblay, D. Cyrr and G.P. Thériault. 1986. Estimating the relationship between exposure to tar volatiles and the incidence of bladder cancer in aluminum smelter workers. Scand. J. Work Env. Health. 12: 486-493

ATSDR (Agency for Toxic Substances and Disease Registry). 1998. Toxicological Profile for Aluminum (Update). U.S. Public Health Service. Atlanta, GA.

Bast-Pettersen, R., P.A. Drablos, L.O. Goffeng, Y. Thomassen and C.G. Torres. 1994. Neuropsychological deficit among elderly workers in aluminum production. Am. J. Ind. Med. 25: 649-662.

Cawthon, M.L. 1988. Chronic cyanide toxicity: A cause of neurological disease in aluminum workers? Presented at the Northwest Occupational Health Conference. October 1988; Spokane, WA. (as cited in White et al., 1992).

Christie, H., R.J. MacKay and A.M. Fisher. 1963. Pulmonary effects of inhalation of aluminum by rats and hamsters. Ind. Hyg. J. 24:47-56.

Drablos, P.A., S. Hetland, F. Schmidt and Y. Thomassen. 1992. Uptake and excretion of aluminum in workers exposed to aluminum fluoride and aluminum oxide. In Gitelman, H.J. (ed.): Proceedings of the second international conference on aluminum and health. The Aluminum Association, Washington, DC. p. 157-160.

Drew, R.T., B.N. Gupta, J.R. Bend et al. 1974. Inhalation studies with a glycol complex of aluminum-chloride hydroxide. Arch. Environ. Health. 28: 321-326.

Ganrot, P.O. 1986. Metabolism and possible health effects of aluminum. Environ. Health Perspect. 65: 363-441.

Garruto, R.M., S.K. Shankar, R. Yanagihara et al. 1989. Low-calcium high-aluminum diet-induced motor neuron pathology in cynomolgus monkeys. Acta Neuropathol. 78:210-219.

Gibbs, G.W. 1985. Mortality and aluminum reduction plant workers, 1950 through 1977. J. Occup. Med. 27: 761-770.

Gross, P., R.H. Harley and R.T.P. de Treville. 1973. Pulmonary reaction to metallic aluminum powders. Arch. Environ. Health. 26: 227-236.

Hanninen, H., E. Matikainen, T. Kovala, S. Valkonen and V. Riihimaki. 1994. Internal load of aluminum and the central nervous system function of aluminum welders. Scand. J. Work Environ. Health. 20: 279-285.

Hosovski, E., Z. Mastelica, D. Suderic and D. Radulovic. 1990. Mental abilities of workers exposed to aluminum. Med. Lav. 81(2): 119-123.

Iyengar, G.V., J.T. Tanner, W.R. Wolf and R. Zeisler. 1987. Preparation of a mixed human diet material for the determination of nutrient elements, selected toxic elements and organic nutrients: a preliminary report. Sci. Total Environ. 61: 235-252.

Langauer-Lewowicka, H. and Z. Braszczynska. 1983. A trial evaluation of combined action of certain physical and chemical and harmful factors on the nervous system. Neurol. Neurochir. Pol. 24: 91-96. (as cited in White et al., 1992).

Lione, A. 1985. Aluminum toxicology and the aluminum-containing medications. Pharmacol. Therap. 29: 255-285.

Marquis, J.K. Neurotoxicity of aluminum. 1989. Environmental Chemistry and Toxicology of Aluminum. E. Lewis, Editor; Chelsea, Michigan, Lewis Publishers, Inc., pp. 289-298.

NIOSH (National Institute for Occupational Safety and Health). 1994. Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Washington, DC.

Oneda, S., T. Takasaki, K. Kuriwaki et al. 1994. Chronic toxicity and tumorigenicity of aluminum potassium sulfate in B6C3F1 mice. In Vivo. 8: 271-278.

Pearson, R.J.C., M.C. Battigelli and J.T. Gamble. 1993. Mortality from working in the aluminum reduction industry. Environ. Res. 61: 19-24.

Pennington, J.A. and S.A. Schoen. 1995. Estimates of dietary exposure to aluminum. Food Add. Contam. 12: 119-128.

Pigott, G.H., B.A. Gaskell and J. Ishmael. 1981. Effects of long-term inhalation of aluminum fibres in rats. Br. J. Exper. Pathol. 62: 323-331.

Rifat, S.L., M.R. Eastwood, D.R. Crapper McLachlan and P.N. Corey. 1990. Effect of exposure of miners to aluminum powder. Lancet 336 (8724): 1162-1165.

Ronneberg, A. and F. Langmark. 1992. Epidemiologic evidence of cancer in aluminum reduction plant workers. Am. J. Ind. Med. 22: 573-590.

Schroeder, H.A. and M. Mitchener. 1975a. Life-term studies in rats: effects of aluminum, barium, beryllium, and tungsten. J. Nutr. 105: 421-427.

Schroeder, H.A. and M. Mitchener. 1975b. Life-term effects of mercury, methyl mercury, and nine other trace metals on mice. J. Nutr. 105: 452-458.

Sjogren, B., P. Gustavsson and C. Hogstedt. 1990. Neuropsychiatric symptoms among welders exposed to neurotoxic metals. Br. J. Ind. Med. 47: 707-707.

Sjogren, B., A. Iregren, W. Frech et al. 1996. Effects on the nervous system among welders exposed to aluminum and manganese. Occup. Environ. Med. 53: 32-40.

Spinelli, J.J., P.R. Band, L.M. Svirchev and R.P. Gallagher. 1991. Mortality and cancer incidence in aluminum reduction plant workers. J. Occup. Med. 33(11): 1150-1155.

Steinhagen, W.H., F.L. Cavender and B.Y. Cockrell. 1978. Six month inhalation exposures of rats and guinea pigs to aluminum chlorohydrate. J. Environ. Path. Toxicol. 1: 267-277.

Stokinger, H.E. 1981. Aluminum. The metals. In: Patty's Industrial Hygiene and Toxicology, Volume IIA, 3rd rev. ed., G.D. Clayton and F.E. Clayton, Ed. John Wiley and Sons, NY. p. 1493-1504.

Thériault, G., C. Tremblay, S. Cordier and S. Gingras. 1984. Bladder cancer in the aluminum industry. Lancet i: 949-950.

Thériault, G.P., C.G. Tremblay and B.G. Armstrong. 1990. Bladder cancer screening among primary aluminum production workers in Quebec. J. Occup. Med. 32(9): 869-872.

Tremblay, C., B. Armstrong, G. Theriault and J. Brodeur. 1995. Estimation of risk of developing bladder cancer among workers exposed to coal tar pitch volatiles in the primary aluminum industry. Am. J. Ind. Med. 27: 335-348.

U.S. EPA. 1986. Guidelines for Carcinogen Risk Assessment. Fed. Reg. 51: 33992-34003.

U.S. EPA. 1987. Health Effects Assessment for Aluminum. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, D.C. EPA600/8-88/016.

U.S. EPA. 1994. Chemical Assessments and Related Activities (CARA). Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA. 1996. Proposed Guidelines for Carcinogenic Risk Assessment. Fed. Reg. 61: 17960-18011.

U.S. EPA. 1997. Health Effects Assessment Summary Tables. FY-1997 Annual and FY-1997 Supplement. Office of Research and Development, Office of Emergency and Remedial Response, Washington, DC.

U.S. EPA. 1999. Integrated Risk Information System (IRIS). Online. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

White, D.M., W.T. Longstreth, Jr., L. Rosenstock, K.H.J. Claypoole, C.A. Brodkin and B.D. Townes. 1992. Neurologic syndrome in 25 workers from an aluminum smelting plant. Arch. Intern. Med. 152(7): 1443-1448.

Wilhelm, M., D.E. Jager and F-K. Ohnesorge. 1990. Aluminum toxicokinetics. Pharmacol. and Toxicol. 66: 4-9.

Wilhelm, M., I. Lombeck, B. Kouros, J. Wuthe and F-K. Ohnesorge. 1995. Duplicate study on the dietary intake of some metals/metalloids by German children. Part II: Aluminum, cadmium and lead. Zbl. Hyg. 197: 357-369.

Yokel, R.A. and P.J. McNamara. 1988. Influence of renal impairment, chemical form, and serum protein binding on intravenous and oral aluminum kinetics in the rabbit. Toxicol. Appl. Pharmacol. 95: 32-43.

Risk Assessment Issue Paper for:
Derivation of a Provisional Oral RfD for Aluminum (CASRN 7429-90-5)

NOTE: This provisional risk assessment paper for the oral chronic reference dose (RfD) for Aluminum has received external peer review.

INTRODUCTION

Verified toxicity values for aluminum (Al) and its compounds are unavailable on IRIS or HEAST (U.S. EPA, 1999, 1997), except for a chronic oral RfD of 4E-4 mg/kg-day for aluminum phosphide. However, occupational guidelines and standards have been established for a number of chemical and physical forms of Al, including, from ACGIH, 8-hour TWA-TLVs of 10 mg/m^3 for the compound as a metal dust or oxide, 5 mg/m^3 as "pyro" powders or welding fumes, and 2 mg/m^3 for soluble salts or organic forms of the metal (ACGIH, 1998). From NIOSH, 10-hour TWA-RELs of 10 mg/m^3 are specified for "total" Al dust versus 5 mg/m^3 for the respirable portion (NIOSH, 1994), NIOSH covers all other forms of the metal by identical values to those specified by ACGIH (ACGIH, 1998). OSHA PELs for Al include an 8-hour TWA value of 15 mg/m^3 for "total" metal dust, versus 5 mg/m^3 for the respirable portion (NIOSH, 1994). The U.S. EPA's CARA list (U.S. EPA, 1994) cites a HEA for Al (U.S. EPA, 1987), and ATSDR has updated its toxicological profile of the element (ATSDR, 1998).

Research papers pertinent to the potential toxicological effects of Al were sought through computer arches of the HSDB, RTECS, MEDLINE, and TOXLINE (and its subfiles) databases, covering the time riod 1995-1999. The literature searches were conducted in June, 1999.

REVIEW OF THE PERTINENT LITERATURE

The review by Stokinger (1981) gives an account of Al as an all-pervasive component of products that are central to the daily lives of most Americans. For example, the metal is a crucial part of manufactured products for the building, automobile, and container industries, while Al as powder or flake is a component in a number of consumer products, such as paints, fireworks, etc. Al complexes and minerals are used in the brewing and paper industries, and as coagulants for water purification. Aluminum oxide finds application in abrasives, as a catalyst or absorbent, and as a component in fillers. Aluminum chloride is included in cosmetic formulations such as deodorants.

Human exposure to Al arises principally from food and water, through its widespread use in food additives, packaging and cooking utensils, and in Al-containing medications, particularly antacid, buffered aspirin, anti-ulcer and anti-diarrheal formulations (Marquis, 1989; Lione, 1985). Pennington and Schoen (1995) estimated daily Al intakes of 0.1-0.3 mg/kg-day for infants and children 6 months-6 years of age and 0.1-0.18 mg/kg-day for older children and adults, based on the FDA Total Diet Study (1993) and the U.S. Department of Agriculture Nationwide Food Consumption Survey (1987-1988). These data are in broad agreement with those of Wilhelm et al. (1995) who reported the dietary intake of Al in German children (living in the Duisberg area) as ranging from 0.008 to 0.11 mg Al/kg-day. In addition, these values are consistent with a range of 1-20 mg/day (0.014-0.3 mg/kg -day) for normal oral daily Al intake from food and water reported by other

investigators (Ganrot, 1986; Iyengar et al., 1987; Wilhelm et al., 1990). However, users of Al-containing medications can ingest much larger amounts of the element, possibly as high as 840-5000 mg/day (12-71 mg/kg-day) from antacids, 126-728 mg/day (1.8-10.4 mg/kg-day) from buffered aspirins and 828 mg/day (11.8 mg/kg-day) from anti-ulcer compounds when taken at recommended dosages (Lione, 1985).

Toxicokinetic of Aluminum

There is a large amount of information available on the absorption, transfer from tissue to tissue and elimination of Al from the body, including data that have been amassed from studies on either human volunteers or laboratory animals. In general, the chemical appears to be poorly absorbed from the gastrointestinal tract, though the portion of the load that is retained will vary depending on the concentration, the chemical species administered, the fasting or fed state of the host, gastrointestinal pH, animal model, etc. For example, Yokel and McNamara (1988) administered single oral doses of a number of Al compounds (both water soluble and insoluble) to New Zealand white rabbits and obtained absorbed proportions of the load ranging from 0.27% to 27%. Fractional uptake of Al in humans under normal conditions (i.e., with no intake of large quantities of Al from medicine) was estimated to be 0.1-0.3% assuming an intake of 20 mg Al/day (0.3 mg Al/kg-day) and urinary excretion of 20-50 : g Al/day (0.3-0.7 : g Al/kg-day) (Ganrot, 1986). However, little information is available on the actual mechanism by which the element and its compounds are transported across the brush border. (Wilhelm et al., 1990; Lione, 1985).

Although the overall extent of Al absorption is poor, there may be significant intake of the compound by those taking large amounts of Al compounds in patented remedies. As stated, absorption of Al is influenced by gastrointestinal conditions and content because Al can form various complexes with different solubilities and oxidation states depending on pH and interactions with dietary constituents. At low pH (3-5) in aqueous solutions, the soluble (ionic) forms of the Al prevail (Al^{3+}); at high pH (>8), Al in the form of soluble aluminum oxide is present; and at pH 5-8, the element is predominantly in the form of aluminum hydroxide, which is insoluble (van der Voet and de Wolff, 1986; Wilhelm et al., 1990). Ingested constituents that can influence absorption by forming complexes with Al include phosphate, fluoride, calcium, citrate and lactate. For example, Al is used to bind dietary phosphorus and decrease its absorption as a control for hyperphosphatemia, and citrate and lactate are complexing agents that can significantly increase Al absorption (Slanina et al., 1984, 1985, 1986; Partridge et al., 1989; Domingo et al. 1991; Ittel et al., 1991; Lione, 1985; Wihelm et al., 1990).

A number of recent reports of studies on the gastrointestinal absorption of Al have examined the influence of organic anions such as citrate. In general, the presence of such components appears to enhance the absorption of Al, within narrow limits. For example, Deng et al. (1998) administered a single oral dose of either distilled water, 2 mmoles/L aluminum chloride or 2 mmoles/L aluminum chloride plus 2 mmoles/L sodium citrate to 6 male Wistar rats/group. Animals were bled at 1, 2 and 4 hours after dosing, then terminated after 6 hours. Inductively coupled plasma (ICP) was used to measure Al concentrations in blood, bone (tibia), kidney, liver and the intestinal wall. Irrespective of treatment, the appearance of Al in the blood of dosed groups peaked after 1 hour, with the concentration of the element at higher levels in those animals receiving citrate in addition to aluminum chloride. In those animals receiving aluminum chloride alone, significant tissue concentrations of the element were restricted to the gastrointestinal wall. Those receiving citrate displayed measurable quantities of the element in several of the other monitored tissues, including bone.

Sutherland and Greger (1998a) used a similar dosing regimen to examine the kinetics of absorption and elimination of Al in male Sprague-Dawley rats that had received a single oral dose of 0, 0.25, 0.5 or 1

mmoles/L/kg body weight aluminum lactate in 1 mL of 16% citrate. Concentrations of Al in serum, liver, kidney or bone (tibia) were measured at various post-dosing time intervals up to 6 hours. Depending on the dose, absorption factors for Al of up to 4.2% of the administered dose were observed, with the greater proportion retained in bone. The authors reported a slower rate of absorption in those animals receiving Al at the higher doses, an observation potentially indicating reduced gut motility and/or saturation of the transcellular absorption processes at the higher concentrations. Aluminum deposited in kidney and bone appeared to turnover at a slower rate than in the liver.

The influence of citrate on the gastrointestinal absorption of Al in man was examined directly by Taylor et al. (1998) who administered a drink containing Al and citrate to three volunteers. Aluminum and citrate concentrations were monitored in serial blood and urine samples for up to 24 hours. The kinetics of citrate and Al differed markedly, the former peaking in plasma after 32 minutes, versus 87 minutes for Al. This suggests that Al probably does not cross the gastrointestinal barrier as the citrate. Furthermore, the authors reported that the overall extent of Al absorption had probably not exceeded 1% in their experiment, a finding that contrasts with the higher values reported by Sutherland and Greger (1998a) in Sprague-Dawley rats and by Deng et al. (1998) in Wistar rats.

As discussed in a report by Glynn et al. (1999), gastrointestinal absorption of Al from aqueous media will be almost impossible to predict, because of the likelihood that the element will become absorbed to food particles in the intestinal lumen. Accordingly, depending on the dose, mode of delivery, and caloric state of the experimental animal (fed/fasted), significant amounts of aqueous forms of Al will be absorbed only when available binding sites on food have become saturated. This presents an inherently complex overall picture of the element's absorption since, additionally, the normal dietary content of Al will be substantial. Thus, it may be assumed that some sequestered Al will be absorbed along with non-sequestered water soluble forms of the element, while the rest will be retained within the gastrointestinal tract.

Sutherland and Greger (1998b) used their aluminum lactate in 16% citrate dosing regimen to examine the comparative importance of biliary versus urinary excretion of Al. Five to seven male Sprague-Dawley rats/group who had previously received an implanted bile cannula were treated by gavage. Another similarly-treated cohort of five animals/group were housed in metabolic cages immediately after dosing to provide 0-3 hour and 3-6 hour urine specimens. At termination, all animals were sacrificed and exsanguinated, and tissue, bile and urine samples were measured by graphite furnace atomic absorption spectroscopy. Among the key findings to emerge from this study was the incremental appearance of Al in bile as early as 15 minutes after dosing. However, overall amounts of Al were greater in the 3-hour urine samples than those that had accumulated in bile samples collected within a similar time frame. The fact that control rats excreted three times more Al in bile than in urine during the first 3 hours after dosing led the authors to conclude that, at low exposure to Al (in controls receiving Al solely from food), the liver is capable of excreting the element to the bile, a mechanism that becomes saturated as the level of Al administration becomes increased. Thereafter, urinary excretion becomes the primary route of elimination in circumstances of Al overload.

Prevailing perceptions of the overall toxicity of Al have changed during recent years. Thus, while the element has not been shown to have a definite biological function and was long regarded as nontoxic largely because gastrointestinal absorption is normally minimal, recent health effects research in humans and animals has shown that elevated levels of Al in the body may be toxic, particularly to the central nervous, skeletal and hematological systems.

Neurotoxicity as a Primary Toxicological Effect of Aluminum

One of the greatest health concerns regarding Al is its neurological effects. The first evidence for Al-induced neurotoxicity in humans was seen in patients who, as a result of receiving long-term hemodialysis for chronic renal failure, developed a degenerative neurological syndrome (dialysis dementia) characterized by the gradual loss of motor, speech, and cognitive functions (Alfrey, 1993). This dementia, attributable to Al in the dialysate, is usually fatal within 6-9 months after the first clinical signs appear. In addition, many patients received high oral doses of Al to act as phosphate binders. Autopsies of these patients revealed increased concentrations of Al in the gray matter and cerebral spinal fluid (CSF) but no evidence of neurofibrillary degeneration (NFD) despite the elevated Al levels. Once the connection between Al and dialysis dementia was established, Al was removed from dialysis fluid and the incidence of dementia rapidly declined, thereby strengthening the argument that Al was a causal agent in dialysis dementia.

Amyotrophic Lateral Sclerosis (ALS) and Parkinson's Disease (PD) are other neurological diseases which have been associated with Al exposure. ALS is a progressive disease of the Central Nervous System (CNS) that is characterized by an accumulation of neurofibrillary tangles. In Guam, southern West New Guinea, and parts of Japan there is an unusually high prevalence of ALS and PD. This may be related to the natural abundance of Al coupled with the virtual lack of magnesium and calcium in the drinking water supplies and soil of these areas. In a study designed to evaluate effects of high Al and low calcium levels in the diet, much like the conditions associated with Guam and other similar areas, cynomolgus monkeys were placed on a low calcium diet either with or without supplemental Al and manganese (Garruto et al., 1989). Chronic calcium deficiency alone produced neurodegenerative effects, although neurofibrillary changes were most frequently seen in the monkeys on a low calcium diet supplemented with Al and manganese.

Perhaps the best evidence for the neurotoxicological effects of Al in human beings comes from studies of patients with reduced renal function who accumulated Al as a result of long-term intravenous hemodialysis therapy with Al-containing dialysis fluid and, in many cases, concurrent administration of high oral doses of aluminum hydroxide or other Al salts to regulate phosphate levels. Inferential evidence that these health effects (dialysis encephalopathy) were associated with exposure to Al is suggested by the fact that such neurological impairments have largely disappeared with improved purification of dialysis water (Ganrot, 1986).

Though a cause and effect relationship between Al and three forms of chronic encephalopathy in humans: senile dementia of the Alzheimer type (SDAT, Alzheimer's Disease), endemic Amyotrophic Lateral Sclerosis (ALS) and endemic Parkinsonism-dementia (PD, a mixture of Parkinsonism and senile dementia) has been suggested, there is no firm evidence that it plays a causal role in the development of these diseases (Ganrot, 1986; Lione, 1985). Thus, in humans, dialysis encephalopathy syndrome is the only neurologic condition commonly accepted as being caused by Al (Ganrot, 1986). The condition is degenerative and characterized by the progressive loss of speech, motor and cognitive functions, with death typically occurring within 1-6 months. Autopsies of patients revealed increased concentrations of Al in the gray matter and cerebral spinal fluid (CSF), though with no conclusive evidence of neurofibrillary degeneration (NFD) or other neuropathological changes despite the elevated Al levels.

The neurotoxicity of Al is well documented in certain animal species. Aluminum induces a spectrum of behavioral abnormalities and brain neurofibrillary degenerative changes in rabbits and cats when injected intracranially or parenterally in high doses, though hamsters and monkeys are less sensitive (Ganrot, 1986; Lione, 1985). Such studies have been designed as models for the possible neurotoxicological effects of Al in humans. However, it should be noted that the neurofibrillary changes in affected animals differ in

morphological detail from those associated with SDAT. As discussed further in the Oral Toxicity section, oral doses of Al can also induce neurobehavioral effects in adult mice and rats and in their developing offspring. In general, such neurotoxic effects of Al appear to be more subtle than those induced through routes of administration that by-pass the gastrointestinal tract, perhaps reflecting the lower doses of Al reaching the brain.

Recent reports of studies on the effects of Al on neurotoxicity in animals have sought to define the biochemical mechanisms that are impaired when Al crosses the blood-brain barrier. However, a unifying concept has yet to emerge, though the passage of the element into various regions of the brain has been clearly demonstrated (Deloncle et al., 1995). Among the many biochemical functions and processes that appear to be perturbed by the presence of Al in the brain are the peroxidation status of biological membranes (Katyal et al., 1997; Deloncle et al., 1999), inhibition of the neuronal glutamate-nitric oxide-cyclic GMP pathway (Cucarella et al., 1998), and the marked reduction of protein- and non-protein-bound thiols and the specific activity of Na^+/K^+ and Mg^{++} ATPases (Katyal et al., 1997). The relative importance of each of these mechanisms and how (or whether) they interact to bring about the observed physiological changes remains unclear.

Osteomalacia was frequently observed among long-term dialysis patients with neurological signs and is commonly attributed to Al overload (Ganrot, 1986; Lione, 1985). This bone condition is characterized by widened osteoid (unmineralized bone matrix) with no fibrosis, reduced mineralization rate, skeletal pain and a strong tendency for fractures, lack of response to vitamin D therapy, and increased Al concentration in bone. Effects on bone histology and elevated bone Al levels have also been observed in patients with normal renal function who received total parenteral nutrition with Al-contaminated casein as a protein source, and in parenteral Al loading induced osteomalacia in rats and dogs (Lione, 1985).

ORAL TOXICITY

In contrast to the well-characterized symptoms associated with dialysis encephalopathy, very few reports have been identified that address the toxicological effects of Al in humans exposed orally. Furthermore, in a review, Reiber et al. (1995) pointed to the conflicting findings that have been reported when the incidence of neurological symptoms has been assessed in relation to Al exposure in either cross-sectional, ecological or case-control epidemiological studies. Among the more recent studies that have used this approach, Martyn et al. (1997) discussed the findings of a case-control study involving 441 men in England and Wales who were afflicted with either Alzheimer's disease, brain cancer, dementia or other neurological conditions. Assessing the historical exposure of these subjects failed to establish a link between Al in drinking water at the prevailing concentrations (below 0.2 mg/L) and the incidence of one or more of the conditions under investigation.

Numerous subchronic animal studies were located in the biomedical/toxicological literature but only those that define the threshold region of the oral dose-response relationship are summarized in this issue paper. A major limitation of many of the studies of Al toxicity is the lack of complete information on total dietary (e.g., food and drinking water) intake of Al and of other elements that are known to effect Al biokinetics and toxicity (e.g., calcium and magnesium). For example, Golub et al. (1992a) reported that commercial grain-based mouse feeds contain high levels of Al (200-1200 ppm), as well as excess and variable amounts of essential and nonessential trace minerals and metal binding ligands. Estimated or reported dosages used in studies in which Al content of the basal diets are not reported must be assumed to underestimate the actual experimental dosages. The magnitude of the underestimate may be considerable. For example, a range of Al contents of 200-1200 mg Al/kg for commercial grain-based diets (Golub, 1992b) would provide 30-200 mg Al/kg bw-day in a subchronic or chronic mouse bioassay [based on U.S. EPA (1988) default values for body weight and food

intake]. On this basis, studies in which complete dietary Al intakes were not reported or could not be estimated may provide some information about the hazards of oral exposure to Al but are inappropriate for establishing NOAELs or LOAELs for the critical effect of Al. NOAELs and LOAELs from studies that provide estimates of total Al dosages, or otherwise provide information relevant to determining the NOAEL/LOAEL boundary for the critical effect of Al are presented in Table 1 and are summarized below.

Systemic Toxicity

Groups of 10 female Sprague-Dawley rats were administered aluminum nitrate nonahydrate in sugar-containing drinking water at doses of 360, 720 and 3600 mg/kg-day (26, 52 and 259 mg Al/kg bw-day, respectively) for 100 days (Domingo et al., 1987). A control group received sugar-containing distilled water only. Sugar had been added to the drinking water of all groups to reduce the taste-aversive effects of Al. The level of Al in the diet was not reported. Animals were housed in metabolic cages to facilitate the collection of fecal and urine samples. Food and water consumption were measured daily, body weights weekly, and blood samples were taken a monthly intervals and at termination to monitor clinical chemistry and hematological parameters. At termination, all animals were necropsied, and the weights of major organs (brain, heart, lungs, kidneys, liver, and spleen) were monitored. Aluminum concentrations were measured in various tissues, pieces of which were processed for histopathological examination. A significant decrease ($p<0.05$) in body weight gain was observed in the 259 mg Al/kg-day group, attributed by the authors to decreased food intake. Overall, no consistent variations in hematological (hemoglobin, hematocrit) or clinical chemistry (SGOT, SGPT, alkaline phosphatase, urea, creatinine, total protein, cholesterol, glucose) parameters were observed. No histopathological alterations in the heart, liver, kidney, spleen, brain and cerebellum were observed. Interpretation of these data was complicated by the concurrent exposure of the rats to high doses of nitrate of up to 475 times the RfD for nitrate (1.6 mg nitrate-nitrogen/kg-day) which is based on methemoglobinemia in humans (U.S. EPA, 1999). Therefore, because of nitrate co-exposure, the absence from the study design of a food-restricted control group and uncertainty surrounding the contribution of Al in food, the apparent effect of Al on body weight gain cannot be conclusively attributed to Al alone.

Some recent studies have identified a number of potential toxicological responses in laboratory animals exposed orally to Al compounds in a subchronic or chronic dosing regimen. In most cases, however, only one dose level was employed in the study compared to controls, and since the amount of Al in the diet was not given, the resulting dose level represents an incremental dose of Al compared to that of controls as baseline. However, while these studies may offer inadequate quantitative dosimetric information for NOAEL/LOAEL identification and consequent RfD development, they provide an qualitative indication of a range of potential toxicological responses that might be induced in humans exposed to the element. For example, Garbossa et al. (1998) studied the potential for water-soluble Al to affect the erythropoietic integrity of late erythroid progenitor cells in the bone marrow. Three groups of five male Wistar rats/group were either (1) gavaged with citrate at a dose of 1.0 : m Al/g-day (27 mg/kg-day), 5 days/week, for 15 weeks, (2) had drinking water containing 100 mmol Al/L made available to them as the citrate for the same length of time, or (3) maintained as controls. As calculated by the authors, the dose associated with the applied concentration of Al in drinking water approximated to 14-17 : mol/g-day (420 mg/kg-day). Rats had access to a standard chow diet, though with no indication of the baseline concentration of Al provided therein. At the end of the in-life phase of the study, all rats were sacrificed, and samples of blood were obtained for hematological investigation. Femoral bone marrow cells were flushed with physiological medium, stimulated with recombinant human erythropoietin, then monitored for the comparative incidence of colony-forming units-erythroid (CFU-E).

Further tests were carried out to monitor the osmotic fragility and average life-span of erythrocytes from each test group. The animals in the group receiving Al at the higher dose showed decreased hematocrit, hemoglobin concentration, median osmotic fragility and erythrocyte life-span values compared to controls. The content of Al increased in the serum and bone of both exposed groups, the distribution of concentrations in bone correlating inversely with the extent of an animal's CFU-E development.

That Al in drinking water may have the ability to cause histopathological changes and altered hepatic enzyme activities was suggested by Basu et al. (1997) who made available aluminum chloride in drinking water to groups of eight male Sprague-Dawley rats at a dose of 50 mg/kg-day (10.1 mg Al/kg-day) for 40 days. Additionally, other groups of similarly-treated rats received drinking water containing either 0, 50, 100, 200 or 400 ppm (mg/L) added calcium (Ca), as the chloride. The authors reported increased specific activities of acid and alkaline phosphatases in liver 10,000 x g supernatants from Al-receiving animals versus controls, and in alkaline phosphatase activity in equivalent kidney preparations. The presence of Ca in the drinking water appeared to reverse these changes, plus the accompanying histopathological features associated with them.

Konishi et al. (1996) examined the ability of Al and Ca to cause opposite and potentially harmful effects in laboratory animals, in relation to the well-documented association between Al and the onset of osteomalacia. Male STD Wistar rats were divided into four groups (n = 4), receiving either (1) a normal diet (Group I), (2) a normal diet supplemented with Al (Group II), (3) a Ca-deficient diet (Group III), or (4) a Ca-deficient diet with supplemental Al (Group IV), for 10 weeks. Blood samples were taken at termination, then animals were perfused with paraformaldehyde/glutaraldehyde fixative. Levels of Ca, iron (Fe) and Al in serum and bone were measured by atomic absorption spectrophotometry, and sections of the resected right tibia were prepared for histopathological examination after decalcification in 5% formic acid in 10% formalin.

There were statistically-significant changes in body weight gain when those of groups 3 and 4 were compared to animals from groups 1 and 2, the values for the latter groups remaining constant from about 4 weeks of dosing. In discussing their histopathological findings, the authors described no decrease in the thickness of cortical bone in Group II compared to control, while bone specimen from Groups III and IV showed "an increase in osteoid as well as osteoblasts and osteoclasts", in addition to other disturbances of ossification. Such effects were considered to suggest bone fragility, with changes being more marked in Group IV compared to III. The amount of Al in the tibia of exposed rats was significantly greater in Group II than in Group I, whereas the average levels in Groups III and IV showed a further increase in Al deposition, most notably in group IV. There were also differences among the groups in the concentration of Fe in bone (tibia), and in the concentrations of Al, Ca, Fe and the levels of parathyroid hormone in blood. The authors concluded that Ca deficiency appeared to potentiate the deposition of orally administered Al in bone, and the attendant inhibition of ossification. Iron deposition was also thought to play a role in the osteogenic disturbance, where Ca is deficient.

A histopathological investigation indicated profound changes in the cerebrovascular and neuronal integrity when male Long-Evans rats (n=9) were exposed for 52 weeks to 0.5 ppm aluminum fluoride in drinking water (Varner et al., 1998). This corresponded to an Al dose of 0.019 mg/kg-day, based on a default drinking water consumption of 0.057 L/day, and a default body weight of 0.472 kg for male Long-Evans rats (U.S. EPA, 1988). Duel control groups received either NaF (fluoride controls) or double distilled deionized water. Tissue levels of Al were measured in brain, liver, and kidney by the use of a direct current plasma technique. Animals receiving aluminum fluoride showed poor survival compared to the other groups, with 6/9 having died by week 48. The tissue concentrations of Al were increased in the brain and kidney compared to

both the control groups, with Al-fluorescence being used to demonstrate that Al deposition was mostly in the vasculature. Morphological and histopathological changes due to treatment were apparent in the liver, kidney and spleen. Some changes in neuronal integrity were also evident in the hippocampus and neocortex. Other cytological changes in the brain were associated with chromatid clumping, pyknosis and vacuolation.

A report by Somova et al. (1997) describes a study in which 10 male Wistar rats/group received either 0, 5 or 20 mg/kg-day aluminum chloride by gavage in water for 6 months. At termination, all animals were exsanguinated, then subjected to a necropsy in which excised pieces of liver, kidney and cardiac and skeletal muscle were taken for histopathological examination. Pieces of brain were examined by electron as well as light microscopy, and all tissues were monitored for Al concentration by atomic absorption spectrophotometry. As tabulated by the authors, Al in plasma and all of the listed tissues was dose-dependently increased to levels that were statistically significantly greater than controls. However, though described in qualitative terms and illustrated photographically, the Al-induced lesions did not receive a quantitative treatment in the report. Thus, while at least some of the low dose rats displayed NFD (neuro fibrillar degeneration) of the hippocampal region of the brain, insufficient data are provided in the report to apply this observation to the identification of a NOAEL or LOAEL.

Dietary Experiments

Six Beagle dogs/sex/group were fed a diet providing either, in males, 0, 118, 317 or 1034 mg/kg-day sodium aluminum phosphate (0, 3.4, 9.0 or 29.4 mg Al/kg-day, respectively) or, in females, 0, 112, 361 or 1087 mg/kg-day sodium aluminum phosphate (0, 3.2, 10.3 or 30.9 mg Al/kg bw-day, respectively), for 6 months (Katz et al., 1984). No information was available on the level of Al in the diet, and no compound-related effects on body weight gain, hematological and clinical chemistry parameters (parameters not specified), or histopathological endpoints (major organs and tissues examined) were observed. A highest NOEL of 30.9 mg Al/kg-day could be tentatively identified in this study, but this would not include the contribution of Al from the basal diet, nor reflect the identification of any toxicological effects, since the NOEL occurred at the upper limit of the dose-response curve.

Neurotoxicity

A number of studies have been reported in which neurotoxicological/neurobehavioral effects have been explicitly evaluated. In others, the effects of Al on neurological developmental have been addressed. For example, Golub et al. (1989) fed diets containing Al as the lactate at 25 (controls), 500 or 1000 mg Al/kg diet (3.3, 65 or 130 mg Al/kg-day) to groups of 15 female Swiss-Webster mice for 6 weeks (Golub et al., 1989). No mice were exposed to lactate alone. While no statistically significant differences in food intake or body weight gain were observed, mice fed the highest Al concentration gained less weight than the controls or low-dose group. As reported by the authors, a significant decrease (20%) in spontaneous motor activity (i.e., total, vertical, and horizontal movement) was observed in the 130 mg Al/kg-day group. Activity in the 65 mg Al/kg-day group was not significantly different than the controls. Thus, the highest NOAEL is 65 mg Al/kg-day and the LOAEL is 130 mg Al/kg-day.

Neurobehavioral effects of aluminum lactate were evaluated in groups of 12 female N:NIH Swiss-Webster mice (4.5-5.5 weeks old) that were fed 25 (controls) or 1000 mg Al/g diet for 90 days (Golub et al., 1992a). Based on a food factor of 0.19 kg diet/kg body weight/day calculated using an algorithm relating food consumption to body weight (U.S. EPA, 1988) and reported body weight data (the time-weighted average weight is 25.4 g), the dosage in the treated mice is estimated to be 190 mg Al/kg bw-day. No mice were

exposed to lactate alone. A neurobehavioral test battery used by Donald et al. (1989) was administered at the beginning of the experiment (day 0) and after 45 and 90 (±3) days, with motor activity evaluated at the latter two time points. Aluminum levels were measured in brain, femur and liver at the end of the exposure period.

Body weight was significantly increased in the treated mice but no exposure-related changes in food intake or overt signs of neurotoxicity were observed. Results of the neurobehavioral tests showed significantly decreased hindlimb grip strength at 90 days, decreased air puff startle response at 90 days and decreased auditory startle response at 45 days in the treated mice. Spontaneous motor activity was reduced at 90 days as indicated by decreased total activity counts, horizontal activity counts and percentage of intervals with high activity counts. Aluminum concentrations in the brain and liver were increased approximately threefold in the treated mice, but brain and liver lipid peroxidation indices were not altered.

Male Wistar rats (6-8 per group) were exposed continuously for 6 months to food containing 1.52 mg Al/kg (normal diet) or 1000 mg Al/kg as aluminum chloride with citrate (Florence et al., 1994). The average daily Al intake was estimated to be 0.13 or 84 mg Al/kg bw-day, assuming a body weight of 0.305 kg (arithmetic mean of default mature weight of male Wistar rats and the starting weight in this study of 0.11 kg) and a food intake of 0.026 kg food/kg bw-day, calculated using an algorithm relating food intake to body weight (U.S. EPA, 1988). The citrate content of the diet was in a 1:1 stoichiometric proportion to Al, therefore, the estimated daily intake was 598 mg/kg-day. Rats exposed to Al developed histopathological abnormalities in brain tissue, not specific to any brain region, characterized by extensive cytoplasmic vacuolization in astrocytes, swelling of astrocytic processes, particularly of astrocyte end-feet abutting blood vessels. Neurons also exhibited vacuolization and nuclear inclusions. Although no specific behavioral assays were reported, the investigators noted that "no significant behavioral changes were observed". Accordingly, the functional significance of the histopathological lesions is uncertain. The lesions appear to differ from the NFD observed with parenteral Al exposures (Kowall et al., 1989; Wakayama et al., 1993); or from exposures to Al in combination with calcium deprivation (Garruto et al., 1989; Kihira et al., 1995; Mitani, 1992). The LOAEL for histopathological changes in the brain was 84 mg Al/kg-day.

Male Sprague-Dawley rats (40 per group) were exposed in drinking water to 0, 50 or 100 mg Al/kg bw-day as aluminum nitrate with citric acid for 6.5 months beginning at 21 days of age, 8 months of age, or 16 months of age (Domingo et al., 1996). The citric acid dosage was 355 or 710 mg/kg-day in the 50 or 100 mg Al/kg bw-day groups, respectively. Controls did not receive citric acid. Dietary Al intake was not reported; the rats were maintained on Panlab rat chow. Animals from control and exposed groups were subjected to a number of neurobehavioral tests, and at termination, Al levels were measured in various excised regions of the brain. The authors observed the highest Al levels in the olfactory bulb and rhachidical bulb, while the cortex and thalamus were the regions showing the lowest Al content. However, compared to controls, there were no significant effects ($p>0.05$) of Al (with citric acid) on spontaneous motor activity (open-field) or passive avoidance operant training or performance (grid floor shock, light/dark shuttle box). Thus, the NOAEL was 100 mg Al/kg-day with citric acid; although this does not include the Al contribution from food. This study is listed on Table 1 because the NOAEL, although probably underestimated because of unreported Al intake from food, is still lower than the LOAELs from other studies.

Groups of 6 male albino rats were administered 0 or 25 mg Al/kg bw-day as aluminum nitrate in normal saline by gavage, 10% ethanol in drinking water, or 25 mg Al/kg bw-day by gavage combined with 10% ethanol in drinking water, 6 days/week for 6 weeks (Flora et al., 1991). The level of Al in the diet was not

reported. Urinary α-aminolevulinic acid (ALA), blood ALA-dehydratase (ALAD), blood zinc protoporphyrin (ZPP), glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) in serum and liver, and brain biogenic amines and their metabolites [dopamine (DA), norepinephrine (NE), 5-hydroxytryptamine (5-HT), homovanillic acid (HVA) and 5-hydroxyindolacetic acid (5-HIAA)] were evaluated at the end of the treatment period. Treatment with Al alone caused significantly increased blood ALAD ($p<0.01$), decreased liver GPT ($p<0.05$), decreased brain DA ($p<0.01$), increased brain NE ($p<0.05$) and decreased brain 5-HT ($p<0.05$). Compared to treatment with Al alone, concurrent exposure to ethanol and Al produced significantly decreased ALAD, increased ALA, increased ZPP, increased liver GPT, increased serum GOT and increased brain HVA. Significant changes found only in the combined Al and ethanol group included increased serum GPT, increased brain NE and decreased brain 5-HT. Treatment with ethanol alone only inhibited blood ALAD. The rats were co-exposed to relatively high levels of nitrate [comparable to those in the Domingo et al. (1987) subchronic study], but it seems likely that some of the changes (i.e., effects on brain chemicals) are related to aluminum which is known to be neurotoxic. Because the toxicological significance of the changes is unclear due to lack of evaluation of neurobehavioral performance and other endpoints, there is uncertainty whether the 25 mg Al/kg-day dose is a NOAEL or a LOAEL, an uncertainty compounded by the absence of information about the level of Al in the basal diet.

Reproductive/Developmental Toxicity

A number of studies have been carried out to examine the effects of Al compounds on developmental toxicity, particularly their effects on postnatal neurobehavioral development. For example, Bernuzzi et al. (1989) exposed groups of 6-12 pregnant Wistar rats to aluminum chloride or aluminum lactate in the diet on gestational days 1 through 21. The rats received nominal daily doses of 0, 100, 300, 400 mg Al/kg as aluminum chloride or 0, 100, 200, or 400 mg Al/kg as aluminum lactate. No rats were exposed to lactate alone, and information regarding level of Al in the basal diet was not reported. On the average, there was a less than 10% decrease in maternal body weight gain and no effect on food or water intake. No significant difference in litter size was observed. However, postnatal mortality increased 55% and 26% in offspring of the rats exposed to 300 or 400 mg Al/kg-day, respectively. The offspring of dams fed $ 300 mg Al/kg-day weighed significantly less than controls on postnatal day 1. Decreased body weight was also observed on postnatal days (PD) 4 and 14 in the offspring of rats fed 400 mg Al/kg-day as aluminum lactate. The following tests were used to assess neuromotor development (maturation): righting reflex, grasping reflex, negative geotaxis, suspension test, and locomotor coordination. The tests were performed on PDs 4, 6, 9, 12 and 20, respectively. Impairment of neuromotor development (righting and grasping reflexes) was observed in the pups exposed to $ 200 mg Al/kg-day. Impaired grasping reflex was also observed in the 100 mg/kg-day aluminum lactate group. Offspring of rats fed 400 mg/kg-day also exhibited altered performance on the locomotor coordination test.

A follow-up study by the same research group found that ingestion of 400 mg Al/kg bw-day as aluminum lactate had no effect on postnatal mortality, body weight and righting and grasping reflex tests (Muller et al., 1990), although significant differences between control and exposure groups were noted in locomotor coordination and operant conditioning tests. Significant differences between controls and exposed groups in the negative geotaxis test were limited to those pups of dams treated during the second and third weeks of gestation, a finding interpreted by the authors to indicate the possibility of long-term effects on the central nervous system of trans-placenta exposure to Al during a later organogenic phase. According to Muller et al. (1990), the contradictions between this and their earlier study (Bernuzzi et al., 1989) could be related to environmental modifications. In particular, the mothers and pups were much more protected in the Muller et al.

(1990) study than in the previous one because they were housed in plastic cages instead of wire mesh cages and received cotton to build nests. Body temperature of the pups, therefore, may have been more adequately maintained in the Muller et al. (1990) study. As discussed in this study, toxicity in pups can be confounded by insufficient body temperature, and delayed pup weight gain could explain the differences in neuromotor performance.

Muller et al. (1990) administered diets supplemented with 0 or 400 mg Al/kg bw-day as aluminum lactate to groups of 6-9 pregnant Wistar rats on days 1-7, 1-14, or 1-21 of gestation. No rats were exposed to lactate alone, and information regarding level of Al in the basal diet was not reported. Neuromotor development was assessed on postnatal days 4, 6, 9, 12 and 20 using tests of righting reflex, grasping reflex, negative geotaxis, suspension and locomotor coordination, respectively. Learning ability was also tested on PD 65 using operant conditioning. No effects on maternal body weight or food intake was observed in dams exposed on gestational days 1-7 or 1-14. In the dams exposed on gestational days (GD) 1-21, a significant decrease in maternal body weight (26 and 35%, respectively) was observed on days 16 and 19 of gestation. Decreased food intake was also observed on day 19 of gestation. No effects on litter size, postnatal mortality, or postnatal body weight were observed. Impairment of neuromotor development ($p<0.05$) was observed in 2 of the 5 tests (negative geotaxis and locomotor coordination); no differences between the three treated groups were observed. For the operant conditioning test, there were significant differences ($p<0.05$) between the treated and control young rats. No differences between the 3 treated groups were observed. The LOAEL for developmental toxicity is 400 mg Al/kg-day, but this does not include the contribution of Al from the basal diet.

Groups of 10 pregnant Sprague Dawley rats were administered 180, 360, or 720 mg/kg-day aluminum nitrate nonahydrate by gavage (13, 26, 52 mg Al/kg bw-day) on GDs 6-14 (Paternain et al., 1988). A vehicle (water) only control group was used. The level of Al in the diet was not reported. Aluminum exposed dams gained significantly less weight than the controls. No significant effect on the numbers of litters, corpora lutea, fetal implants, live fetuses, resorptions, or runt fetuses were observed. Significant decreases in fetal body weight and tail length were observed at all three Al doses; decreased fetal body length was also observed at the 52 mg Al/kg-day dose level. No dose-related external or visceral malformations were observed in the offspring. However, a significant increase in the incidence of skeletal malformations (delayed ossification, hypoplastic deformed ribs) was observed at all three treatment levels. In addition, the incidence of hematomas was significantly increased at the high dose. Because the rats were co-exposed to relatively high levels of nitrate [comparable to those in the Domingo et al. (1987) subchronic study], the effects of treatment cannot be conclusively attributed to Al alone, in the absence of a nitrate-exposed control group.

By contrast to the striking findings of potentially teratogenic effects of aluminum nitrate in Sprague-Dawley rats, as described above (Patermain et al. 1988), equivalent experiments by Domingo et al. (1989) in Swiss mice did not reveal any reproductive, developmental or teratogenic effects of Al, when administered to dams as the hydroxide. Domingo et al. (1989) administered by gavage 0, 66.5, 133, or 266 mg/kg-day aluminum hydroxide (0, 23.9, 47.8, 95.5 mg Al/kg bw-day) to groups of 20 pregnant Swiss mice on GD 6-15. The level of Al in the diet was not reported. The dams were killed on GD 18. No compound-related effects were observed on maternal mortality, clinical signs, body weight, food intake, or absolute or relative heart, lung, spleen, liver, kidney and brain weights. In addition, no compound-related effects were observed on numbers of implantations, resorptions, live and dead fetuses, sex ratio, and the incidences of external malformations, internal soft-tissue defects or skeletal abnormalities. Therefore, this study identifies a NOEL of 95.5 mg Al/kg-day by default for reproductive, developmental and teratogenic toxicity in mice. However, neuromotor development was not assessed and the contribution of Al from the basal diet was not stated in the report.

A number of studies have been designed to evaluate the influence of citrate or lactate on the potential developmental toxicity of Al. For example, Gomez et al. (1991) exposed groups of 15-19 pregnant Sprague-Dawley rats to either distilled water (controls) or 133 mg Al/kg bw-day in the form of either aluminum hydroxide (384 mg/kg-day), aluminum citrate (1064 mg/kg-day) or aluminum hydroxide (384 mg/kg-day) concurrent with citric acid (62 mg/kg-day) by gavage on GD 6-15. The level of Al in the diet was not reported and no rats were exposed to citric acid alone. Terminations were performed on GD 20. Maternal and fetal evaluations showed exposure-related effects only in the group exposed to aluminum hydroxide and citric acid concurrently. Significant changes included reduced maternal body weight gain on GDs 6-20 (but not at sacrifice on day 20), reduced fetal body weight and some skeletal variations (increased delayed occipital and sternebrae ossification and increased absence of xiphoides). No effects were seen on maternal food consumption or clinical signs, maternal absolute or relative liver, kidney or brain weights, gravid uterine weight, corpora lutea/dam, implantations/litter, pre- or postimplantation loss/litter, viable or nonviable implants/litter, fetal sex ratio or fetal malformations (external, visceral or skeletal). This study identified a stand alone minimum LOAEL of 133 mg Al/kg-day for non-neurobehavioral developmental toxicity of aluminum hydroxide and aluminum citrate in rats. Although confidence in this LOAEL is low (because aluminum hydroxide administered concurrently with citric acid induced did developmental effects and because the dose does not include a contribution of Al from the basal diet) the value is consistent with the developmental NOAEL of 95.5 mg Al/kg-day for aluminum hydroxide in mice (Domingo et al., 1989).

In a similar experimental protocol, groups of 11-13 pregnant female Swiss albino (CD-1) mice were administered 57.5 mg Al/kg bw-day as either aluminum hydroxide (166 mg/kg-day), aluminum lactate (627 mg/kg-day) or aluminum hydroxide (166 mg/kg-day) concurrent with lactic acid (570 mg/kg-day) by gavage on gestation days 6-15 (Colomina et al., 1992). Other groups were treated with lactic acid alone (570 mg/kg-day, equivalent to the amount in 627 mg/kg of aluminum lactate) or distilled water (controls). The level of Al in the diet was not reported. Fetal evaluations were performed on GD 18, including examinations for skeletal and visceral abnormalities in approximately two-thirds and one-third of the pups, respectively. The investigators noted that the dose of Al (57.5 mg/kg-day) is equivalent to ingestion of 3.5 g Al/day by a 60 kg person, which is higher than the usual quantities of Al ingested therapeutically for peptic disorders. Maternal body weight gain was significantly lower than control values in the aluminum lactate-treated mice when evaluated over GDs 6-9 (92%), 6-12 (55.6%) and 0-18 (38.5%), and in the mice treated with combined aluminum hydroxide and lactic acid evaluated over GDs 6-12 (37.8%), 6-15 (42.7%) and 0-18 (15.7%). The decreased maternal weight gain in the aluminum lactate group was accompanied by significantly reduced food consumption during gestation days 6-18. Significant developmental and/or teratological effects in the aluminum lactate group included 16% reduced fetal body weight ($p<0.01$) and increased incidences of cleft palate (13.2%, $p<0.05$), dorsal hyperkyphosis (i.e., excessive flexion of spine) (13.5%, $p<0.05$) and delayed parietal ossification (15.4%, $p<0.01$). These developmental effects were not observed in any of the control or aluminum hydroxide exposed pups, and the only other significant changes in the other groups were decreased maternal relative liver weight and delayed fetal parietal ossification in the lactic acid only exposure group. Other types of internal or skeletal malformations or variations were not found in any of the fetuses. Additionally, no effects were seen on maternal absolute or relative kidney weight, gravid uterine weight, numbers of implantation sites/litter, live or dead fetuses, resorptions, postimplantation loss/litter, litters with dead fetuses or fetal sex ratio in any of the groups. By analogy to the findings of the Domingo et al. (1989) and Gomez et al. (1991) studies, the lack of developmental effects of aluminum hydroxide at the tested dose could be related to low solubility and absorption.

In a more recent study, pregnant Swiss mice were administered gavage doses of 0 or 104 mg Al/kg bw-day as aluminum hydroxide on days 6-15 of gestation (Colomina et al., 1994). Dietary Al intake was not reported; the mice were maintained on Panlab rodent chow. Compared to controls, there were no effects ($p>0.05$) of Al on maternal body or organ weight, number of implantations per litter, number of resorptions per litter, number of dead fetuses per litter, percentage of positive post-implantation loss, sex ratio or fetal body weight per litter. Gross external, visceral or skeletal examination of fetuses revealed no abnormalities or developmental variations. Thus, the NOAEL for development effects from this study is 104 mg Al/kg-day, however, this does not include the Al contribution from food. Thus, based on this study and the previous study (Colomina et al., 1992), aluminum lactate appears to be more potent as a developmental toxicant in mice than the less water soluble aluminum hydroxide.

Groups of 16 pregnant Swiss-Webster mice were fed 25 (control group), 500 or 1000 mg Al/kg diet as aluminum lactate throughout gestation and lactation (Donald et al., 1989). The control diet was fed to pups that were selected for post-weaning neurobehavioral assessment. Reported maternal doses were 5, 100 and 200 mg Al/kg bw-day at the beginning of pregnancy and 10.5, 210 and 420 mg Al/kg bw-day near the end of lactation. No mice were exposed to lactate alone. There were no treatment-related changes in maternal survival, body weight (measured on GD 0 and 16 and PDs 0, 5, 10, 15 and 20), food intake, toxic signs or neurobehavior (evaluated after pups were weaned at PD 21 using the same test battery used for the pups and described below), or on litter size or postnatal growth and development in pups as assessed by body weight, toxic signs on PDs 0-55, and by crown-rump length on PDs 0 and 20. Neurobehavioral maturation was tested in 2 pups per litter on PDs 8-18 with a 12 item test battery (fore- and hindlimb grasp, fore- and hindpaw placement on sticks of 2 widths, vibrissa placing, visual placing, auditory and air puff startle, eye opening, and screen grasp, cling and climb). A neurobehavioral test battery was administered to 6 pups per litter at age 25 days (4 days postweaning) or 39 days (fore- and hindlimb grip strengths, temperature sensitivity of tail, negative geotaxis, startle reflex to air puff and auditory stimuli) or age 21 and 35 days (foot splay). The pre-weaning neurobehavioral testing showed that a significant ($p=0.007$) number of pups in the high dose group had impaired vertical screen climb performance. The postweaning neurobehavioral assessment showed significantly ($p<0.05$) altered performance on several tests. These included decreased forelimb grip strength at age 39 days in the low dose group, increased hindlimb grip strength at age 25 days in both low and high dose groups, increased foot splay distance at age 21 days in both low and high dose groups and at age 35 days in the low dose group, and increased forelimb grip strength at age 25 days and decreased thermal sensitivity at age 25 and 39 days in the high dose group. There were no treatment-related changes in concentrations of Al in pup liver or bone (brain tissue was not analyzed).

In a more recent study of similar design by the same group of investigators, groups of 14 and 9 female Swiss Webster mice (6-8 weeks old) were fed 25 (control) or 1000 mg Al/g diet as aluminum lactate, respectively, during gestation and lactation (Golub et al., 1992b). The 1000 mg/g concentration was selected based on the demonstration of neurobehavioral effects in weanlings at this level (Donald et al., 1989). No mice were exposed to lactate alone. Using food intake and body weight values estimated from reported data, maternal doses are estimated to be approximately 4.3 and 174 mg Al/kg bw-day at the beginning of gestation and 4.8 and 607 at the end of the lactation period. At birth, litters were fostered either within or between groups to provide 4 groups of offspring that were exposed to excess Al via maternal diet during gestation, lactation, both or neither (i.e., 25 ppm during gestation and lactation, 1000 ppm during gestation and 25 ppm during lactation, 25 ppm during gestation and 1000 ppm during lactation, and 1000 ppm during gestation and lactation). Maternal effects included significantly (p#0.015) reduced (10-12%) body weight gain and food intake in the treated group during late pregnancy and lactation, and signs of neurotoxicity (hindlimb splaying

and dragging) in one treated dam at postnatal day 21 (weaning); this dam had seizures and died 4 days later. No treatment-related effects on litter size, birth weight, crown-rump length, righting ability at birth, sex ratio or postnatal survival were observed. Both gestation-only and lactation-only exposure caused significantly ($p<0.05$) decreased body weight gain in the treated pups beginning on postnatal day 10; combined gestation and lactation exposure produced the greatest decrease (approximately 24% at weaning). Neurobehavioral testing using the same battery as Donald et al. (1989) was performed at weaning on the dams and on a total of 12, 16, 12 and 6 pups (1 male and 1 female pup per litter) from the control, gestation-only, lactation-only and combined gestation and lactation groups, respectively. Results of this testing showed effects only in pups, including significantly decreased forelimb grip strength after gestation-only exposure, increased hindlimb grip strength after both gestation and lactation exposure, decreased temperature sensitivity after lactation-only exposure, and longer negative geotaxis latency after lactation-only exposure. In general, the findings of this study are consistent with those of Donald et al. (1989) in showing neurodevelopmental effects at the 1000 mg/kg dietary concentration, although intake dosages are dissimilar at the end of lactation. Using the dosage at the beginning of gestation, this study defines a LOAEL of 174 mg/kg-day for developmental effects.

The Donald et al. (1989) study differs from that of Golub et al. (1992b) in that offspring were not fostered, were tested at a later age (25 vs. 21 days), were allowed 4 days of recovery from the treated diet prior to testing, participated in other behavioral tests currently, and experienced no growth retardation. The effects found only in the cross-fostered groups in the Golub et al. (1992b) study (lower forelimb strength after gestation exposure and altered negative geotaxis latencies after lactation only exposure) were not observed by Donald et al. (1989). Increased footsplay was observed by Donald et al. (1989) but not by Golub et al. (1992b), perhaps due to an opposing effect of smaller pup body size in this study. Neither gestation or lactation exposure affected pup brain or liver Al concentrations, but lactation exposure caused significantly lower manganese and iron concentrations in liver and manganese concentrations in brain.

In a further extension of the two previous studies (Donald et al., 1989; Golub et al., 1992b), pregnant female Swiss-Webster mice were exposed continuously to a semi-purified diet containing 7 (control), 500 or 1000 mg Al/kg from the time of conception, through pregnancy and lactation (Golub et al., 1995). At weaning, pups were exposed to the same Al diet as their mothers (500 or 1000 mg Al/kg) until they were 150-170 days of age or were switched to the control diet (7 mg Al/kg) for the same time period. Based on reported dosages in previous studies by the same investigators, estimated daily dosages for mice exposed to 1000 mg Al/kg diet were as follows: 200 mg/kg bw-day in pregnant mice, 420 mg/kg-day in lactating mice and 130 mg/kg-day in offspring (Golub et al., 1994); doses for the mice exposed to 500 mg Al/kg diet were assumed to be approximately half of that of mice fed 1000 mg Al/kg, or 100 mg/kg-day in pregnant mice, 210 mg/kg-day in lactating mice and 65 mg/kg-day in offspring. Compared to the control diet, the Al diet had no effect on dam weight, gestation length, litter size, pup weight, offspring growth or organ weights. Operant conditioning (nose poke) of offspring for delayed spatial alternation or discrimination reversal tasks was initiated at 50 days of age and continued 5 days/wk for a total of 35 sessions. A neurobehavioral test battery was conducted when the offspring were 150-170 days of age (forelimb and hindlimb grip strength, temperature sensitivity, negative geotaxis, air puff and auditory startle response). Maternal and pre-weaning exposure to 500 mg Al/kg significantly affected ($p<0.05$) operant training in the offspring, but not performance after training in delayed spatial alternation or discrimination reversal tasks (i.e., decreased number of training sessions to achieve the training criteria). This exposure also significantly decreased forelimb and hindlimb grip strength and puff startle response ($p<0.05$). Pre-weaning and combined pre- and post-weaning exposure to 1000 mg Al/kg significantly increased ($p<0.05$) incidence of cagemate aggression at the time behavioral testing. No effects were observed on auditory startle response, temperature sensitivity, or negative geotaxis in offspring.

Histopathological examination of the brain and spinal cord revealed no treatment-related changes. Thus, the LOAEL for combined maternal and pre-weaning exposure on neurobehavioral effects in mice would approximate to 100 mg Al/kg-day (estimated daily maternal dosage).

Pregnant Charles River CD rats were administered gavage doses of 0, 250, 500 or 1000 mg Al/kg bw-day ("experiment A") or 0, 5, 25, 50, 250 or 500 mg Al/kg bw-day ("experiment B") as aluminum lactate in distilled water on GDs 5-15 (Agarwal et al., 1996). Dietary Al intake was not reported. Offspring were examined for body weight, anogenital distance, oestrus cycle regularity (after puberty), duration of pseudopregnancy induced by mechanical stimulation of the cervix, oocyte production induced by an injection of human chorionic gonadotropin, and male and female gonad weights. Aluminum had no effect on litter size and no consistent effects on birth weight were observed. For example, birth weights were decreased in male offspring from dams that received 250 mg Al/kg-day, but not at higher dosages, and the effect was observed only in experiment A. Female offspring birth weights decreased at certain dosage levels in experiment A and increased at these same dosage levels in experiment B. Similar inconsistencies between experiment A and B were observed for gonadal weights, anogenital distance, time to puberty (vaginal opening), duration of pseudopregnancy or numbers of superovulated oocytes. A significantly increased ($p<0.05$) number of abnormal oestrus cycle lengths (defined as less than 4 days or greater than 5 days) occurred in offspring from dams that received 250 mg Al/kg-day (in experiment A, the endpoint was not measured in experiment B). However, the effect was most pronounced in the first 3 oestrus cycles (of 5 observed) and not detected by the 5th cycle. Thus, the NOAEL for temporary disturbance of the oestrus cycle in offspring of dams administered Al is 250 mg Al/kg-day. NOAELs for all other reproductive endpoints in this study were 1000 mg Al/kg-day. These NOAELs do not include the contribution of Al in food.

In a three-generation study, Ondreicka et al. (1966) exposed initial groups of 7 female and 3 male Dobra Tpda mice to either 0 or 19.3 mg Al/kg bw-day as aluminum chloride in drinking water. The diet also contained 160 to 180 ppm Al, giving an estimated intake of 27-31 mg/kg-day based on default values for food consumption and body weight for chronic exposure of mice (U.S. EPA, 1988). Using this estimate, the total Al intakes (drinking water and food) were 27 mg/kg-day (controls) and 46.3 mg/kg-day (exposed group). The P_0 group produced 3 litters (designated F_{1a}, F_{1b}, and F_{1c}) and the F_{1a} group produced 2 litters (designated F_{2a} and F_{2b}) from which the weanlings were exposed to Al in the drinking water starting at 4 weeks of age. There were no difference in body weight gain among the groups in the P_0 generation, a result that contrasted with the striking decrease in this parameter in the treated F_{1b}, F_{1c}, F_{2a}, and F_{2b} groups. Though no effects on erythrocyte count, hemoglobin levels, or histopathology of the liver, spleen, and kidneys were observed in the P_0, F_1 or F_2 generations at the end of the study and no significant differences were seen in the number of litters or offspring between the exposed and control groups, the study identified a LOAEL of 46.3 mg Al/kg-day, based on the observed changes in body weight gain.

Other Toxicological Effects of Aluminum

In a study designed to determine the effects of oral Al exposure on susceptibility to bacterial infection, female Swiss-Webster mice (13-14 per group) were exposed to a diet containing 25 (control), 500 or 1000 mg Al/kg as aluminum lactate during pregnancy, through lactation and for 10 days following weaning of the pups (Yoshida et al., 1989). Based on reported dosages in previous studies by the same investigators, estimated daily dosages for mice exposed to 1000 mg Al/kg diet are as follows: 200 mg/kg-day during pregnancy and 420 mg/kg-day during lactation; doses for the mice exposed to 500 mg Al/kg diet are assumed to be approximately half of that of mice fed 1000 mg Al/kg, or 100 mg/kg-day in pregnant mice and 210 mg/kg-day in lactating

mice (Golub et al., 1994). At weaning, dams and pups were inoculated with a tail vein injection of *Listeria monocytogenes* and monitored for mortality for 10 days. In a separate experiment, female mice, 6 weeks of age, were exposed to the same dietary Al levels for six weeks and then inoculated with *L. monocytogenes*. Estimated Al dosages were 5, 98 or 195 mg Al/kg bw-day for the 25, 500 or 1000 mg Al/kg dietary levels, respectively, based on a default food factor of 0.195 kg diet/kg bw-day assuming a reference "subchronic" food intake and body weight for female B6C3F1 mice over the period from weaning to 90 days (U.S. EPA, 1988). Inoculation resulted in significantly greater ($p<0.025$) mortality in dams exposed to 500 or 1000 mg Al/kg diet compared to controls. There were no differences in mortality between the groups of inoculated pups or between groups of inoculated adult mice exposed to Al for six weeks. The LOAEL for pregnant mice was 100 mg Al/kg bw-day and the NOAEL for adult, non-pregnant mice was 195 mg Al/kg bw-day. Although the exposure duration in this study was only 7 weeks, it is included in Table 1 because it provides the only dose-response data on the effects of Al on resistance to pathogens.

DERIVATION OF A PROVISIONAL CHRONIC ORAL RFD

This survey of the toxicological effects of Al in rodents suggests that neurotoxicological and developmental (including neurodevelopmental) endpoints are among the most sensitive indicators of Al toxicity. However, as vehicles for the development of toxicity values such as a provisional chronic RfD, the latter group of studies are considered to be more appropriate, since the level of exposure to Al appears to be better characterized. In fact, neurobehavioral deficits have been observed in mice and rats exposed during various stages of development and in subchronic studies (Bernuzzi et al., 1989; Donald et al., 1989; Golub et al., 1989, 1992a, 1992b, 1995; Muller et al., 1990), as described above. These deficits include impaired operant learning, changes in grip strength, altered startle response and impaired motor coordination. In addition, several studies have shown that oral Al can produce histopathological changes in the CNS, although the histopathological lesions have yet to be causally related to the neurobehavioral deficits. Thus, Florence et al. (1994) reported histopathological changes in the brain of rats exposed to dietary Al for 6 months, the changes including the appearance of vacuolation of the cell body and cell processes of astrocytes in the brain and swelling of astrocytic processes. In addition, more localized vacuolization of neurons in the brain also was observed. These changes were observed in rats exposed to elevated Al in the diet and are distinct from the NFD that has been observed in rats, rabbits and monkeys maintained on elevated dietary Al in combination with reduced dietary calcium (Garruto et al., 1989; Kihira et al., 1994; Mitani, 1992; Yano et al., 1989; Yoshida et al., 1990) or in rabbits administered intracisternal or intraventricular injections of Al (Kowall et al., 1989; Wakayama et al., 1993). Interpretation of the low-calcium studies is complicated by the observation that NFD was observed in animals maintained on low-calcium diets without excess Al and was enhanced by the addition of excess Al to these diets (Garruto et al., 1989; Kihira et al., 1994). Furthermore, Al has been shown to inhibit the gastrointestinal absorption of calcium (Orihuela et al., 1996), an effect that may exacerbate the calcium deprivation induced by low calcium diets. Thus, it is not clear whether calcium deprivation enhances the neurotoxicity of Al or Al exacerbates the adverse effects of calcium deprivation.

Donald et al. (1989) and Golub et al. (1995) are co-principal studies that identify a LOAEL of 100 mg Al/kg-day for minimal neurotoxicity in the offspring of mice exposed to dietary aluminum lactate (soluble aluminum) during gestation and lactation. The neurotoxicity associated with this LOAEL is consistent with LOAELs from other developmental and subchronic neurobehavioral studies in mice and rats which used higher dietary dosages of aluminum lactate or aluminum chloride (Golub et al., 1989, 1992a, 1992b; Bernuzzi et al., 1989; Muller et al., 1990). Of the above, Golub et al., (1995) is the only study in which a histopathological examination of the brain and spinal cord was conducted and no abnormalities were reported. The Florence et al.

(1994) study indicates that histopathological abnormalities of the CNS can occur in rats exposed subchronically to 84 mg/kg-day; although this is lower than the LOAEL for neurobehavioral effects, it was not chosen as the principal study because the functional significance of the histopathological lesions are uncertain.

A number of studies were identified that, at face value, appeared to indicate LOAELs at lower doses than the 100 mg Al/kg-day value selected herein, for example, Patermain et al. (1988) and Colomina et al. (1992). However, in these as in many of the studies under consideration, insufficient information on dietary Al (Al content and/or feed type) was reported to permit a reliable estimation of the overall dose level to which the animals were subjected.

Other developmental studies with aluminum hydroxide and/or citrate in mice and rats identified a NOAEL which are equivalent (95.5 mg Al/kg-day) to, or a minimum LOAEL that was greater (133 mg Al/kg-day) than the 100 mg Al/kg-day critical LOAEL (Domingo et al., 1989; Gomez et al., 1991), an overlap potentially related to differences in effective doses due to variations in unreported Al dietary content and factors affecting absorption such as chemical form (e.g., the use of less absorbable aluminum hydroxide). In addition, the LOAEL of 43.3 mg Al/kg-day for decreased body weight gain in mice exposed to aluminum chloride for 180-390 days (Ondreicka et al., 1966) was thought be inappropriate for risk assessment due to the small sample size and to the poor reporting of study details. Aluminum nitrate caused alterations in levels of brain biogenic amines and hepatic and hematological indices in rats exposed to 21.4 mg Al/kg-day for 6 weeks (Flora et al., 1991). This dose is a NOAEL because insufficient information is available to determine if the effects are adverse.

Therefore, the LOAEL of 100 mg Al/kg-day for minimal neurotoxicity in the offspring of mice (Donald et al., 1989, Golub et al., 1995) is selected as the basis for the provisional chronic RfD. The LOAEL is considered minimal because the results of the postweaning neurobehavioral test battery indicate that performance deficits may be marginal. In particular, of the three observed effects (decreased forelimb and increased hindlimb grip strengths, increased hindlimb foot splay distance), one effect (increased grip strength) has unclear toxicological significance and two effects (increased grip strength and foot splay distance) did not persist after two weeks of no further exposure.

Application of an uncertainty factor (UF) of 100 (3 for use of a minimal LOAEL, 10 for interspecies extrapolation, and 3 for intrahuman variability where the critical effects have been observed in a sensitive sub-group) results in a provisional RfD of

RfD = 1E-0 mg Al/kg-day.

The provisional RfD of **1E-0** mg Al/kg-day is approximately 3-fold higher than estimated normal daily Al intake of approximately 0.2-0.3 mg/kg-day (Iyengar et al., 1987; Ganrot, 1986; Wilhelm et al., 1990). Chronic users of medications such as antacids, buffered aspirins and antiulceratives would be expected to ingest much larger amounts of Al, possibly as high as 10-70 mg/kg-day. However, these subjects would not represent the most sensitive population (developing infants), as indicated by the animal data.

Low confidence is placed in the co-critical studies, because they only identify a LOAEL for a sensitive effect and evaluated comparatively small numbers of animals. Confidence in the data base is low because the most reliable supporting data for neurotoxicity of Al in humans are of limited general relevance (e.g., dialysis encephalopathy is manifested in patients with impaired renal function and excessive Al uptake from intravenous

exposure). In fact, neurotoxicity remains to be assessed in animals chronically exposed to Al, and developmental morphology has not been adequately investigated in two animal species. These limitations in the Al data base do not increase uncertainty in the RfD; therefore, a data base uncertainty factor was not used. However, reflecting the low confidence in the co-critical studies, there is low overall confidence in the RfD.

RISK CHARACTERIZATION

Cancer Hazard Summary There are no records for Al in the U.S. EPA's IRIS or HEAST databases (U.S. EPA, 1999, 1997), nor has the carcinogenicity of Al compounds been formally evaluated by the agency. However, a number of scientific investigations have addressed the issue of the carcinogenicity of Al, though with inconclusive results. For example, a 20-month exposure of B6C3F1 mice to aluminum potassium sulfate dodecahydrate in the diet at concentrations up to 10% w/w displayed no indication of compound-related carcinogenicity and, in general, no indication of adverse toxicological effects of any kind (Oneda et al., 1994). Similarly, the life-time exposure of Swiss mice and Long-Evans rats to 5 ppm Al as aluminum potassium sulfate in drinking water provided no convincing evidence for the carcinogenicity of Al compounds (Schroeder and Mitchener 1975a,b). A considerable number of epidemiological studies have examined the incidence of excess tumor formation in persons occupationally exposed to Al in the form of dusts or fumes. In general, a body of inferential evidence exists for an increase in cancer of the bladder and lung with occupational exposure to Al, though conclusions linking cause with effect are frequently confounded by co-exposure to other harmful emissions, cigarette smoking, and the absence of adequate reference populations. Taking all of the evidence of Al carcinogenicity together, a qualitative weight-of evidence classification of D, -not classifiable as to human carcinogenicity, is suggested, in line with the agency's guidelines for carcinogenic risk assessment (U.S. EPA, 1986). In accordance with the agency's proposed guidelines for carcinogenic risk assessment (U.S. EPA, 1996), the compound's carcinogenicity *cannot be determined* on the available evidence.

SUPPORTING INFORMATION

Human Data Occupational exposure to fumes and dusts containing Al compounds, for example, in welding shops, has provided insubstantial evidence of links to increased tumor incidence, in some studies. Overall, the links between cause and effect are considered marginal, at best, and are potentially by co-exposure to other carcinogenic substances.

Animal Data Studies of the carcinogenicity of Al compounds in experimental animals have yielded negative results.

Mutagenicity The small amount of evidence that exists on the capacity of the element to induce gene reversion in *S. typhimurium* is negative for Al compounds (Ahn and Jeffrey, 1995).

MODE OF ACTION

No data.

DISCUSSION

Epidemiological studies of metal dusts and fumes in such settings as welding shops, smelters, etc., have provided a body of evidence that suggests but does not prove that emissions containing a number of air-borne l may be carcinogenic. However, the evidence for such a proposition is weak, yielding data on the borderne of statistical significance, if at all. There is no hard evidence for the carcinogenicity of Al compounds via the oral route.

BRIEFING SUMMARY

Routes	Class	Designation or Rationale	Dose Response
oral/inhalation	cannot be determined	not applicable	no data

Basis for classification/dose response

1. **Human data:** Insufficient evidence in epidemiological/occupational exposure studies.

2. **Animal data:** Existing evidence is largely negative for Al's carcinogenicity.

3. **Structural analogue data:** None.

4. **Other key data:** Available mutagenicity data are negative for Al compounds.

5. **Mode of action:** No data.

6. **Hazard classification/uncertainties:** The chosen weight-of-evidence descriptors are based on a lack of sufficiently hard evidence for the carcinogenicity of Al compounds. Positive evidence of non-carcinogenicity is also lacking.

7. **Dose response:** Not applicable

REFERENCES

ACGIH (American Conference of Governmental Industrial Hygienists). 1998. 1998 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. ACGIH, Cincinnati, OH.

Ahn, H-W. and E.H. Jeffrey. 1995. Effect of aluminum on fluoride uptake by Salmonella typhimurium TA98: Implications for the Ames mutagenicity assay. J. Toxicol. Environ. Health 41: 357-368.

ATSDR (Agency for Toxic Substances and Disease Registry). 1998. Toxicological Profile for Aluminum (Update). U.S. Public Health Service. Atlanta, GA.

Agarwal, S.K., L. Ayyash, C.S. Gourley, J. Levy, K. Faber and C.L. Hughes Jr. 1996. Evaluation of the developmental neuroendocrine and reproductive toxicology of aluminum. Food Chem. Toxicol. 34: 49-53.

Basu, S., D. Chaudhuri and A.N. Chaudhuri. 1997. Influence of calcium on the toxic effects of dietary aluminum. J. Food Sci. Toxicol. 34: 264-266.

Bernuzzi, V., D. Desor and P.R. Lehr. 1989. Developmental alterations in offspring of female rats orally intoxicated by aluminum chloride or lactate during gestation. Teratol. 40: 21-27.

Colomina, M.T., M. Gomez, J.L. Domingo, J.M. Llobet and J. Corbella. 1992. Concurrent ingestion of lactate and aluminum can result in developmental toxicity in mice. Res. Commun. Chem. Pathol. Pharmacol. 77: 95-106.

Colomina, M.T., M. Gomez, J.L Domingo and J. Corbella. 1994. Lack of maternal and developmental toxicity in mice given high doses of aluminum hydroxide and ascorbic acid during gestation. Pharmacol. Toxicol. 74: 236-239.

Cucarella, C., C. Montoliu, C. Hermenegildo et al. 1998. Chronic exposure to aluminum impairs neuronal glutamate-nitric oxide-cyclic GMP pathway. J. Neurochem. 70: 1609-1614.

Deloncle, R., O. Guillard, F. Huguet and F. Clanet. 1995. Modification of the blood-brain barrier through chronic intoxication by aluminum glutamate. Possible role in the etiological of Alzheimer's disease. Biol. Trace Element Res. 47: 227-238.

Deloncle, R., F. Huguet, P. Babin, B. Fernandez, N. Quellard and O. Guillard. 1999. Chronic administration of aluminum L-glutamate in young mature rats: Effects on iron levels and lipid peroxidation in selected brain areas. Toxicol. Lett. 104: 65-73.

Deng, Z., C. Coudray, L. Gouzoux, A. Mazur, Y. Rayssiguier and D. Pepin. 1998. Effects of oral aluminum and aluminum citrate on blood level and short-term tissue distribution of aluminum in the rat. Biol. Trace Element Res. 63: 139-147.

Domingo, J.L., J.M. Llobet, M. Gomez, J.M. Tomas and J. Corbella. 1987. Nutritional and toxicological effects of short-term ingestion of aluminum by the rat. Res. Commun. Chem. Pathol. Pharmacol. 56: 409-419.

Domingo, J.L., M. Gomez, M.A. Bosque and J. Corbella. 1989. Lack of teratogenicity of aluminum hydroxide in mice. Life Sci. 45: 243-247.

Domingo, J.L., M. Gomez, J.M. Llobet, and J. Corbella. 1991. Influence of some dietary constituents on aluminum absorption and retention in rats. Kidney Int. 39: 598-601.

Domingo, J.L., J. Llorens, D.J. Sanchez, M. Gomez, J.M. Llobet and J. Corbella. 1996. Age-related effects of aluminum ingestion on brain aluminum accumulation and behavior in rats. Life Sci. 58: 1387-1395.

Donald, J.M., M.S. Golub, M.E. Gershwin and C.L. Keen. 1989. Neurobehavioral effects in offspring of mice given excess aluminum in diet during gestation and lactation. Neurotoxicol. Teratol. 11: 345-351.

Flora, S.J.S., M. Dhawan and S.K. Tandon. 1991. Effects of combined exposure to aluminum and ethanol on aluminum body burden and some neuronal, hepatic and hematopoietic biochemical variables in the rat. Hum. Exp. Toxicol. 10: 45-48.

Florence, A.L., A. Gauthier, C. Ponsar, P. Van den Bosch de Aguilar and R.R. Crichton. 1994. An experimental animal model of aluminum overload. Neurodegeneration. 3: 315-323

Ganrot, P.O. 1986. Metabolism and possible health effects of aluminum. Environ. Health Perspect. 65: 363-441.

Garbossa, G., G. Galvez, M.E. Castro and A. Nesse. 1998. Oral aluminum administration to rats with normal renal function. 1. Impairment of erythropoiesis. Hum. Exp. Toxicol. 17: 312-317.

Garruto, R.M., S.K. Shankar, R. Yanagihara, A.M. Salazar, H.L. Amyx and D.C. Gajdusek. 1989. Low-calcium high-aluminum diet-induced motor neuron pathology in cynomolgus monkeys. Acta Neuropathol. 78: 210-219.

Glynn, A.W., A. Sparen, L-G. Daniellson, B. Sundstrom and L. Jorhem. 1999. Concentration-dependent absorption of aluminum in rats exposed to labile aluminum in drinking water. J. Toxicol. Environ. Health 56: 501-512.

Golub, M.S., J.M. Donald, M.E. Gershwin, and C.L. Keen. 1989. Effects of aluminum ingestion on spontaneous motor activity of mice. Neurotoxicol. Teratol. 11: 231-235.

Golub, M.S., B. Han, C.L. Keen and M.E. Gershwin. 1992a. Effects of dietary aluminum excess and manganese deficiency on neurobehavioral endpoints in adult mice. Toxicol. Appl. Pharmacol. 112(1): 154-160.

Golub, M.S., C.L. Keen and M.E. Gershwin. 1992b. Neurodevelopmental effect of aluminum in mice: Postnatal studies. Neurotoxicol Teratol. 14(3): 177-182.

Golub, M.S., B. Han, C.L. Keen and M.E. Gershwin. 1994. Auditory startle response in Swiss-Webster mice fed excess aluminum in diet. Neurotoxicol. Teratol. 16: 423-425.

Golub, M.S., B. Han, C.L. Keen, M.E. Gershwin and R.P. Tarara. 1995. Behavioral performance of Swiss-Webster mice exposed to excess dietary aluminum during development or during development and as adults. Toxicol. Appl. Pharmacol. 133: 64-72.

Gomez, M., J.L. Domingo and J.M. Llobet. 1991. Developmental toxicity evaluation of oral aluminum in rats: Influence of citrate. Neurotoxicol. Teratol. 13(3): 323-328.

Ittel, T.H., A. Griesner and H.G. Siberth. 1991. Effect of lactate on the absorption and retention of aluminum in the remnant kidney rat model. Nephron. 57: 332-339.

Iyengar, G.V., J.T. Tanner, W.R. Wolf and R. Zeisler. 1987. Preparation of a mixed human diet material for the determination of nutrient elements, selected toxic elements and organic nutrients: a preliminary report. Sci. Total Environ. 61: 235-252.

Katyal, R., B. Desigan, C.P. Sodhi and S. Ojha. 1997. Oral aluminum administration and oxidative injury. Biol. Trace Element Res. 57: 125-130.

Katz, A.C., D.W. Frank, M.W. Sauerhoff, G.M. Zwicker, and R.I. Freudenthal. 1984. A 6-month dietary toxicity study of acidic sodium aluminum phosphate in beagle dogs. Food Chem. Toxic. 22: 7-9.

Kihira, T., S. Yoshida, Y. Uebayashi, I. Wakayama and Y. Yase. 1994. Experimental model of motor neuron disease: oral aluminum neurotoxicity. Biomed. Res. 15(1): 27-36.

Kihira, T, S.Yoshida, J. Komoto, I. Wakayama, Y. Yase. 1995. Aluminum-induced model of motor neuron degeneration: subperineurial injection of aluminum in rabbits. Neurotoxicol. 16: 413-424.

Konishi. Y., K. Yagyu, H. Kinebuchi, N. Saito, T. Yamaguchi and Y. Ohtsuki. 1996. Chronic effect of aluminum ingestion on bone in calcium-deficient rats. Pharmacol. Toxicol. 78: 429-434.

Kowall, N.W., W.W. Pendlebury, J.B. Kessler, D.P. Perl and M.F. Beal. 1989. Aluminum-induced neurofibrillary degeneration affects a subset of neurons in rabbit cerebral cortex, basal forebrain and upper brainstem. Neuroscience 29: 329-37.

Lione, A. 1985. Aluminum toxicology and the aluminum-containing medications. Pharmacol. Therap. 29: 255-285.

Marquis, J.K. Neurotoxicity of aluminum. 1989. Environmental Chemistry and Toxicology of Aluminum. T.E. Lewis, Editor; Chelsea, Michigan, Lewis Publishers, Inc., pp. 289-298.

Martyn, C.N., D.N. Coggon, H. Inskip, R.F. Lacey and W.F. Young. 1997. Aluminum concentrations in drinking water and risk of Alzheimer's disease. Epidemiology 8: 281-286.

Mitani, K. 1992. Relationship between neurological diseases due to aluminium load, especially amyotrophic lateral sclerosis, and magnesium status. Magnes. Res. 5: 203-213.

Muller, G., V. Bernuzzi, D. Desor, M-F. Hutin, D. Burnel and P.R. Lehr. 1990. Developmental alterations in offspring of female rats orally intoxicated by aluminum lactate at different gestation periods. Teratol. 38: 253-261.

NIOSH (National Institute for Occupational Safety and Health). 1994. Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Washington, DC.

Ondreicka, R., E. Ginter and J. Kortus. 1966. Chronic toxicity of aluminum in rats and mice and its effects on phosphorus metabolism. Brit. J. Industr. Med. 23: 305-312.

Oneda, S., T. Takasaki, K. Kuriwaki et al. 1994. Chronic toxicity and tumorigenic study of aluminum potassium sulfate in B6C3F1 mice. In Vivo. 8: 271-278.

Orihuela, D., C.E. Carnovale, J.A. Monti and M.C. Carrillo. 1996. Sex-related differences in the effect of aluminum on calcium transport in the small intestine of the rat. Toxicol. Lett. 85:165-171.

Partridge, N.A., F.E. Regnier, J.L. White and S.L. Hem. 1989. Influence of dietary constituents on intestinal absorption of aluminum. Kidney Int. 35: 1413-1417.

aternain, J.L., J.L. Domingo, J.M. Llobet and J. Corbella. 1988. Embryotoxic and teratogenic effects of aluminum nitrate in rats upon oral administration. Teratol. 38: 253-257.

Pennington, J.A. and S.A. Schoen. 1995. Estimates of dietary exposure to aluminum. Food Add. Contam. 12: 119-128.

Reiber, S., W. Kukull and P. Standish-Lee. 1995. Drinking water aluminum and bioavailability, J. Am. Water Works Assoc. 87: 86-100.

Schroeder, H.A. and M. Mitchener. 1975a. Life-term studies in rats: effects of aluminum, barium, beryllium, and tungsten. J. Nutr. 105: 421-427.

Schroeder, H.A. and M. Mitchener. 1975b. Life-term effects of mercury, methyl mercury, and nine other trace metals on mice. J. Nutr. 105: 452-458.

Slanina, P., Y. Falkeborn, W. Frech and A. Cedergren. 1984. Aluminum concentrations in the brain and bone of rats fed citric acid, aluminum citrate or aluminum hydroxide. Food Chem. Toxicol. 22: 391-397.

Slanina, P., W. Frech, A. Bernhardson, A. Cedergren and P. Mattsson. 1985. Influence of dietary factors on aluminum absorption and retention in the brain and bone of rats. Acta Pharmacol. Toxicol. 56: 331-336.

anina, P., W. Frech, L.G. Ekstrom, L. Loof, S. Slorach and A. Cedergren. 1986. Dietary citric acid enhances sorption of aluminum in antacids. Clin. Chem. 32: 539-541.

Somova, L.I., A. Missankov and M.S. Khan. 1997. Chronic aluminum intoxication in rats: Dose-dependent morphological changes. Meth. Find. Exp Clin. Pharmacol. 19: 599-604.

Stokinger, H.E. 1981. The Metals: Aluminum. In: Patty's Industrial Hygiene and Toxicology, Volume IIA, 3rd rev ed., G.D. Clayton and F.E. Clayton, eds. John Wiley and Sons, NY. P. 1493-1504.

Sutherland, J.E. and J.L. Greger. 1998a. Kinetics of aluminum disposition after ingestion of low to moderate doses of aluminum. Toxicology. 126: 115-125.

Sutherland, J.E. and J.L. Greger. 1998b. Effect of the size of an oral dose of aluminum on the relative importance of biliary *v.* urinary aluminum excretion in conscious rats. Food Chem. Toxicol. 36: 505-512.

Taylor, G.A., P.B. Moore, I.N. Ferrier, S.P. Tyrer and J.A. Edwardson. 1998. Gastrointestinal absorption of aluminum and citrate in man. J. Inorg. Biochem. 69: 165-169.

U.S. EPA. 1986. Guidelines for Carcinogenic Risk Assessment. Fed. Reg. 51: 33992-34003.

U.S. EPA. 1987. Health Effects Assessment for Aluminum. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, D.C. EPA600/8-88/016.
U.S. EPA. 1988. Recommendations for and Documentation of Biological Values for Use in Risk Assessment. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC. EPA 600/6-87-008. NTIS PB88-179874.

U.S. EPA. 1994. Chemical Assessments and Related Activities (CARA). Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA. 1996. Proposed Guidelines for Carcinogenic Risk Assessment. Fed. Reg. 61: 17960-18011.

U.S. EPA. 1997. Health Effects Assessment Summary Tables. FY-1997 Annual and FY-1997 Supplement. Office of Research and Development, Office of Emergency and Remedial Response, Washington, DC.

U.S. EPA. 1999. Integrated Risk Information System. Online. Office of Health and Environmental Assessment, National Center for Environmental Assessment, Cincinnati, OH.

van der Voet, G.B. and F.A. de Wolff. 1986. Intestinal absorption of aluminum in rats: effect of intraluminal pH and aluminum concentration. J. Appl. Toxicol. 6: 37-41.

Varner, J., K.F. Jensen, W. Horvath and R.L. Isaacson. 1998. Chronic administration of aluminum-fluoride or sodium-fluoride to rats in drinking water: Alterations in neuronal and cerebrovascular integrity. Brain Res. 784: 284-298.

Wakayama, I., V.R. Nerurkar and R.M. Garruto. 1993. Immunocytochemical and ultrastructural evidence of dendritic degeneration in motor neurons of aluminum-intoxicated rabbits. Acta Neuropathol. 85:122-128.

Wilhelm, M., D.E. Jager and F-K. Ohnesorge. 1990. Aluminum toxicokinetics. Pharmacol. Toxicol. 60: 4-9.

Wilhelm, M., I. Lombeck, B. Kouros, J. Wuthe and F-K. Ohnesorge. 1995. Duplicate study on the dietary intake of some metals/metalloids by German children. Part II: Aluminum, cadmium and lead. Zbl. Hyg. 197: 357-369.

Yano, I., S. Yoshida, Y. Uebayashi, F. Yoshimasu and Y.Yase. 1989. Degenerative changes in the central nervous system of Japanese monkeys induced by administration of aluminum salt. Biomed. Res. 10: 33-41.

Yokel, R.A. and P.J. McNamara. 1988. Influence of renal impairment, chemical form, and serum protein binding on intravenous and oral aluminum kinetics in the rabbit. Toxicol. Appl. Pharmacol. 95: 32-43.

Yoshida, S., M.E. Gershwin, C.L. Keen, J.M., Donald and M.S. Golub. 1989. The influence of aluminum on resistance to *Listeria monocytogenes* in Swiss-Webster mice. Arch. Allergy Appl. Immunol. 89: 404-409.

Yoshida, S., I. Yano, I. Wakayama, K. Mitani, and Y. Yase. 1990. Morphometric analysis of neurodegenerative changes induced by low calcium-magnesium and excessive aluminum intake. Biomed. Res. (1): 11-18.

Table 1. Summary of Oral Toxicity Data for Aluminum[1]

Study	Type	Species	Al	Exposure Concentration (ppm)	Exposure Dosage (mg Al/kg-day)	Exposure Frequency and Duration	Critical Effect	NOAEL (mg Al/kg-day)	LOAEL (mg Al/kg-day)	FEL (mg Al/kg-day)
Ondreicka et al., 1966	Subchronic 3-gen dietary	Dobra Voda mice	chloride	--	27 (control), 46	Continuous, 180-390 day	Decreased body weight gain in F1 and F2.	--	46	--
Golub et al., 1989	Subchronic dietary	S-W mice	lactate	25 (control), 500,1000	3.3 (control), 65,130	Continuous, 6 wk	Decreased spontaneous motor activity; decreased weight gain.	65	130	--
Golub et al., 1992a	Subchronic dietary	S-W mice	lactate	25 (control), 1000	190	Continuous, 90 day	Decreased hindlimb grip, decreased spontaneous motor activity, decreased startle response.	--	190	--
Florence et al., 1994	Subchronic dietary	Wistar rat	chloride (with citric acid)	1.52 (control), 1000	0.13 (control), 84	Continuous, 6 mo.	Histopathological changes in brain astrocytes and neurons.	--	84	--
Domingo et al., 1996	Subchronic drinking water	Sprague Dawley rats	nitrate (with citric acid)	--	0, 50, 100 (plus unreported dietary Al)	Continuous, 6.5 mo.	Operant conditioning and performance	100	--	--
Yoshida et al., 1989	Subchronic dietary	S-W mice	lactate	25 (control), 500, 1000	5 (control), 98, 195	Continuous, 7 wk	Increased mortality from L. monocytogenes inoculation	195	--	--
Donald et al., 1989	Developmental dietary	S-W mice	lactate	25 (control), 500, 1000	5 (control), 100, 200	Continuous, gestation and lactation	Neurobehavioral effects.	--	100	--
Golub et al., 1992b	Developmental dietary	S-W mice	lactate	25 (control), 1000	4 (control), 174	Continuous, gestation and lactation	Neurobehavioral effects.	--	174	--
Golub et al., 1995	Developmental dietary	S-W mice	lactate	7, 500, 1000	1 (control), 100, 200	Continuous, gestation, lactation to maturity	Neurobehavioral effects.	--	100	--
Yoshida et al., 1989	Developmental dietary	S-W mice	lactate	25 (control), 500, 1000	4 (control), 100, 200	Continuous, gestation and lactation	Increased mortality of dams from L. monocytogenes inoculation	--	100	--

[1]Studies for which total dosages were reported or could be estimated (unless otherwise noted).

Attachment 4

SRC SF 01-021c/11-14-01

Risk Assessment Issue Paper for: Evaluation of the Carcinogenicity Assessment for Iron (CASRN 7439-89-6) and Compounds

INTRODUCTION

A cancer assessment for iron is not listed on IRIS (U.S. EPA, 2001), the HEAST (U.S. EPA, 1997), or the Drinking Water Standards and Health Advisories list (U.S. EPA, 2000), and was not considered by the CRAVE Work Group (U.S. EPA, 1995). The CARA list (1991, 1994) includes a Health Effects Assessment for Iron and Compounds (U.S. EPA, 1984) that assigned iron and its compounds to weight-of-evidence Group C, possible human carcinogen. This assessment was based on conflicting evidence of lung tumors following occupational inhalation exposure to ferric oxide (mixed exposure), and injection-site tumors in one patient and in mice treated with iron-dextran. IARC (1972, 1987) assigned ferric oxide to Group 3, not classifiable as to its carcinogenicity to humans based on inadequate data in humans (increased incidence of lung cancer following occupational exposure to iron dusts in mixtures) and apparently negative evidence for carcinogenicity in mice, hamsters and guinea pigs exposed by inhalation or intratracheal instillation. For ferric oxide dust and fume, the ACGIH (1991, 2001) lists an A4 notation, not classifiable as a human carcinogen; this is based on mixed exposure studies in humans and primarily negative studies in animals.

Iron has not been the subject of a toxicological review by ATSDR (2001) or the WHO (2001). Monographs by IARC (1972, 1984, 1987), a toxicity review on iron (Grimsley, 2001), and the NTP (2001a, 2001b) management status report and chemical repository summary were consulted for information relevant to the carcinogenicity of iron and inorganic iron compounds. The following computer searches, performed in April, 1993, were screened to identify additional pertinent studies not discussed in review documents: TOXLINE (1983-April, 1993), CANCERLIT (1990 - April, 1993), MEDLINE (1991 - April, 1993), TSCATS, RTECS, and HSDB. Update literature searches were conducted in September, 2001 in TOXLINE (1992-September, 2001), CANCERLIT (1992- September, 2001), MEDLINE (1992-September, 2001), TSCATS, RTECS, DART/ETICBACK, EMIC/EMICBACK, HSDB, GENETOX, and CCRIS.

REVIEW OF PERTINENT LITERATURE

Human Studies

Oral Exposure

Since iron is an essential element, the NAS (2001) has established guidelines for daily dietary intakes, based on gender, age, and physiological status, that are designed to avoid adverse effects of deficiency and excess. Individuals of northern European descent who are affected by hereditary hemochromatosis, an autosomal, recessive disorder, are not protected by these guidelines. These individuals exhibit excessive absorption of dietary iron, which results in abnormally high accumulations of iron in the tissues. When the liver consequently develops cirrhosis, the risk of developing primary hepatocellular carcinoma increases significantly. It is not clear whether these findings are relevant to excess iron intake by the general population.

Bird et al. (1996) investigated the association between plasma ferritin and iron intake and the development of adenomatous polyps, which are intermediate markers for colorectal cancer. The study population consisted of men and women between the ages of 50 and 75 years old who underwent routine screening by flexible sigmoidoscopy at one of two medical centers during 1991-1993. Individuals with cancer, inflammatory bowel disease, or familial polyposis were excluded. Cases (300 men and 167 women) were subjects diagnosed for the first time with one or more histologically confirmed adenomatous polyps. Controls (331 men and 167 women) had no history of polyps and none discovered at sigmoidoscopy. Cases and controls were matched by sex, age (" 5 years), date of sigmoidoscopy (" 3 months), and medical center. Plasma ferritin levels, hematocrit, and certain nutritional indicators (carotenoids, ascobate, folate) were measured in blood samples drawn 6 months after examination. Iron intakes for the year preceding sigmoidoscopy were estimated by means of a semiquantitative food frequency questionnaire. After excluding subjects with possible non-iron-related elevations in ferritin, subjects with high plasma ferritin levels (>289 : g/L) had a multivariate-adjusted odds ratio for colorectal polyps of 1.5 (95% confidence interval (C.I..) 1.0-2.3) compared to subjects with low/normal levels (73-141 : g/L). The pattern for iron intake was U-shaped. Compared with subjects consuming an adequate amount of iron (11.6-13.6 mg/day), multivariate-adjusted odds ratios for colorectal polyps were 1.6 (95% C.I. 1.1-2.4) for intakes below 11.6 mg/day and 1.4 (95% C.I. 0.9-2.0) for intakes above 27.3 mg/day. The authors conclude that there is a weak positive association between iron exposure and colorectal polyps that may increase the risk of colorectal cancer.

Inhalation Exposure

Most studies of cancer incidence following occupational exposure to iron dust are excluded from consideration because of confounding exposures to silica, radon daughters, soot, asbestos, or other types of metals in the study populations (U.S. EPA, 1984; IARC, 1972, 1984, 1987).

A case-control study examined cancer incidence in a Swedish male worker population (1958-1971) with a high exposure to iron oxides from the production of sulfuric acid from pyrite (FeS_2) (Axelson and Sjöberg, 1979). The workers were exposed to iron oxide (Fe_2O_3) along with 1-2% copper, 0.01-0.1% arsenic, nickel and cobalt as impurities. Exposure in the workroom was estimated as approximately 50-100 mg/m^3, and the particle size as 25% below 10 : m and 5-10% below 5 : m. No cases of siderosis were known from the plant. The Swedish National Cancer Register was consulted for locating cases of cancer that could have been caused by environmental exposure; the study examined cancers of the stomach, liver, lung, kidney, and bladder, and hematological malignancies. Each cancer case was matched with two controls from the local population register by matching for sex, age, and residency in the same or adjacent neighborhood block. Company files were searched to determine the length of exposure; those with less than 5 months of exposure were considered to be nonexposed. The study found no association between exposure to iron oxides and any of the selected types of cancer.

Animal Studies

Oral Exposure

Groups of F344 rats (50 per sex per group) were given ferric chloride ($FeCl_3 \cdot 6H_2O$) in drinking water at concentrations of 0, 0.25, or 0.5% (weight/volume) for 104 weeks, and then given distilled water for an 8 week recovery period (Sato et al., 1992). The intake of ferric chloride was reported to be 0, 169.7, or 319.7 mg/kg-day for males and 0, 187.9, or 336.0 mg/kg-day for females. The iron intakes were 0, 58.4, or 110 mg/kg-day in males and 0, 64.6, or 115.6 mg/kg-day in females. Rats were observed daily for clinical signs and mortality. Body weights were measured once a week for 13 weeks and every fourth week thereafter. All rats dying prematurely and survivors at week 112 were examined for gross and microscopic neoplastic and non-neoplastic lesions. There were dose-related decreases in drinking water intake and

terminal body weight in both sexes. These may have been related to reduced palatability. Survival in both sexes was not significantly affected by exposure to ferric chloride. No increases in tumor incidence were observed in rats exposed to ferric chloride for two years.

Inhalation Exposure

Groups of male Syrian hamsters (132 per group) were exposed to filtered air or Fe_2O_3 (analytic grade) dust at a concentration of 40 mg/m^3, 6 hours/day, 5 days/week for life (Nettesheim et al., 1975). The particle size had a geometric mean diameter of 0.11 : m. In addition, two satellite groups (15 hamsters per treatment) were sacrificed, three animals at a time, at 2, 4, 8, 12, and 104 weeks, so that the accumulation of iron in the lung from inhaled Fe_2O_3 could be compared to background iron concentrations in heme. The animals were examined daily, before and after each exposure, for clinical signs; body weights were recorded monthly. All animals except those cannibalized (<2%) were necropsied. Histological analyses were performed for the major organs, including heart, trachea, lungs, and nasal cavities. Examination of the satellite groups demonstrated a gradual increase in iron accumulation in the lung, reaching a total of 10 mg per lung at 104 weeks. Exposure to Fe_2O_3 had no effect on survival or body weight gain and did not increase the incidence of tumors. The authors concluded that inhalation of Fe_2O_3 was not carcinogenic to hamsters.

Groups of Syrian golden hamsters (24 per sex per group) received intratracheal instillations of 0 or 3 mg[1] of Fe_2O_3 dust in 0.2 ml of saline once a week for 15 weeks, and then were observed up to week 120 (Stenbäck et al., 1976). Analysis by the sedimentation method demonstrated that 98% of the particles were less than 10 : m in diameter. Animals were weighed weekly and autopsied. Organs with gross lesions and the larynx, trachea, bronchi, and lungs were examined histologically. Treatment with ferric oxide had no effect on survival and did not affect body weight except during the final weeks of survival (data not shown). Treatment did not induce tumors of the respiratory tract and the incidence of forestomach papillomas in the treatment group was less than in the control group.

Other Studies

Genotoxicity

Genotoxicity assays of inorganic iron salts were primarily negative in bacteria, but were more often positive in mammalian systems. Iron did not induce reverse mutations in *Salmonella typhimurium* strains TA98, TA102, TA1535, or TA1537, with or without activation (Wong, 1988). Ferric chloride and ferrous sulfate tested negative in strains TA98, TA100, TA1535, TA1537, and TA1538 with or without metabolic activation (Shimizu et al., 1985; Dunkel et al., 1999). Ferrous sulfate also tested negative in strains TA97 and TA102, with or without activation (Fujita et al., 1994), but positive in TA1537 and TA1538 (U.S. EPA, 1984). Ferrous and ferric chloride did not induce DNA repair in *Bacillus subtilis* (rec assay) (Leifer et al., 1981). Ferrous sulfate increased the frequency of mutations at the TK locus of mouse L5178Y lymphoma cells, with or without metabolic activation, but only at high concentrations; ferric chloride only increased the frequency of TK mutations when tested with metabolic activation (Dunkel et al., 1999). Ferrous sulfate did not induce sister chromatid exchanges *in vitro* (Ohno et al., 1982). DNA-protein cross-links were generated in mammalian cells cultured in the presence of ferrous iron (Altman et al., 1995). Single- and double-strand DNA breaks were produced in supercoiled plasmid DNA (Toyokuni and Sagripanti, 1992) and in isolated rat liver nuclei (U.S. EPA, 1984) treated with ferrous or ferric chloride. No breakage was detected electrophoretically in Chinese hamster ovary cell DNA treated with ferrous chloride (U.S. EPA, 1984). In a model of oxidative damage within cells, ferrous sulfate, in the presence of hydrogen peroxide, was

---

[1]The authors characterized the treatment as a 'maximum dose of 3 mg'. It is not clear whether the hamsters received lower doses on some occasions.

demonstrated to induce double-strand breaks and intra-strand cross-links in DNA *in vitro* (Lloyd and Phillips, 1999).

Cell transformation

Iron compounds have yielded variable results in studies of cell transformation *in vitro*. Particles of magnetite (Fe_3O_4) induced transformation of cultured a Chinese hamster lung cell line (V_{79}), but only at cytotoxic concentrations (Elias et al., 1995). Ferrous chloride and ferrous sulfate induced cell transformation in viral-enhanced Syrian hamster embryo (SA7/SHE) cells (U.S. EPA, 1984).

Mechanistic Studies

Adverse effects of iron are thought to be related to the formation of reactive oxygen species via the Fenton reaction (Henle and Linn, 1997). Hydrogen peroxide can react with ferrous ion, resulting in the conversion to ferric ion and the production of hydroxyl radicals. Ferric ion can also react with hydrogen peroxide, producing superoxide radical. Reactive oxygen species may react with DNA.

PROVISIONAL WEIGHT-OF-EVIDENCE CLASSIFICATION

U.S. EPA (1984) classified iron and its compounds, including ferric dextran, as a possible human carcinogens (Group C). This assessment was based on reports associating an increased incidence of lung cancer with exposure to hematite dust (confounded by coincident exposures to tobacco, alcohol, silica, soot, and fumes of other metals), inconsistent reports of lung tumors in animals exposed by inhalation or tracheal instillation to ferric oxide, and reports of injection site tumors in one patient injected with iron dextran and in mice injected with iron dextran or saccharated iron oxide. The current issue paper excludes organic forms of iron and studies in which the levels of impurities are significant.

Results of the case-control study by Bird et al. (1996) provide evidence of a weak association between elevated iron intake or high plasma ferritin (a measure of body stores) and the prevalence of adenomatous colorectal polyps, a possible precursor to colorectal cancer. Weaknesses of this study include the 6-month period between examination and ferritin measurements, and the possible recall errors affecting the dietary questionnaire for the previous year. Although the association between cirrhotic hereditary hemochromatosis and hepatocellular carcinoma is well established, the evidence for dietary iron intake and hepatic cancer in the general population was characterized by the NAS (2001) as inconclusive. In a chronic rat assay, Sato et al. (1992) found no evidence of carcinogenicity of ferric chloride ingested in drinking water at concentrations up to 0.5%. In summary, the evidence for carcinogenicity of ingested inorganic iron compounds in humans and animals appears to be inadequate.

Evidence from the case-control study of Axelson and Sjöberg (1979) suggests that inhaled iron oxide may not be carcinogenic to humans. However, uncertainty remains because levels of exposure were not measured, the durations of exposure were not reported, and individuals exposed for up to 5 months were categorized as 'nonexposed.' In addition, the lack of reported cases of siderosis in the workplace suggests that the exposure levels may have been lower than estimated. Thus, the evidence for carcinogenicity of inhaled iron oxide in humans is considered inadequate. Results of the study of Nettesheim et al. (1975) indicate that chronic inhalation exposure to iron oxide at a concentration of 40 mg/m^3 is not carcinogenic to hamsters. This finding is supported by the negative results for carcinogenicity of iron oxide administered by intratracheal instillation to hamsters for 15 weeks (Stenbäck et al., 1976). However, as both hamster studies used single exposure concentrations, the possibility of carcinogenicity at higher exposure levels cannot be disregarded.

Based on these data, and genotoxicity results that were primarily negative (albeit positive for DNA strand breaks in mammalian systems), iron and inorganic iron compounds are most appropriately placed in U.S. EPA (1986) Weight-of-Evidence Group D - not classifiable as to human carcinogenicity. Following the U.S. EPA (1996, 1999) proposed guidelines for carcinogen risk assessment, the available data are inadequate for an assessment of the human carcinogenic potential of inhaled iron oxide or ingested iron chloride.

QUANTITATIVE ESTIMATES OF CARCINOGENIC RISK

Derivation of quantitative estimates of cancer risk for ingested or inhaled iron or iron oxide is precluded by the absence of adequate data demonstrating carcinogenicity.

REFERENCES

ACGIH (American Conference of Government Industrial Hygienists). 1991. Iron Oxide, CAS: 1309-37-1. Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th Ed. ACGIH. Cincinnati, OH. p. 803-805.

ACGIH (American Conference of Government Industrial Hygienists). 2001. Threshold limit values (TLV) for chemical substances and physical agents and biological exposure indices. ACGIH, Cincinnati, OH. p. 36.

Altman, S.A., T.H. Zastawny, L. Randers-Eichhorn et al. 1995. Formation of DNA-protein cross-links in cultured mammalian cells upon treatment with iron ions. Free Radic. Biol. Med. 19: 897-902.

ATSDR (Agency for Toxic Substances and Disease Registry). 2001. Internet HazDat - Toxicological Profile Query. Examined September, 2001. Online at http://www.atsdr.cdc.gov/gsql/toxprof.script.

Axelson, O. and A. Sjöberg. 1979. Cancer incidence and exposure to iron oxide dust. J. Occup. Med. 21: 419-422.

Bird, C.L., J.S. Witte, M.E. Swendseid, et al. 1996. Plasma ferritin, iron intake, and the risk of colorectal polyps. Am. J. Epidemiol. 144: 34-41.

Dunkel, V.C., R.H. San, H.E. Seifried and P. Whittaker. 1999. Genotoxicity of iron compounds in *Salmonella typhimurium* and L5178Y mouse lymphoma cells. Environ. Molec. Mutagen. 33: 28-41.

Elias, Z., O. Poirot, O. Schneider et al. 1995. Cytotoxic and transforming effects of some iron-containing minerals in Syrian hamster embryo cells. Cancer Detect. Prevent. 19: 405-414.

Fujita, H., N. Aoki and M. Sasaki. 1994. Mutagenicity test of food additives with Salmonella typhimurium TA97 and TA102. IX. Tokyo-Toritsu Eisei Kenkyusho Kenkyu Nenpo. 45: 191-199.

Grimsley, L.F. 2001. Iron and cobalt. In: Patty's Toxicology, 5th Edition, vol. 3, E. Bingham, B. Cohrssen and C.H. Powell, Eds. John Wiley and Sons, New York. p. 169-193.

Henle, E.S. and S. Linn. 1997. Formation, prevention, and repair of DNA damage by iron/hydrogen peroxide. J. Biol. Chem. 272: 19095-19098.

IARC (International Agency for Research on Cancer). 1972. Haematite and iron oxide. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Vol. 1, pp. 29-39. Lyon, France.

IARC (International Agency for Research on Cancer). 1984. Iron and steel founding. Polynuclear Aromatic Compounds, Part 3, Industrial Exposures in Aluminium Production, Coal Gasification, Coke Production, and Iron and Steel Founding. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Vol. 34, pp. 133-190. Lyon, France.

IARC (International Agency for Research on Cancer). 1987. Haematite and ferric oxide. Overall Evaluations of Carcinogenicity: An Updating of *IARC Monographs* Volumes 1 to 42. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Suppl. 7, pp. 216-219. Lyon, France.

Leifer, Z., T. Kada, M. Mandel et al. 1981. An evaluation oftests using DNA repair-deficient bacteria fro predicting genotoxicity and carcinogenicity. A report of the U.S. EPA's Gene-Tox program. Mutat. Res. 87: 211-297.

Lloyd, D.R. and D.H. Phillips. 1999. Oxidative DNA damage mediated by copper(II), iron(II) and nickel(II) Fenton reactions: evidence for site-specific mechanisms in the formation of double-strand breaks, 8-hydroxydeoxyguanosine and putative intrastrand cross-links. Mutat. Res. 424: 23-36.

NAS (National Academy of Sciences). 2001. Iron. In: Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Institute of Medicine, Food and Nutrition Board. National Academy Press, Washington, DC. p. 233-310. Online at: http://books.nap.edu/books/0309072794/html/.

Nettesheim, P., D.A. Creasia and T.J. Mitchell. 1975. Carcinogenic and cocarcinogenic effects of inhaled synthetic smog and ferric oxide particles. J. Natl. Cancer Inst. 55: 159-169.

NTP (National Toxicology Program). 2001a. Status Report for Ferric Chloride. Examined September, 2001. Online at: http://ntp-server.niehs.nih.gov/htdocs/Results_Status/Resstatf/7705080.Html.

NTP (National Toxicology Program). 2001b. NTP Chemical Repository Report for Ferric Chloride. Examined September, 2001. Online at: http://ntp-server.niehs.nih.gov/htdocs/CHEM_H&S/NTP_Chem7/Radian7705-08-0.html.

Ohno, H., F. Hanaoka and M.A. Yamada. 1982. Inducibility of sister-chromatid exchanges by heavy-metal ions. Mutat. Res. 104: 141-145.

Sato, M., F. Furukawa, K. Toyoda et al. 1992. Lack of carcinogenicity of ferric chloride in F344 rats. Food Chem. Toxicol. 30: 837-842.

Shimizu, H., Y. Suzuki, N. Takemura et al. 1985. Results of microbial mutation test for forty-three industrial chemicals. Sangyo Igaku. 27: 400-419.

Stenbäck, F., J. Rowland and A. Sellakumar. 1976. Carcinogenicity of benzyo(a)pyrene and dusts in the hamster lung (instilled intratracheally with titanium oxide, aluminum oxide, carbon and ferric oxide. Oncology. 33: 29-34.

Toyokuni, S. and Sagripanti, J.L. 1992. Iron-mediated DNA damage: sensitive detection of DNA strand breakage catalyzed by iron. J. Inorg. Biochem. 47: 241-248.

U.S. EPA. 1984. Health Effects Assessment for Iron (and Compounds). Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Emergency and Remedial Response, Washington, DC. EPA 540/1-86-054.

U.S. EPA. 1986. Guidelines for Carcinogen Risk Assessment. September 24, 1986. Fed. Reg. 51 (185): 33992-34003.

U.S. EPA. 1991. Chemical Assessments and Related Activities. Office of Health and Environmental Assessment, Washington, DC. April, 1991. OHEA-I-127.

U.S. EPA. 1994. Chemical Assessments and Related Activities. Office of Health and Environmental Assessment, Washington, DC. December, 1994. OHEA-I-127.

U.S. EPA. 1995. Quarterly Status Report of RfD/RfC Work Group (as of 9/01/95). Office of Research and Development. National Center for Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1996. Proposed Guidelines for Carcinogen Risk Assessment. Federal Register. 61:17960-18011.

U.S. EPA. 1997. Health Effects Assessment Summary Tables. Annual Update. FY-1997. Prepared by the National Center for Environmental Assessment, Cincinnati, OH, for the Office of Research and Development, Office of Emergency and Remedial Response, Washington, D.C. July 1997. EPA-540-R-97-036. PB97-921199.

U.S. EPA. 1999. Guidelines for Carcinogen Risk Assessment. Review Draft. Risk Assessment Forum, Washington, DC. July, 1999. NCEA-F-0644.

U.S. EPA. 2000. Drinking Water Standards and Health Advisories. Office of Water, Washington, DC. Summer, 2000. EPA 822-B-00-001. Examined September, 2001. http://www.epa.gov/ost/drinking/standards/dwstandards.pdf

U.S. EPA. 2001. Substance index. Integrated Risk Information System (IRIS). Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. Examined September, 2001. Online at http://www.epa.gov/iris/subst/index.html.

WHO (World Health Organization). 2001. Online catalogs for the Environmental Health Criteria series. Examined September, 2001. Online at http://www.who.int/dsa/cat97/zehc.htm and http://www.who.int/dsa/justpub/add.htm.

Wong, P.K. 1988. Mutagenicity of heavy metals. Bull. Environ. Contam. Toixicol. 40: 597-603.

Attachment 5

SRC SF 01-021b/11-14-01

Risk Assessment Issue Paper for:
Feasibility of Deriving a Provisional RfC for
Iron (CASRN 7439-89-6)and Compounds

INTRODUCTION

An RfC for iron is not listed on IRIS (U.S. EPA, 2001) and was not considered by the RfD/RfC Work Group (U.S. EPA, 1995). The HEAST (U.S. EPA, 1997) reported that data regarding iron were inadequate for quantitative risk assessment. The CARA list (1991, 1994a) includes a Health Effects Assessment for Iron and Compounds (U.S. EPA, 1984) that reported negative epidemiological studies (no association between excess mortality or respiratory diseases and occupational exposure to iron oxide dusts) and no available subchronic or chronic inhalation studies in animals.

Occupational exposure limits have been established for soluble iron salts and iron oxide, as well as for organic iron compounds not covered in this issue paper. The ACGIH (1991a, 2001) has adopted a TLV-TWA, NIOSH (2001a) has established a REL-TWA, and OSHA (2001a, 2001b) has adopted a construction industry PEL-TWA of 1 mg/m^3, as Fe, to reduce the likelihood of irritation to eyes, skin, and respiratory tract from exposure to aerosols or mists of soluble iron salts (ferrous and ferric sulfates and chlorides, and ferric nitrate). The ACGIH (1991b, 2001) has adopted a TLV-TWA and NIOSH (2001b) has established a REL-TWA of 5 mg/m^3, as Fe, for dust and fume of ferric oxide (Fe_2O_3) to protect against siderosis, a benign pneumoconiosis. OSHA (2001c) has adopted a PEL-TWA of 10 mg/m^3 for ferric oxide fume, to protect against accumulation of iron dust in the lungs.

Iron has not been the subject of a toxicological profile by ATSDR (2001) or the WHO (2001). Monographs by IARC (1972, 1984, 1987), a toxicity review on iron (Grimsley, 2001), and the NTP (2001a, 2001b) management status report and chemical repository summary were consulted for information relevant to inhalation toxicity of iron and inorganic iron compounds. The following computer searches, performed in April, 1993, were screened to identify additional pertinent studies not discussed in review documents: TOXLINE (1983-April, 1993), CANCERLIT (1990 - April, 1993), MEDLINE (1991 - April, 1993), TSCATS, RTECS, and HSDB. Update literature searches were conducted in September, 2001 in TOXLINE (1992-September, 2001), CANCERLIT (1992- September, 2001), MEDLINE (1992-September, 2001), TSCATS, RTECS, DART/ETICBACK, EMIC/EMICBACK, HSDB, GENETOX, and CCRIS.

REVIEW OF PERTINENT LITERATURE

Human Studies

A number of studies have examined the relationship between respiratory disease and inhalation exposure to iron compounds for workers employed in hematite mining or other iron-related occupations, such as welding or steel-making (U.S. EPA, 1984; IARC, 1972, 1984; Grimsley, 2001). However, since these studies involved concurrent exposure to silica and other metals, they are not suitable for the health risk assessment of iron or iron compounds. The literature search did not discover any studies that examined subchronic or chronic inhalation exposures of humans to quantified levels of iron or iron compounds alone.

In a case-control study of cancer incidence, a Swedish male worker population (1958-1971) was reported to have had a high exposure to iron oxides from the production of sulfuric acid from pyrite (FeS_2)

(Axelson and Sjöberg, 1979). The workers were exposed to iron oxide (Fe_2O_3) along with 1-2% copper, 0.01-0.1% arsenic, nickel and cobalt as impurities. Exposure in the workroom was estimated as approximately 50-100 mg/m^3, and the particle size as 25% below 10 : m and 5-10% below 5 : m. However, there were no measurements of exposure levels or particle size, and exposure durations were not reported. No cases of siderosis were known from the plant.

Animal Studies

Inhalation studies for iron compounds in animals include a chronic study of hamsters exposed to ferric oxide (Fe_2O_3) dust (Nettesheim et al., 1975) and a 2-month study in rabbits exposed to aerosols of ferric chloride (Johansson et al., 1992).

In a cancer study, groups of male Syrian hamsters (132 per group) were exposed to filtered air or Fe_2O_3 (analytic grade) dust at a concentration of 40 mg/m^3, 6 hours/day, 5 days/week for life (Nettesheim et al., 1975). The particle size had a geometric mean diameter of 0.11 : m. In addition, two satellite groups (15 hamsters per treatment) were sacrificed, three animals at a time, at 2, 4, 8, 12, and 104 weeks, so that the accumulation of iron in the lung from inhaled Fe_2O_3 could be compared to background iron concentrations in heme. The animals were examined daily, before and after each exposure, for clinical signs, and body weights were recorded monthly. All animals except those cannibalized (<2%) were necropsied. Histological analyses were performed on the major organs, including heart, trachea, lungs, and nasal cavities. Examination of the satellite groups demonstrated the gradual increase in iron accumulation in the lung, reaching a total of 10 mg per lung at 104 weeks. Histological examination revealed iron deposits in the lungs and tracheal and bronchial lymph nodes of all exposed animals. Diffuse and focal alveolar fibrosis was also frequently observed in the lungs of treated animals. Results for the histological endpoints were not reported quantitatively. In this study, 40 mg/m^3 is a LOAEL for respiratory effects (alveolar fibrosis) in hamsters exposed to Fe_2O_3 dust.

Groups of 8 male rabbits (strain not reported) were exposed to aerosols of 0, 1.4, or 3.1 mg/m^3 of iron as $FeCl_3$ 6 hours/day, 5 days/week for 2 months (Johansson et al., 1992). At termination, the upper left lung lobe was examined by light microscopy, pieces of the lower left lung were analyzed by electron microscopy or used for phospholipid analysis, and the right lung was lavaged to obtain macrophages for morphological and functional analyses. The mass median aerodynamic diameter of the aerosols was ~1 : m as measured with an impactor. Treatment had no effect on survival. Lungs were spotted with black in 7/8 high-iron rabbits, in 2/8 low-iron rabbits, and in 0/8 controls. The absolute weight of the left lower lobe of the lung was significantly elevated compared to controls in the high-iron group. Exposure-related histopathology was observed in the lungs. In the high-exposure group, the lungs contained naked granulomas [large nodules ($1 mm) of densely packed granular macrophages], accumulations of granular macrophages in terminal bronchioles, and foci of interstitial lymphocytic inflammatory reaction. Small granulomas were observed in one low-iron and one control rabbit. Accumulations of normal and granular macrophages were observed in the alveoli of exposed rabbits. In the control group, normal lung tissue contained some small accumulations of macrophages with occasional small inflammatory reaction. The high exposure group had a significantly higher density of alveolar type II cells than the controls. Ultrastructural analysis of macrophages showed a significantly higher number of abnormal cells, cells with enlarged lysosomes, and black inclusions in cells in both exposed groups; the high-iron group had higher percentages of cells with laminar inclusions or with smooth cell surfaces. In functional tests, macrophages from the high-exposure group showed significantly elevated phagocytic activity, but no significant increase in oxidative metabolic activity (superoxide generation). Total phospholipids were elevated in the high-exposure group, but, as indicated by the lack of increase in phosphatidyl cholines or the percentage of 1,2-dipalmitoylphosphatidylcholine, the amount of surfactant was unchanged. In this study, the low concentration of 1.4 mg/m^3 is a NOAEL and the high concentration of 3.1 mg/m^3 is a LOAEL for adverse lung effects (nodular granulomas $1 mm in diameter, abnormal macrophages) in rabbits exposed to ferric chloride aerosols. Because of its focus on alveolar

macrophage effects, this study provided no information regarding clinical signs of toxicity, body weight changes, clinical biochemistry, nasopharyngeal effects or histology of any other tissue besides the lung.

Other Studies

In a cancer study, groups of Syrian golden hamsters (24 per sex per group) received intratracheal instillations of 0 or "a maximum dose"[2] of 3 mg of Fe_2O_3 dust in 0.2 ml of saline once a week for 15 weeks, and then were observed up to week 120 (Stenbäck et al., 1976). Analysis by the sedimentation method demonstrated that 98% of the particles were less than 10 : m in diameter. Animals were weighed weekly and autopsied. Organs with gross lesions and the larynx, trachea, bronchi, and lungs were examined histologically. Treatment with ferric oxide had no effect on survival and no effect on body weight except during the final weeks of survival (data not shown). Deposited iron oxide was grossly visible as dark patches on the lung surface. Histologically, dust accumulations surrounded by cellular infiltrates were observed in the peribronchial region. Interstitial fibrosis was observed occasionally, but distinct inflammatory changes were rare. Results for the nonneoplastic endpoints were not reported quantitatively.

FEASIBILITY OF DERIVING A PROVISIONAL RfC FOR IRON

No adequate human or animal inhalation data are available for exposure to iron or inorganic iron compounds. The epidemiological study of Axelson and Sjöberg (1979) did not provide quantitative measures of exposure and did not characterize noncancer endpoints. Although Nettesheim et al. (1975) reported diffuse and focal alveolar fibrosis in the lungs of hamsters chronically exposed to iron oxide by inhalation at a concentration of 40 mg/m^3, the lack of incidence data prevents an evaluation of the significance of these findings. The subchronic study of Johansson et al. (1992), in which rabbits were exposed to aerosols of ferric chloride for 2 months, demonstrated a NOAEL of 1.4 mg/m^3 and a LOAEL of 3.1 mg/m^3 for respiratory effects (granuloma nodules greater than 1 mm diameter in the lungs). However, this study does not meet the minimum standards for an inhalation bioassay as stipulated by the U.S. EPA (1994b) guidelines for derivation of an inhalation reference concentration. Inadequacies of the study include relatively small group sizes, relatively short study duration, and the failure to examine a sufficient array of endpoints. Thus this study is inadequate for the purposes of deriving an RfC for iron.

---

[2]The authors provided no further information regarding dosage. It is not clear whether animals were given amounts lower than 3 mg on some occasions.

REFERENCES

ACGIH (American Conference of Government Industrial Hygienists). 1991a. Iron Salts (Soluble). Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th Ed. ACGIH. Cincinnati, OH. p. 808-809.

ACGIH (American Conference of Government Industrial Hygienists). 1991b. Iron Oxide, CAS: 1309-37-1. Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th Ed. ACGIH. Cincinnati, OH. p. 803-805.

ACGIH (American Conference of Government Industrial Hygienists). 2001. Threshold limit values (TLV) for chemical substances and physical agents and biological exposure indices. ACGIH, Cincinnati, OH. p. 36.

ATSDR (Agency for Toxic Substances and Disease Registry). 2001. Internet HazDat - Toxicological Profile Query. Examined September, 2001. Online at http://www.atsdr.cdc.gov/gsql/toxprof.script.

Axelson, O. and A. Sjöberg. 1979. Cancer incidence and exposure to iron oxide dust. J. Occup. Med. 21: 419-422.

Grimsley, L.F. 2001. Iron and cobalt. In: Patty's Toxicology, 5th Edition, vol. 3, E. Bingham, B. Cohrssen and C.H. Powell, Eds. John Wiley and Sons, New York. p. 169-193.

IARC (International Agency for Research on Cancer). 1972. Haematite and iron oxide. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Vol. 1, pp. 29-39. Lyon, France.

IARC (International Agency for Research on Cancer). 1984. Iron and steel founding. Polynuclear Aromatic Compounds, Part 3, Industrial Exposures in Aluminium Production, Coal Gasification, Coke Production, and Iron and Steel Founding. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Vol. 34, pp. 133-190. Lyon, France.

IARC (International Agency for Research on Cancer). 1987. Haematite and ferric oxide. Overall Evaluations of Carcinogenicity: An Updating of *IARC Monographs* Volumes 1 to 42. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Suppl. 7, pp. 216-219. Lyon, France.

Johansson, A., T. Curstedt, O. Rasool et al. 1992. Macrophage reaction in rabbit lung following inhalation of iron chloride. Environ. Res. 58: 66-79.

Nettesheim, P., D.A. Creasia and T.J. Mitchell. 1975. Carcinogenic and cocarcinogenic effects of inhaled synthetic smog and ferric oxide particles. J. Natl. Cancer Inst. 55: 159-169.

NIOSH (National Institute for Occupational Safety and Health). 2001a. Iron salts (soluble, as Fe). NIOSH Pocket Guide to Chemical Hazards. September, 2001. Online at http://www.cdc.gov/niosh/npg/npgd0346.html.

NIOSH (National Institute for Occupational Safety and Health). 2001b. Rouge (Fe_2O_3), CAS 1309-37-1. NIOSH Pocket Guide to Chemical Hazards. September, 2001. Online at http://www.cdc.gov/niosh/npg/npgd0549.html.

NTP (National Toxicology Program). 2001a. Status Report for Ferric Chloride. Examined September, 2001. Online at: http://ntp-server.niehs.nih.gov/htdocs/Results_Status/Resstatf/7705080.Html.

NTP (National Toxicology Program). 2001b. NTP Chemical Repository Report for Ferric Chloride. Examined September, 2001. Online at: http://ntp-server.niehs.nih.gov/htdocs/CHEM_H&S/NTP_Chem7/Radian7705-08-0.html.

OSHA (Occupational Safety and Health Administration). 2001a. OSHA Preambles. Air Contaminants (29 CFR 1910). VI. Health Effects Discussion and Determination of Final PEL. Examined September, 2001. Online at http://www.osha-slc.gov/Preamble/AirCont_data/AIRCON6.html.

OSHA (Occupational Safety and Health Administration). 2001b. Iron Salts, Soluble (as Fe). Chemical Sampling Information. Revision dated January 15, 1993. Examined September, 2001. Online at http://www.osha-slc.gov/dts/chemicalsampling/data/CH_247600.html.

OSHA (Occupational Safety and Health Administration). 2001c. Iron Oxide Fume. Chemical Sampling Information. Revision dated January 11, 1999. Examined September, 2001. Online at http://www.osha-slc.gov/dts/chemicalsampling/data/CH_247400.html.

Stenbäck, F., J. Rowland and A. Sellakumar. 1976. Carcinogenicity of benzyo(a)pyrene and dusts in the hamster lung (instilled intratracheally with titanium oxide, aluminum oxide, carbon and ferric oxide. Oncology. 33: 29-34.

U.S. EPA. 1984. Health Effects Assessment for Iron (and Compounds). Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Emergency and Remedial Response, Washington, DC. EPA 540/1-86-054.

U.S. EPA. 1991. Chemical Assessments and Related Activities. Office of Health and Environmental Assessment, Washington, DC. April, 1991. OHEA-I-127.

U.S. EPA. 1994a. Chemical Assessments and Related Activities. Office of Health and Environmental Assessment, Washington, DC. December, 1994. OHEA-I-127.

U.S. EPA. 1994b. Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry. Office of Research and Development, Washington, D.C. October, 1994. EPA/600/8-90/066F.

U.S. EPA. 1995. Quarterly Status Report of RfD/RfC Work Group (as of 9/01/95). Office of Research and Development. National Center for Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1997. Health Effects Assessment Summary Tables. Annual Update. FY-1997. Prepared by the National Center for Environmental Assessment, Cincinnati, OH, for the Office of Research and Development, Office of Emergency and Remedial Response, Washington, D.C. July 1997. EPA-540-R-97-036. PB97-921199.

U.S. EPA. 2001. Substance index. Integrated Risk Information System (IRIS). Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. Examined September, 2001. Online at http://www.epa.gov/iris/subst/index.html.

WHO (World Health Organization). 2001. Online catalogs for the Environmental Health Criteria series. Examined September, 2001. Online at http://www.who.int/dsa/cat97/zehc.htm and http://www.who.int/dsa/justpub/add.htm.

Attachment 6

SRC SF 01-021a/11-14-01

Risk Assessment Issue Paper for:
Derivation of the Provisional RfD for Iron (CASRN 7439-89-6) and Compounds

INTRODUCTION

An RfD for iron is not available on IRIS (U.S. EPA, 2001) or the Drinking Water Standards and Health Advisories list (U.S. EPA, 2000), and was not discussed by the RfD/RfC Work Group (U.S. EPA, 1995). The HEAST (U.S. EPA, 1997) reported that data regarding iron were inadequate for quantitative risk assessment. The CARA list (1991, 1994) includes a Health Effects Assessment for Iron and Compounds (U.S. EPA, 1984) that found no reliable quantitative oral toxicity data. Iron has not been the subject of a toxicological review by ATSDR (2001) or the WHO (2001). Monographs by IARC (1972, 1987), toxicity reviews by Jacobs (1977), Bothwell et al. (1979), Lauffer (1991), and Grimsley (2001), a review on dietary iron by the NAS (2001), and the NTP (2001a, 2001b) management status report and chemical repository summary were consulted for relevant information. The following computer searches, performed in April, 1993, were screened to identify additional pertinent studies not discussed in review documents: TOXLINE (oral and inhalation toxicity and cancer from 1983-April, 1993), CANCERLIT (1990 - April, 1993), MEDLINE (1991 - April, 1993), TSCATS, RTECS, and HSDB. Update literature searches were conducted in September, 2001 in TOXLINE (1992-September, 2001), CANCERLIT (1992- September, 2001), MEDLINE (1992-September, 2001), TSCATS, RTECS, DART/ETICBACK, EMIC/EMICBACK, HSDB, GENETOX, and CCRIS.

Iron is an essential element, and deriving a risk assessment value for such chemicals poses a special problem in that the dose adversity curve is "U-shaped." Thus, the risk value must be protective against deficiency as well as toxicity. The NAS (2001) has established guidelines for iron intake that take into account physiological differences during different life stages (the following values per kg use the specified reference body weights). For non-breast-fed infants aged 0-6 months, the NAS (2001) established a daily adequate intake (AI) for iron of 0.27 mg/day (0.04 mg/kg-day for infants 2-6 months old) based on the daily amount of iron secreted in human milk; breast-fed infants typically receive only 0.15 to 0.3 mg Fe/day. The NAS (2001) Recommended Dietary Allowances (RDAs) for children are as follows: 11 mg/day (1.2 mg/kg-day) for infants between the ages of 7 and 12 months, 7 mg/day (0.54 mg/kg-day) for children aged 1-3 years, 10 mg/day (0.45 mg/kg-day) for ages 4-8 years, 8 mg/day (0.2 mg/kg-day) for ages 9-13 years, and 11 mg/day (0.17 mg/kg-day) for boys and 15 mg/day (0.26 mg/kg-day) for girls aged 14-18 years. The RDA for men aged 19 years and above is 8 mg/day (0.11 mg/kg-day). The RDA for non-pregnant women is 18 mg/day (0.29 mg/kg-day) for ages between 19 and 50 years and 8 mg/day (0.13 mg/kg-day) for ages 51 years and older. The RDA for pregnant women is 27 mg/day (0.37 mg/kg-day for those aged 14-18 years and 0.35 mg/kg-day for those aged 19-50 years). The RDA during lactation is 10 mg/day (0.18 mg/kg-day) for women aged 14-18 years and 9 mg/day (0.15 mg/kg-day) for women aged 19-50 years.

In humans and other animals, levels in the body are regulated primarily through changes in the amount of iron absorbed by the gastrointestinal mucosa. The absorption of dietary iron is influenced by body stores, by the amount and chemical nature of iron in ingested food, and by a variety of dietary factors that increase or decrease the availability of iron for absorption. However, excessive accumulation of iron in the body resulting from chronic ingestion of high levels of iron cannot be prevented by intestinal regulation of absorption, nor do humans have a mechanism to increase excretion of absorbed iron in response to elevated

body levels (NAS, 1989, 2001). Below are summaries of selected epidemiological and medical studies, and of available toxicity studies in animals exposed to iron and inorganic compounds.

REVIEW OF PERTINENT LITERATURE

Human Studies

While chronic iron toxicity occurs in people with genetic metabolic disorders resulting in excessive iron absorption, with abnormal hemoglobin synthesis, or who receive frequent blood transfusions (Jacobs, 1977; Bothwell et al., 1979), there is a long-standing controversy as to whether a chronic overload due to oral intake is possible in individuals with a normal ability to control iron absorption (Hillman and Finch, 1985). Nevertheless, "the cumulative experience in human subjects suffering from iron overload of various etiologies strongly suggests that iron is noxious to tissues [when]...present in parenchymal cells...for a sufficiently long period of time" (Bothwell et al., 1979).

Looker et al. (1988) made comparisons of dietary iron intake and biochemical indices of iron status based on values taken from the second National Health and Nutrition Examination Survey (NHANES II) data base[3]. NHANES II was a probability sample of the noninstitutionalized U.S. population aged 6 months to 74 years, conducted between 1976 and 1980 by the National Center for Health Statistics. These data suggest that normal intake of iron by men 16-74 years old exceeds the RDAs, and that iron intake is somewhat lower than the RDA for women younger than 51 years. Concomitant with the study of dietary intake, the NHANES II measured the iron status of these populations. The serum ferritin levels, which index total body iron stores, ranged from 23.8 Fg/L, for premenopausal women not using iron supplements, to 105.6 Fg/L for 45- to 64-year-old supplement users. These values are well within the normal range of 12-300 Fg/L (Cook, 1991). (From Taber's Medical Dictionary, ferritin is the form in which iron is stored in the tissues, principally in the reticuloendothelial cells of the liver, spleen, and bone marrow. [It is] an iron-phosphorus-protein complex containing about 23% iron.) The percent serum transferrin saturation, a measure of the residual capacity of the iron transport system to process potential variations in iron from dietary intake or catabolized body stores, ranged from 23.9% saturation for pre- and post-menopausal women not using iron supplements, to 28.9% saturation for male supplement users in the 25- to 44- and 65- to 75-year-old groups. These values are also within the normal range (20-40%), establishing that the intake levels of 0.15-0.27 mg/kg-day consumed by these groups are both sufficient to protect against iron deficiency and insufficient to cause the toxic effects of iron overload (Elinder, 1986; Cook, 1991; Hillman and Finch, 1985). Therefore, 0.15-0.27 mg/kg-day represents a NOEL for chronic dietary iron intake.

Hemosiderosis (or siderosis) and iron overload are increases in tissue iron or a general increase in iron stores without associated tissue damage (Bothwell et al., 1979; Jacobs, 1977). Hemochromatosis describes massive iron overload (15 g of body iron stores or greater) together with cirrhosis and/or other tissue damage attributable to iron. Although focal deposits of iron may occur in any part of the body where red cells are extravasated, the clinical syndrome of hemochromatosis typically involves damage to the

---

[3] The latest version of this data base, NHANES III (1984-1988) evaluated 30,000 subjects aged 2 months and above (NAS, 2001). Despite minor differences in the data sets, the conclusions drawn by Looker et al. (1988) based on NHANES II appear to be valid for the NHANES III data.

hepatic parenchyma (particularly fibrosis), heart (cardiac dysfunction including failure) and endocrine glands (particularly hypogonadism). Pancreatic iron deposition is common, and massive deposits may be associated with fibrosis and diabetes. A number of studies involving chronic oral administration of iron to animals have been designed in an attempt to identify an animal model for hemochromatosis. Most of these studies have been negative (Bothwell et al., 1979; NRC, 1979). Animal studies involving parenteral administration of iron have been generally negative as well, even though parenteral routes bypass the mechanisms that regulate absorption of iron from the gastrointestinal tract.

Chronic iron toxicity has been observed in people with idiopathic hemochromatosis (a genetic metabolic disorder resulting in excessive iron absorption), abnormalities of hemoglobin synthesis (e.g., thalassemia) or various anemic states (e.g., sideroblastic anemia), frequent blood transfusions or a combination of these conditions (Jacobs, 1977; Bothwell et al., 1979). Chronic hemochromatosis has also occurred among the South African Bantu population from an excessive intake of absorbable iron in an alcoholic beverage.

Habitual excessive intake of iron by the Bantus is attributed to consumption of home-brewed Kaffir beer, which was contaminated by iron vessels during brewing (Bothwell and Bradlow, 1960; Bothwell et al., 1964). The beer's high acidity (pH 3-3.5) enhanced iron leaching from the vessels. The iron in the beer is readily assimilable (i.e., ionizable) due to the acidity and presence of iron-complexing ligands such as fructose, and is absorbed to approximately the same degree as ferric chloride. The alcohol content of the beer is also believed to contribute to the bioavailability of the iron (Jacobs, 1977; Finch and Monsen, 1972). Based primarily on drinking habits and analyses of beer samples, the estimated average dietary iron intake of the Bantu men ranged from 50-100 mg/day from beer alone (Bothwell et al., 1964). Using a reference body weight of 70 kg (U.S. EPA, 1987), this range corresponds to 0.7-1.4 mg/kg-day. Histological examinations of the liver of 147 Bantus (129 male, 18 female), ranging in age from 11-70 years (most were between 20 and 50 years old) that died from acute traumatic causes, were performed (Bothwell and Bradlow, 1960). Varying degrees of hepatic siderosis were observed in 89% of the cases; the degree tended to increase with age 40-50 years or less. The siderosis was mild in 59%, and severe in 19% of the cases, respectively. There was a close correlation between hepatic iron concentration and portal fibrosis and cirrhosis. Although the overall prevalence was low (15.6% fibrosis and 1.4% cirrhosis), all 11 subjects with the highest iron concentrations (>2.0% dry weight of liver) showed either fibrosis or cirrhosis. Histological examination of the spleen (50 subjects) also showed siderosis and unspecified histological changes. Malnutrition and alcoholism could have played a role in the etiology of the hepatic and splenic siderosis in the Bantus.

Hemosiderosis of the skin and liver with cirrhotic changes, accompanied by a serum iron level of 246 Fg/100 mL and 100% saturation of transferrin, also developed in a 60-year-old female patient who ingested approximately 12,000 g of elemental iron (as 12 g ferrous carbonate/day or 2 g ferrous gluconate/day) for 27 years (Turnberg, 1965). Assuming a mean body weight of 64 kg for a woman 33-60 years old, 12 kg iron 365 days/year for 27 years averages to approximately 19 mg/kg-day. Using an estimated intake of 0.17 mg iron/kg-day for dietary iron, the total intake of iron was approximately 19.2 mg/kg-day. The author noted that the patient was not anemic during the treatment period, was absorbing iron at a normal rate, had no history of hepatitis (a potential complication in people with iron overload following repeated transfusion) and did not consume alcohol. It was concluded that the prolonged high iron intake was the sole origin of the clinical picture of hemochromatosis.

Ethiopia reportedly has the highest per capita iron intake in the world, with an average daily intake of 471 mg iron/day (range 98-1418 mg/day; 1.4-20.3 mg iron/kg-day assuming 70 kg body weight) (Roe, 1966; Hofvander, 1968). Increased stored iron in the liver and adverse health effects have not been observed due to low bioavailability of the iron in Ethiopian food.

A study in Eastern Finnish men suggested that high serum ferritin concentration and high dietary iron intake are risk factors for myocardial infarction (Salonen et al., 1992). Of the 1,931 randomly selected men aged 42-60 years who had no history of coronary heart disease upon entry to the study, 51 experienced an acute myocardial infarction during the average 3-year follow-up. After adjusting via Cox proportional hazards model for age and examination year, cigarette-pack years, ischemic ECG in exercise test, oxygen uptake, systolic blood pressure, blood glucose, serum copper, blood leukocyte count, and concentrations of serum high density lipoprotein cholesterol, apolipoprotein B, and triglyceride, those having serum ferritin at levels $ 200 Fg/L (median value for healthy adult men is 69-140 Fg/L) showed increased risk ($p<0.01$) of myocardial infarction compared to those with lower serum ferritin. Use of the same model and covariates indicated dietary iron intake was also significantly ($p<0.05$) associated with disease risk; consumption of red meat had the strongest correlation of all foods with serum ferritin concentration ($r=0.059$). High serum low density lipoprotein (LDL) cholesterol concentrations (≥ 5.0 mM/L) associated with elevated serum ferritin was also a strong risk factor for acute myocardial infarction; this lent support to the theory that iron overload elevates risk of acute myocardial infarction by promoting oxidation of LDL (Lauffer, 1991; Sullivan, 1992).

Although follow-up studies by the same laboratory and a prospective cohort study by a different investigator reported an association between high serum ferritin concentrations and increased risk of coronary heart disease or carotid vascular disease, respectively, five other large studies found no association between serum ferritin levels and coronary heart disease (NAS, 2001). Various other measures of iron status (serum transferrin saturation, serum iron concentration, and total iron-binding capacity) have been examined for a possible link to cardiovascular disease in prospective cohort studies, but results overall have been characterized as contradictory (Meyers, 1996; NAS, 2001). The NAS (2001) concluded that the available evidence "does not provide convincing support for a causal relationship" between the level of dietary iron intake and the risk for coronary heart disease, although iron cannot be definitively excluded as a risk factor.

The effects of acute oral exposure to iron in humans are well characterized. Acute iron toxicity has most often been observed in small children who accidentally ingested iron supplements, usually in the form of ferrous sulfate, but also as ferrous gluconate, ferrous chloride, ferric chloride or ferric ammonium citrate (Bothwell et al., 1979). The pathogenesis of acute oral iron toxicity consists primarily of gastrointestinal, cardiovascular, metabolic, neurological and hepatic alterations caused by direct corrosive action or the presence of unbound iron in the circulation (Bothwell et al., 1979; Banner and Tong, 1986; Engle et al., 1987; Mann et al., 1989). Gastrointestinal toxicity is due to the direct caustic effect of iron on the mucosa, particularly in the stomach and small intestine, and is characterized initially by vomiting, diarrhea and abdominal pain. These symptoms can progress to gastric and intestinal hemorrhage and/or necrosis and, rarely, 4-6 weeks after ingestion, scarring that may result in stenosis in the stomach outlet and small intestine. Cardiovascular toxicity of iron results from severe hemodynamic alterations characterized by loss of vascular integrity, decreased circulating plasma volume, decreased cardiac output and acidosis, leading to shock and cardiac failure. Neurological effects ranging from lethargy and mild obtundation to coma may occur. Hepatic damage, which can range from cloudy swelling of hepatocytes to necrosis, is a rare complication after ingestion of large quantities of iron in acute overexposure.

Determinations of serum iron concentration and total iron binding capacity (TIBC) in blood 2-4 hours after ingestion may provide reliable laboratory indices of the bioavailability of iron resulting from an acute ingestion (Mann et al., 1989), but are impractical for assessments of environmental exposures because they may be difficult to obtain rapidly. Since iron is rapidly cleared from the plasma and taken up by hepatocytes, samples drawn 4-6 hours after exposure may be low and not indicative of the quantity of iron bioaccumulated following ingestion. Clinically serious acute iron toxicity generally occurs when free unbound iron circulates (i.e., when serum iron exceeds the TIBC of transferrin and the serum transferrin is 100% saturated). Serum levels of iron are normally in the range of 65-165 Fg/100 mL; concentrations of 150-350 Fg/100 mL may be associated with mild symptoms, and concentrations >350 Fg/dL are generally considered toxic if the TIBC or the percent saturation of serum transferrin is not available (Engle et al., 1987; Mann et al., 1989). Except for the case reported by Turnberg (1965), in which a chronically exposed patient suffering iron overload had 246 Fg/100 mL iron in her serum with 100% saturation of her serum transferrin, data on serum levels of iron following repeated exposures were not located.

Information on acute oral toxic doses of iron in humans is available from numerous case reports of ingestions by children, but values vary because it is difficult to obtain accurate estimates of the amount taken in most overdose situations. It may be unclear whether amounts of elemental iron or iron compound are reported, and serum iron levels may peak at different times depending upon the type of product ingested (Engle et al., 1987). Reviews of these case reports indicate that doses in the range of 200-300 mg iron/kg are generally considered lethal (Arena, 1970; Krenzelok and Hoff, 1979; NRC, 1979; Engle et al., 1987; Mann et al., 1989; Klein-Schwartz et al., 1990), although doses as low as 40-60 mg iron/kg have been regarded as potentially fatal (NRC, 1979; Krenzelok and Hoff, 1979).

Minimum acute toxic doses of iron in humans are poorly defined because most of the cases of poisoning were overdose situations that relied on clinical histories (information from the patient or parent) for determination of dose. Additionally, toxicity mitigation procedures may complicate determining actual severity of effects. Management of acute iron poisoning typically includes gastrointestinal decontamination (e.g., emesis with syrup of ipecac, gastric lavage) and/or chelation therapy with deferoxamine performed at varying times after ingestion (Mann et al., 1989). Based on reviews of case reports and consensus opinions, treatment protocols generally consider ingestions of <20 mg iron/kg minimally toxic and ingestions of >40 mg iron/kg potentially serious (Engle et al., 1987; Mann et al., 1989; Elinder, 1986). Klein-Schwartz et al. (1990) analyzed 339 iron ingestion cases to validate the treatment protocol of a regional poison control center. According to the protocol of this center, ingestions of 20-40 mg iron/kg required only home treatment if there were no symptoms other than mild gastrointestinal symptoms, and ingestions 40 mg iron/kg or higher required hospital referral. The median age of the subjects was 3 years (range, 9 months to 33 years). The amount of iron ingestion was known in 199 subjects, ranging from 20-301 mg/kg (mean, 39.5 mg/kg). Of the 199 subjects, 144 ingested 20-40 mg/kg, 31 ingested 40-60 mg/kg, and 24 ingested 60 mg/kg and higher. There was no statistically significant difference in the mean dose ingested by patients with symptoms (abdominal pain, vomiting and/or diarrhea), compared with asymptomatic patients [42.2 mg/kg versus 38.5 mg/kg ($p=0.33$)]. The overall prevalence of the gastrointestinal symptoms was higher in the 40-60 mg/kg and 60 mg/kg or higher groups (41.9 and 33.3%, respectively), than in the 20-40 mg/kg group (22.2%), but the differences among the three groups were not statistically significant ($p=0.058$). Also, there was no statistically significant difference ($p>0.05$) in the development of any of the specific symptoms in any of the groups. The prevalence of symptoms generally increased with increasing serum iron levels, but only 20 of the patients had serum iron levels higher than the concentration of 350 Fg/dL, generally considered toxic. Symptoms more serious than gastrointestinal ones (e.g., metabolic, cardiovascular, central

nervous system or hepatic effects) did not develop in any of the patients. The results of this study suggest that acute iron ingestions in the range of 20-60 mg/kg are unlikely to be serious in children. Based on this study, the poison center protocol was changed to home management (i.e., ipecac syrup), for iron ingestions of 20-60 mg/kg unless significant symptoms developed, and hospital referral for ingestions 60 mg/kg or greater.

Effects of iron therapy on the upper gastrointestinal tract were evaluated in 14 healthy volunteers [13 women, 1 man; mean age 29 years (range, 24-48 years)] who were instructed to ingest 325 mg tablets of ferrous sulfate (65 mg iron) 3 times/day (before meals) for 2 weeks (Laine et al., 1988). This study was performed to ascertain whether there is a basis for implications that iron therapy may cause false-positive fecal occult blood testing. Evaluation consisted of gastrointestinal symptom survey, qualitative (Hemoccult) and quantitative (HemoQuant; mg mercury/g stool) testing for fecal blood loss, endoscopy of the upper gastrointestinal tract and histological examination of pinch biopsies of the gastric body, antrum and duodenum. In a separate portion of the study, Hemoccult testing was performed on 13 other subjects [12 men, 1 woman; mean age 33 years (range 23-50 years)] who were similarly treated with ferrous sulfate for 1 week. All subjects served as their own controls and ingested no other substances that could potentially damage the upper gastrointestinal tract during their participation in the study. Based on actual average ingestion of 2.5 tablets/day (2-week study) and 2.6 tablets/day (1-week study) and a reference human body weight of 70 kg (U.S. EPA, 1987), the estimated doses consumed by the subjects were 2.3 and 2.4 mg iron/kg-day, respectively, in addition to dietary iron. All subjects had significantly increased ($p<0.05$) dark brown-black stools and symptoms of nausea and vomiting during the treatment period, but not abdominal pain, compared to the 2 weeks prior to treatment. The stool samples of all 27 subjects were Hemoccult-negative prior to iron treatment. Only 1 of 27 stool samples was questionably trace positive after treatment. Hemoglobin levels in stool did not change significantly after iron treatment. Endoscopic examination showed a significant ($p=0.003$) increase in abnormalities in the stomach, but not duodenum, after therapy. These changes consisted of erythema, small areas of subepithelial hemorrhage and solitary antral erosions in nine, six and two subjects, respectively, and were considered only minimally abnormal. Linear regression analysis showed that there was a significant correlation between endoscopy scores and abdominal pain scores ($r=0.64$, $p=0.01$), but not with vomiting ($r=0.5$, $p=0.07$), diarrhea ($r=0.46$, $p=0.1$) or nausea ($r=0.4$, $p=0.16$). No treatment-related histological changes were observed and there was no correlation between the endoscopic and histologic findings, although the investigators noted that the correlation between endoscopic findings and histologic changes in small mucosal pinch biopsies is "notoriously" poor. Although it was speculated that the changes in the stomach could represent a mild form of iron poisoning, the investigators concluded that the treatment caused mild endoscopic abnormalities of uncertain clinical significance in the stomach. Evidence for iron overload (tissue biopsies or hematologic iron status indices) was not examined.

Adverse developmental effects in humans have not been associated with the ingestion of supplemental iron during pregnancy. As indicated above, NAS (2001) recommended that pregnant women supplement their diets with 27 mg iron/day (0.37 mg/kg-day). McElhatton et al. (1991) reported on 49 women who took an overdose of a simple iron preparation (53%) or iron with folate preparation (47%). For 48 of the women, the amount of iron ingested was known; 28 took > 1.2 g and the remainder took # 1.2 g. Twenty-five of the women received chelation treatment with desferrioxamine (DFO) and 12 received an emetic. Maternal toxicity, consisting of nausea, vomiting, hematoemesis, abdominal pain and diarrhea, was observed in 35 of the women. Two spontaneous abortions occurred and there were 3 premature deliveries. One of the spontaneous abortions and the premature deliveries were not related to the iron overdose. It is not known if the other spontaneous abortion occurring at 22 weeks (3 weeks after the overdose) was caused by the iron

overdose. A LOAEL for maternal toxicity or NOAEL for developmental toxicity could not be identified due to inexact exposure data, variation in type of mitigation used, and time elapsed prior to its administration.

Animal Studies

Repeated-dose oral studies in experimental animals found no significant effect of treatment with inorganic iron compounds. No treatment-related adverse changes in clinical signs, body or organ weights, food consumption, or histopathology were observed in male Sprague-Dawley rats that had daily dietary intakes of 35, 70, or 140 mg of iron (as $FeSO_4$ or FeEDTA) per kg for up to 61 days (Appel et al., 2001). In male and female F344 rats that were exposed to drinking water containing 0.25 or 0.5% ferric chloride ($FeCl_3 \cdot 6H_2O$) for 104 weeks, there were no dose-related effects other than reduced water intake (possibly affected by palatability) and body weight gain (Sato et al., 1992). In the latter study, the iron intakes were 58 or 110 mg/kg-day in males and 65 or 116 mg/kg-day in females.

No treatment-related teratogenic or embryotoxic effects were observed in rats given 2.7 mg iron/kg-day as ferric chloride on gestational days 6-15 (Nolen et al., 1972), or in rats and mice given 24-76 mg iron/kg-day as ferrous sulfate for 6 days during gestation (days unspecified) (Tadokoro et al., 1979). Some embryonic mortality (numbers and species not reported) occurred in the latter study at 240 mg iron/kg-day.

DERIVATION OF A PROVISIONAL RFD FOR IRON

Most of the quantitative chronic oral toxicity data for iron have been obtained from studies of the Bantu population of South Africa. These data indicate that intakes in the range of 0.7-1.4 mg iron/kg-day in home-brewed beer are associated with hemosiderosis and liver cirrhosis (Bothwell and Bradlow, 1960; Bothwell et al., 1964). However, confounding factors such as malnutrition and unusually high iron bioavailability, due to the high acidity and ethanol in the beer, preclude use of these data for risk assessment. Much higher dietary intakes (average 6.7 mg/kg-day) of less soluble forms of iron are tolerated in nonwestern diets as indicated by studies of populations in Ethiopia. Therapeutic oral doses of 2.3 mg iron/kg-day as ferrous sulfate for 2 weeks were minimally toxic to the gastrointestinal tract, causing nausea, vomiting and endoscopic abnormalities in the stomach (e.g., erythema and small areas of hemorrhage), but no gastric histological changes were found, and evidence for iron overload (tissue biopsies or hematologic iron status indices) was not examined (Laine et al., 1988). One case of hemochromatosis was reported in a woman who ingested 19.2 mg/kg-day of iron for 27 years; treatment was not accompanied by alcohol- or transfusion-induced hepatitis, anemia, malnutrition or abnormal intestinal absorption (Turnberg, 1965). Thus, although toxicity associated with iron overload due to chronic oral intake can be demonstrated qualitatively or even semiquantitatively, assignment of a precise LOAEL for normal individuals consuming western diets is compromised by studies containing confounding factors, inadequate endpoint assessment, too short a duration of exposure or too few subjects.

Nonetheless, it is possible to establish a NOEL for chronic iron overload using the values for dietary intake and iron status indices taken from the second National Health and Nutrition Examination Survey (NHANES II) data base. Looker et al. (1988) made comparisons of dietary iron intake and biochemical indices of iron status using data from NHANES II. The average intakes of iron ranged from 0.15 to 0.27 mg/kg-day. The serum ferritin levels and percent serum transferrin saturation were within the normal range. Thus, intake levels of 0.15-0.27 mg/kg-day are both sufficient to protect against iron deficiency and insufficient to cause the toxic effects of iron overload.

Using the NOAEL of 0.27 (representing the upper bound value in the range of mean dietary iron intakes, dietary plus supplemental, taken from the NHANES II data base) and dividing by an uncertainty factor of 1 yields the provisional chronic oral RfD of 0.3 mg/kg-day. An uncertainty factor of 1 is supported by the fact that iron is an essential element.

The provisional chronic RfD is calculated as follows:

$$RfD = NOAEL_{ADJ} / (UF \times MF)$$

where

NOAEL = 0.27 mg/kg-day (representing the upper bound value in the range of mean dietary iron intakes, dietary plus supplemental, taken from the NHANES II data base)

UF = uncertainty factor = 1 (supported by the fact that iron is an essential element)
MF = modifying factor = 1 (standard default)

thus,

RfD = [0.27 mg/kg-day]/[1] = 0.27 = 0.3 mg/kg-day

In addition, the information used to derive the oral RfD for iron was derived from intake data from over 20,000 individuals aged 6 months to 74 years. Furthermore, humans exert an efficient homeostatic control over iron such that body burdens are kept constant with variations in diet.

NOTE: This RfD supplies adequate levels of iron to meet the nutritional requirements of adults and adolescents over a lifetime. It does not supply the recommended dietary allowance (RDA) to those members of the population that have greater requirements for a short, less-than-lifetime duration such as infants (7-12 months) and pre-adolescent children (1-8 years), and pregnant women. For shorter term requirements for these subpopulations, refer to the RDAs (NAS, 2001). In addition, the RfD exceeds the AI for infants 6 months or younger (NAS, 2001). Furthermore, this RfD may not be protective of people with inherited disorders of iron metabolism and could be conservative if applied to exposure scenarios involving forms of iron with low bioavailability.

STATEMENT OF CONFIDENCE

Confidence in the critical study is high; the NHANES II data were derived from a very large sampling of the U.S. population ranging in age from 6 months to 74 years and are consistent with the findings in the subsequent NHANES III data set (NAS, 2001). Overall confidence in the data base is medium; there are insufficient data to determine what chronic dose level is associated with adverse effects in healthy individuals. While a point estimate has been derived in this risk assessment, individual variations in diet, nutritional status, physiology, etc. suggest that a range of values may be more appropriate. Reflecting the high confidence in the critical study and medium confidence in the data base, confidence in the RfD is medium.

REFERENCES

Appel, M.J., C.F. Kuper, and R.A. Woutersen. 2001. Disposition, accumulation and toxicity of iron fed as iron (II) sulfate or as sodium iron EDTA in rats. Food Chem. Toxicol. 39: 261-269.

Arena, J.M. 1970. Poisoning, 2nd ed. Thomas, Springfield, IL. p. 369. (Cited in Crotty, 1971)

ATSDR (Agency for Toxic Substances and Disease Registry). 2001. Internet HazDat - Toxicological Profile Query. Examined September, 2001. Online at http://www.atsdr.cdc.gov/gsql/toxprof.script.

Banner Jr., W. and T.G. Tong. 1986. Iron poisoning. Pediatr. Toxicol. 33(2): 393-409.

Bothwell, T.H. and B.A. Bradlow. 1960. Siderosis in the Bantu: A combined histopathological and chemical study. Arch. Pathol. 70: 279-292.

Bothwell, T.H., H. Seftel, P. Jacobs, et al. 1964. Iron overload in Bantu subjects: Studies on the availability of iron in Bantu beer. Am. J. Clin. Nutr. 14: 47-51.

Bothwell, T.H., R.W. Charlton, J.D. Cook and C.A. Finch. 1979. Iron Metabolism in Man. Blackwell Scientific Publications, Oxford, UK. p. 7-43, 105-120, 256-283.

Cook, J.D. 1991. Telephone conversation with J.A. Freedman, Syracuse Research Corporation, Syracuse, NY. Discussion of normal ranges of indices of iron status. September 5, 1991.

Crotty, J. 1971. Acute iron poisoning in children. Clin. Toxicol. 4: 615-619.

Elinder, C. 1986. Iron. In: Handbook on the Toxicology of Metals, Vol. II, 2nd ed., L. Friberg, G.F. Nordberg, V.B. Vouk and E. Kessler, Ed. Elsevier Science Publishers, New York. p. 276-297.

Engle, J.P., K.S. Polin and I.L. Stile. 1987. Acute iron intoxication: Treatment controversies. Drug Intell. Clin. Pharm. 21: 153-159.

Finch, C.A. and E.R. Monsen. 1972. Iron nutrition and the fortification of food with iron. J. Am. Med. Assoc. 219: 1462-1465.

Grimsley, L.F. 2001. Iron and cobalt. In: Patty's Toxicology, 5th Edition, vol. 3, E. Bingham, B. Cohrssen and C.H. Powell, Eds. John Wiley and Sons, New York. p. 169-193.

Hillman, R.S. and C.A. Finch. 1985. Drugs effective in iron-deficiency and other hypochromic anemias. In: Goodman and Gilman's The Pharmacological Basis of Therapeutics, 7th ed. MacMillan Publishing Company, New York. p. 1308-1322.

Hofvander, Y. 1968. Hematological investigations in Ethiopia with special reference to a high iron intake. Acta Med. Scand. Suppl. 494: 7-74.

IARC (International Agency for Research on Cancer). 1972. Haematite and iron oxide. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Vol. 1, pp. 29-39. Lyon, France.

IARC (International Agency for Research on Cancer). 1987. Haematite and ferric oxide. Overall Evaluations of Carcinogenicity: An Updating of *IARC Monographs* Volumes 1 to 42. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Suppl. 7, pp. 216-219. Lyon, France.

Jacobs, A. 1977. Iron overload--clinical and pathologic aspects. Semin. Hematol. 14: 89-113.

Klein-Schwartz, W., G.M. Oderda, R.L. Gorman, et al. 1990. Assessment of management guidelines: Acute iron ingestion. Clin. Pediatr. 29(6): 316-321.

Krenzelok, E.P. and J.V. Hoff. 1979. Accidental childhood iron poisoning: A problem of marketing and labeling. Pediatrics. 63(4): 591-596.

Laine, L.A., E. Bentley and P. Chandrasoma. 1988. Effect of oral iron therapy on the upper gastrointestinal tract. A prospective evaluation. Digestive Dis. Sci. 33(2): 172-177.

Lauffer, R.B. 1991. Iron stores and the international variation in mortality from coronary artery disease. Medical Hypothesis 35(2): 96-102.

Looker, A., C.T. Sempos, C. Johnson and E.A. Yetley. 1988. Vitamin-mineral supplement use: Association with dietary intake and iron status of adults. J. Am. Diet. Assoc. 88: 808-814.

Mann, K.V., M.A. Picciotti, T.A. Spevack and D.R. Durbin. 1989. Management of acute iron overdose. Clin. Pharm. 8(6): 428-440.

McElhatton, P.R., J.C. Roberts and F.M. Sullivan. 1991. The consequences of iron overdose and its treatment with desferrioxamine in pregnancy. Human & Exper. Toxicol. 10: 251-259.

Meyers, D.G. 1996. The iron hypothesis–Does iron cause atherosclerosis? Clin. Cardiol. 19: 925-929.

NAS (National Academy of Sciences). 1989. Recommended Dietary Allowances, 10th ed. National Academy of Sciences, National Research Council, Food and Nutrition Board. National Academy Press, Washington, DC. p. 195-205.

NAS (National Academy of Sciences). 2001. Iron. In: Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium, and Zinc. Institute of Medicine, Food and Nutrition Board. National Academy Press, Washington, DC. p. 233-310. Online at: http://books.nap.edu/books/0309072794/html/.

Nolen, G.A., R.L. Bohne and E.V. Buehler. 1972. Effects of trisodium nitrilotriacetate, trisodium citrate, and a trisodium nitrilotriacetate ferric chloride mixture on cadmium and methyl mercury toxicity and teratogenesis in rats. Toxicol. Appl. Pharmacol. 23: 238-250.

NRC (National Research Council). 1979. Iron Metabolism in Humans and Other Mammals. A report of the Subcommittee on Iron, Committee on Medical and Biologic Effects of Environmental Pollutants, Division of Medical Sciences, Assembly of Life Sciences. University Park Press, Baltimore, MD. p. 79-105, 33-165.

NTP (National Toxicology Program). 2001a. Status Report for Ferric Chloride. Examined September, 2001. Online at: http://ntp-server.niehs.nih.gov/htdocs/Results_Status/Resstatf/7705080.Html.

NTP (National Toxicology Program). 2001b. NTP Chemical Repository Report for Ferric Chloride. Examined September, 2001. Online at: http://ntp-server.niehs.nih.gov/htdocs/CHEM_H&S/NTP_Chem7/Radian7705-08-0.html.

Roe, D.A. 1966. Nutrient toxicity with excessive intake. II. Mineral overload. N.Y.S. J. Med. 66: 1233-1237.

Salonen, J.T., K. Nyyssonen, H. Korpela, J. Tuomilehto, R. Seppanen, and R. Salonen. 1992. High stored iron levels are associated with excess risk of myocardial infarction in Eastern Finnish men. Circulation 86(3): 803-811.

Sato, M., F. Furukawa, K. Toyoda et al. 1992. Lack of carcinogenicity of ferric chloride in F344 rats. Food Chem. Toxicol. 30: 837-842.

Sullivan, J.L. 1992. Stored iron and ischemic heart disease. Empirical support for a new paradigm [editorial; comment]. Circulation 36(3): 1036-1037.

Tadokoro, T., T. Miyaji and M. Okumura. 1979. Teratogenicity studies of slow-iron in mice and rats. Oyo Yakuri. 17: 483. (Taken from Chem. Abstr. 91:134052f)

Turnberg, L.A. 1965. Excessive oral iron therapy causing haemochromatosis. Br. Med. J. 1: 1360.

U.S. EPA. 1984. Health Effects Assessment for Iron (and Compounds). Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Emergency and Remedial Response, Washington, DC. EPA 540/1-86-054.

U.S. EPA. 1987. Recommendations for and Documentation of Biological Values for Use in Risk Assessment. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC. EPA 600/6-87-008. NTIS PB88-179874/AS.

U.S. EPA. 1991. Chemical Assessments and Related Activities. Office of Health and Environmental Assessment, Washington, DC. April, 1991. OHEA-I-127.

U.S. EPA. 1994. Chemical Assessments and Related Activities. Office of Health and Environmental Assessment, Washington, DC. December, 1994. OHEA-I-127.

U.S. EPA. 1995. Quarterly Status Report of RfD/RfC Work Group (as of 9/01/95). Office of Research and Development. National Center for Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1997. Health Effects Assessment Summary Tables. Annual Update. FY-1997. Prepared by the National Center for Environmental Assessment, Cincinnati, OH, for the Office of Research and Development, Office of Emergency and Remedial Response, Washington, D.C. July 1997. EPA-540-R-97-036. PB97-921199.

U.S. EPA. 2000. Drinking Water Standards and Health Advisories. Office of Water, Washington, DC. Summer, 2000. EPA 822-B-00-001. Examined September, 2001. http://www.epa.gov/ost/drinking/standards/dwstandards.pdf

U.S. EPA. 2001. Substance index. Integrated Risk Information System (IRIS). Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. Examined September, 2001. Online at http://www.epa.gov/iris/subst/index.html.

WHO (World Health Organization). 2001. Online catalogs for the Environmental Health Criteria series. Examined September, 2001. Online at http://www.who.int/dsa/cat97/zehc.htm and http://www.who.int/dsa/justpub/add.htm.

Michael,

We don't have any toxicity information for Vanadium. However, we do have surrogates for some of the PAHs that you requested. Here are the suggested surrogates:

Chemical	Surrogate
Benzo[a]anthracene	Pyrene (Fluoranthene or Naphthalene)*
Benzo[a]pyrene	None
Benzo[b]fluoranthene	Pyrene (Fluoranthene or Naphthalene)*
Benzo[k]fluoranthene	Pyrene (Fluoranthene or Naphthalene)*
Dibenz[ah]anthracene	Pyrene (Fluoranthene or Naphthalene)*
Indeno[1,2,3-cd]pyrene	Bisphenol A

*Pyrene is the primary suggested surrogate and Fluoranthene or Naphthalene are suggested secondary surrogates.

Please feel free to contact us if you have any other questions.

Thank you,
Ann Parker
STSC

Appendix H
UCL_{95} Calculation Methods and Comparisons with ProUCL Tool

Appendix H-1
Results Comparison Between ProUCL and CH2M HILL Statistical Tools

APPENDIX H

Results Comparison Between ProUCL and CH2MHILL Statistical Tools

During the preparation of the *Draft NFA Report for Nine Sites* (CH2M HILL, 2002), EPA's ProUCL version 2.1 (http://www.epa.gov/nerlesd1/tsc/software.htm) was not available for calculating the exposure point concentrations (EPCs) of the chemicals of potential concern (COPCs) evaluated in this risk assessment. To be consistent with the EPA policy that the 95-percent upper confidence limit (UCL_{95}) of the mean should be used as a reasonable and conservative estimate of the EPC, CH2M HILL developed its own spreadsheet application to calculate the EPC using statistical methods recommended by EPA guidance. The methods and results are provided in the *Draft NFA Report for Nine Sites*.

In response to EPA comments, CH2M HILL has performed a limited comparison of the results obtained using its spreadsheet application to the results obtained from the recently available ProUCL tool provided by EPA. Five different data sets were evaluated using the CH2M HILL tool and ProUCL, and the results were compared. A side-by-side summary table of results is provided in Appendix H-2, and complete output results from both applications is provided in Appendix H-3. Input for the calculations included the analytical results for the following:

Aluminum in surface soil at SWMU 14 (n=14)
Arsenic in surface soil at SWMU 14 (n=14)
Aluminum in surface soil at SWMU 15 (n=16)
Arsenic in surface soil at WWTP (n=16)
Manganese in surface soil at SWMU 15 (n=16)

These data sets were chosen subjectively to represent the typical distributions of data encountered at this site. Two populations are lognormally distributed, one is normally distributed, and two do not fit either distribution (one likely due to left-censored data and the other due to high-detection concentrations).

Both tools provide similar graphical (Q-Q plots) and summary statistics to aide the risk assessor/statistician in choosing the best EPC for the COPC being evaluated. Using the W-test, both tools rejected or accepted the null hypothesis regarding the sample population distribution in the same fashion. For all data sets, the UCL_{95}-based on the student's-t method differed by less than 0.001 percent. For sample populations identified as lognormally distributed, the UCL_{95}based on the H-UCL method differed by no more than 0.13 percent between the two methods and did not differ by more than 2 percent, regardless of the population distribution. For sample populations that did not fit a normal or lognormal distribution, the UCL_{95} calculated using the nonparametric bootstrap method differed by no more than 0.45 percent and did not differ by more than 1.27 percent, regardless of the sample population distribution. The ProUCL does provide other methods for estimating a nonparametric UCL_{95} that are not provided using the CH2M HILL tool. However, a

nonparametric UCL_{95} was used as the EPC in only 9 of 73 instances where a UCL_{95} was taken as the EPC. Thus, the use of a bootstrap UCL_{95} for non-normal/lognormal sample populations as opposed to another method provided by ProUCL would not substantially change the results of the risk calculations and have little effect on the risk characterization at these nine sites. The statistical methods and procedures used to calculate the EPC are reasonable and conservative estimates of potential cocentrations a receptor may encounter at this site and are consistent with EPA guidance and policy.

Assumes normality or approximate normality, presented in Gilbert, 1987

$$95\%UCL = x + t_{\alpha,n-1}(s_x / \sqrt{n}$$

x = mean of untransformed data
$t_{\square,n-1}$ = Student t-statistic (obtained from Gilbert, 1987; linear interpolation used for values not on table
s_x = standard deviation of untransformed data
n = number of samples

H-Statistic

Assumes lognormality, presented in Gilbert, 1987

$$95\%UCL = \exp(y + 0.5s_y^2 + s_y H_{1-\alpha} / \sqrt{(n-1)})$$

y = mean of log transformed data
s_y = standard deviation of log transformed data
$H_{1-\square}$ = H-statistic (from Land, 1971 as given by Gilbert, 1987 and obtained by linear interpolation
n = number of samples

Bootstrap

Distribution free, presented in EPA, 1997

Method

Repeated samples of size n are drawn with replacement from the given dataset. The process is repeated a large number (N) times, and each time an estimate of the parameter of interest (i.e. mean) is calculated. The general method is as follows:

Step 1.

Let (xi1,...xin) represent the the ith sample of size n with replacement from the original data set. Then compute the sample mean and denote it by xI.

Step 2.

Repeat Step 1 independently N times. Each time calculating a new estimate. Denote these estimates as x1, x2, ... xN. The bootstrap estimate of the population mean is the arithmetic mean, xB, of the the N estimates xI. The bootstrap estimate of the std error

$$\sigma_B = \left((1/(n-1)^*\Sigma(x_i-x_B)^2\right)^{1/2}$$

Step 3.

Finally, the (1-2□)*100 confidence interval for xB is:

$(x_B - z_\alpha{}^*\sigma_B,\ x_B + z_\alpha{}^*\sigma_B)$

Thus, the UCL95 bootstrap becomes:

$UCL95 = x_B + 1.645 * \sigma_B$

References

Gilbert, RO. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold. New York.

EPA. 1997. Singh, AK, A Singh, M Engelhardt. The Lognormal Distribution in Environmental Applications. EPA/600/R-97/006. Office of Research and Development, OSWER.

EPA. 1989. Statistical Analsysis of Groundwater Monitoring Data at RCRA Facilities. Interim Final. PB89-151047. OSWER.

Appendix H-2
Final Comparison Table (ProUCL - CH2M HILL Statistical Method)

Appendix H-2

Results Comparison Between EPA's ProUCL and CH2MHILL's UCL_{95} calculation Spreadsheet

Draft Final NFA Report for Nine Sites, Former NASD, Vieques Island, Puerto Rico

								Population Distribution				95% Upper Confidence Limit of the Mean																	
								Normal		Lognormal		Student's t			H-UCL			Standard Bootstrap			CLT		Jacknife		Bootstrap t		Chebyshev	
Parameter	Location	Samples	Detects	Frequency of Detection	Minimum Detect	Maximum Detect	Mean	PROUCL	CH2MHILL	PROUCL	CH2MHILL	PROUCL	CH2MHILL	PERCENT DIFFERENCE	PROUCL	CH2MHILL	PERCENT DIFFERENCE	PROUCL	CH2MHILL	PERCENT DIFFERENCE	PROUCL	CH2MHILL	PROUCL	CH2MHILL	PROUCL	CH2MHILL	PROUCL	CH2MHILL
Aluminum	SWMU 14	14	14	100%	4900	16300	8,471	NO	NO	YES	YES	10,245	10,246	0.0007%	10,636	10,650	0.13%	10,073	10,112	0.38%	10,119	--	10,245	--	10,696	--	12,839	--
Arsenic	SWMU 14	14	13	93%	0.4	3	1.0	NO	NO	YES	YES	1.4	1.4	0.0010%	1.7	1.7	0.08%	1.3	1.3	1.27%	1.3	--	1.4	--	1.5	--	1.9	--
Aluminum	SWMU 15	16	16	100%	5030	21400	8,161	NO	NO	NO	NO	9,884	9,884	0.0005%	9,661	9,591	0.72%	9,693	9,652	0.43%	9,778	--	9,884	--	11,665	--	12,446	--
Arsenic	WWTP	16	3	19%	0.66	1.1	0.35	NO	NO	NO	NO	0.47	0.47	0.0007%	0.46	0.46	1.93%	0.46	0.46	0.45%	0.46	--	0.47	--	0.58	--	0.65	--
Manganese	SWMU 15	16	16	100%	370	786	632	YES	YES	NO	NO	677	677	0.0002%	689	687	0.31%	673	673	0.05%	674	--	677	--	671	--	744	--

Appendix H-3
Complete Output Results from CH2M HILL and ProUCL Methods

CH2M HILL Method

Site: WWTP
Media: ss
Units: mg/kg

Chemical	CASRN	Samples	Detects	NonDetects	FOD	Min Detect	Max Detect	Avg Detect	Mean	Min nondetect	Max nondetect	W-Test	t-Statistic	UCL95 norm	H-statistic	UCL96 log	UCL95 nonparm	UCL95 bootstrap	UTL norm	UTL log	UTL nonparm
Aluminum		14	14	0	100%	4900	16300	8470.714	8470.714	0	0	LOGNORMAL	1.771	10245.51	2.006667	10649.87	5330	10111.73	15344.47	16502.16	16300
Arsenic		14	13	1	93%	0.4	3	1.083846	1.020357	0.195	0.195	LOGNORMAL	1.771	1.373327	2.378	1.68882	0.48	1.323363	2.387404	3.037885	3
Aluminum		16	16	0	100%	5030	21400	8160.625	8160.625	0	0	NONPARAMETRIC	1.753	9883.998	1.841167	9591.414	5950	9651.53	15266.28	14474.58	21400
Arsenic		16	3	13	19%	0.66	1.1	0.873333	0.347813	0.165	0.3	NONPARAMETRIC	1.753	0.468386	2.002167	0.455004	0.22	0.456206	0.844948	0.808685	1.1
Manganese		16	16	0	100%	370	786	631.6875	631.6875	0	0	NORMAL	1.753	676.9146	1.7265	686.9773	572	673.1603	818.1636	866.7782	786
Arsenic		16	3	13	19%	0.66	1.1	0.873333	0.347813	0.165	0.3	NONPARAMETRIC	1.753	0.468386	2.002167	0.455004	0.22	0.460261	0.844948	0.808685	1.1

Site:	SWMU 14
Media:	SS
Units:	mg/kg
Chemical:	Aluminum
CASRN:	

STATISTICS	
N	14
Detects	14
FOD	100%
Mean of Detect	8470.714
Min of Detect	4900.0000
Max of Detect	16300.00
Best Estimate of Mean (arithmetic)	8470.7
Best Estimate of Mean (geometric)	7806.0
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	10245.5
t-statistic	1.77
UCL95 Lognormal	10649.9
H-statistic	2.01
UCL95 Nonparametric	5330
UCL95 Bootstrap	10112

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	15344.4706
coverage	95%
UTL95 Lognormal	16502.15806
coverage	95%
UTL95 Nonparametric	16300.00
coverage	93%

DISTRIBUTION TESTING	
Population is best described as:	LOGNORMAL
W_{normal}	0.839
W_{log}	0.886
$W_{\alpha = 0.05}$	0.874

Notes:

1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values caculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to caclulate a UTL or UCL with any level of confidence.

Site:	SWMU 15
Media:	SS
Units:	mg/kg
Chemical:	Aluminum
CASRN:	

STATISTICS	
N	16
Detects	16
FOD	100%
Mean of Detect	8160.625
Min of Detect	5030.0000
Max of Detect	21400.00
Best Estimate of Mean (arithmetic)	8160.6
Best Estimate of Mean (geometric)	7595.3
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	9884.0
t-statistic	1.75
UCL95 Lognormal	9591.4
H-statistic	1.84
UCL95 Nonparametric	5950
UCL95 Bootstrap	9652

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	15266.2754
coverage	95%
UTL95 Lognormal	14474.57713
coverage	95%
UTL95 Nonparametric	21400.00
coverage	94%

DISTRIBUTION TESTING	
Population is best described as:	NONPARAMETRIC
W_{normal}	0.667
W_{log}	0.847
$W_{\alpha = 0.05}$	0.887

Notes:

1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values caculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to caclulate a UTL or UCL with any level of confidence.

Site:	SMWU 14
Media:	SS
Units:	mg/kg
Chemical:	Arsenic
CASRN:	

STATISTICS	
N	14
Detects	13
FOD	93%
Mean of Detect	1.084
Min of Detect	0.4000
Max of Detect	3.00
Best Estimate of Mean (arithmetic)	1.0
Best Estimate of Mean (geometric)	0.8
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	1.4
t-statistic	1.77
UCL95 Lognormal	1.7
H-statistic	2.38
UCL95 Nonparametric	0.48
UCL95 Bootstrap	1

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	2.387403762
coverage	95%
UTL95 Lognormal	3.037885099
coverage	95%
UTL95 Nonparametric	3.00
coverage	93%

DISTRIBUTION TESTING	
Population is best described as:	LOGNORMAL
W_{normal}	0.851
W_{log}	0.968
$W_{\alpha = 0.05}$	0.874

Notes:
1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values caculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to caclulate a UTL or UCL with any level of confidence.

Site:	WWTP
Media:	ss
Units:	mg/kg
Chemical:	Arsenic
CASRN:	

STATISTICS	
N	16
Detects	3
FOD	19%
Mean of Detect	0.873
Min of Detect	0.6600
Max of Detect	1.10
Best Estimate of Mean (arithmetic)	0.3
Best Estimate of Mean (geometric)	0.3
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	0.5
t-statistic	1.75
UCL95 Lognormal	0.5
H-statistic	2.00
UCL95 Nonparametric	0.22
UCL95 Bootstrap	0

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	0.844948143
coverage	95%
UTL95 Lognormal	0.8086852
coverage	95%
UTL95 Nonparametric	1.10
coverage	94%

DISTRIBUTION TESTING	
Population is best described as:	NONPARAMETRIC
W_{normal}	0.632
W_{log}	0.757
$W_{\alpha = 0.05}$	0.887

Notes:
1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values caculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to caclulate a UTL or UCL with any level of confidence.

Site:	SMWU 15
Media:	SS
Units:	mg/kg
Chemical:	Manganese
CASRN:	

STATISTICS	
N	16
Detects	16
FOD	100%
Mean of Detect	631.688
Min of Detect	370.0000
Max of Detect	786.00
Best Estimate of Mean (arithmetic)	631.7
Best Estimate of Mean (geometric)	622.6
Nondetects at 1/2 DL	YES

95% UPPER CONFIDENCE LIMITS FOR MEAN	
UCL95 Normal	676.9
t-statistic	1.75
UCL95 Lognormal	687.0
H-statistic	1.73
UCL95 Nonparametric	572
UCL95 Bootstrap	673

95% UPPER TOLERANCE INTERVAL	
UTL95 Normal	818.1635852
coverage	95%
UTL95 Lognormal	866.7781669
coverage	95%
UTL95 Nonparametric	786.00
coverage	94%

DISTRIBUTION TESTING	
Population is best described as:	NORMAL
W_{normal}	0.941
W_{log}	0.877
$W_{\alpha = 0.05}$	0.887

Notes:
1. If population does not fit normal or lognormal distribution, check Q-Q plots and W-test values. The population may be close enough to one of those distributions to subjectively select a normal or lognormal distribution.
2. For site data, if the selected UCL95 exceeds the Max Detect, the Max Detect should be chosen as the EPC.
3. Lognormal UCL or UTL values caculated for less than 30 samples may be widely inflated.
4. If there is >90% nondetection, it is generally impossible to caclulate a UTL or UCL with any level of confidence.

ProUCL Method

General Statistics

From File	C:\Documents and Settings\jkase.CH2MHIL				
Summary Statistics for		AL_SMWU14		Summary Statistics for	ln(AL_SMWU14)
Number of Samples		14		Minimum	8.49699
Minimum		4900		Maximum	9.69892
Maximum		16300		Mean	8.962645
Mean		8470.714286		Standard Deviation	0.408367
Median		6680		Variance	0.166764
Standard Deviation		3749.677862			
Variance		14060084.07		Shapiro-Wilk Test Statisitic	0.885672
Coefficient of Variation		0.442663716		Shapiro-Wilk 5% Critical Value	0.874
Skewness		0.98827632		Data Are Lognormal at 5% Significance Level	
Shapiro-Wilk Test Statisitic		0.838839108		Estimates Assuming Lognormal Distribution	
Shapiro-Wilk 5% Critical Value		0.874		MLE Mean	8484.756
Data Not Normal at 0.05 Significance Level				MLE Standard Deviation	3614.496
Try Lognormal or Non-parametric UCL				MLE Coefficient of Variation	0.425999
				MLE Skewness	1.355305
95	% UCL (Normal Data)			MLE Median	7805.974
Student's t		10245.44359		MLE 80% Quantile	11022.73
				MLE 90% Quantile	13192.4
95	% UCL (Adjusted for Skewness)			MLE 95% Quantile	15281.66
Adjusted CLT		10401.92327		MLE 99% Quantile	20181.19
Modified t		10289.55928			
				MVU Estimate of Median	7759.603
95	% Non-parametric UCL			MVU Estimate of Mean	8431.043
CLT		10119.09376		MVU Estimate of Std. Dev.	3513.598
Jackknife		10245.44359		MVU Estimate of SE of Mean	937.9758
Standard Bootstrap		10072.98419			
Bootstrap t		10696.02743		UCL Assuming Lognormal Distribution	
Chebyshev (Mean, Std)		12838.9568		95% H-UCL	10636.48
				95% Chebyshev (MVUE) UCL	12519.58
				99% Chebyshev (MVUE) UCL	17763.78
				Recommended UCL to use:	
				Student's t or H-UCL	

From File	C:\Documents and Settings\jkase.CH2MH				
Summary Statistics for		AL_SWMU	Summary Statistics for	ln(AL_SWMU15)	
Number of Samples		16	Minimum	8.523175	
Minimum		5030	Maximum	9.971146	
Maximum		21400	Mean	8.935287	
Mean		8160.625	Standard Deviation	0.356879	
Median		6725	Variance	0.127362	
Standard Deviation		3932.398			
Variance		15463753	Shapiro-Wilk Test Statisitic	0.847147	
Coefficient of Variation		0.481875	Shapiro-Wilk 5% Critical Value	0.887	
Skewness		2.821226	Data Not Lognormal at 5% Significance Level		
			Try Normal or Non-parametric UCL		
Shapiro-Wilk Test Statisitic		0.667055			
Shapiro-Wilk 5% Critical Value		0.887	Estimates Assuming Lognormal Distribution		
Data Not Normal at 0.05 Significance Level			MLE Mean	8094.727	
Try Lognormal or Non-parametric UCL			MLE Standard Deviation	2983.305	
			MLE Coefficient of Variation	0.368549	
95	% UCL (Normal Data)		MLE Skewness	1.155707	
Student's t		9884.048	MLE Median	7595.316	
			MLE 80% Quantile	10268.63	
95	% UCL (Adjusted for Skewness)		MLE 90% Quantile	12014.58	
Adjusted CLT		10518.57	MLE 95% Quantile	13661.71	
Modified t		9999.612	MLE 99% Quantile	17420.21	
95	% Non-parametric UCL		MVU Estimate of Median	7565.139	
CLT		9777.68	MVU Estimate of Mean	8060.897	
Jackknife		9884.048	MVU Estimate of Std. Dev.	2927.195	
Standard Bootstrap		9692.972	MVU Estimate of SE of Mean	731.2616	
Bootstrap t		11664.82			
Chebyshev (Mean, Std)		12445.86	UCL Assuming Lognormal Distribution		
			95% H-UCL	9661.242	
			95% Chebyshev (MVUE) UCL	11248.39	
			99% Chebyshev (MVUE) UCL	15336.86	
			Recommended UCL to use:		
			Student's t or H-UCL		

General Statistics

From File	C:\Documents and Settings\jkase.CH2MH				
Summary Statistics for	AS_SWMU		Summary Statistics for	ln(AS_SWMU14)	
Number of Samples	14		Minimum	-1.634756	
Minimum	0.195		Maximum	1.098612	
Maximum	3		Mean	-0.214084	
Mean	1.020357		Standard Deviation	0.72293	
Median	0.705		Variance	0.522628	
Standard Deviation	0.745733				
Variance	0.556117		Shapiro-Wilk Test Statisitic	0.967518	
Coefficient of Variation	0.730855		Shapiro-Wilk 5% Critical Value	0.874	
Skewness	1.502176		Data Are Lognormal at 5% Significance Level		
Shapiro-Wilk Test Statisitic	0.850596		Estimates Assuming Lognormal Distribution		
Shapiro-Wilk 5% Critical Value	0.874		MLE Mean	1.048363	
Data Not Normal at 0.05 Significance Level			MLE Standard Deviation	0.868595	
Try Lognormal or Non-parametric UCL			MLE Coefficient of Variation	0.828525	
			MLE Skewness	3.054319	
95	% UCL (Normal Data)		MLE Median	0.80728	
Student's t	1.373314		MLE 80% Quantile	1.487046	
			MLE 90% Quantile	2.043943	
95	% UCL (Adjusted for Skewness)		MLE 95% Quantile	2.651527	
Adjusted CLT	1.433684		MLE 99% Quantile	4.338163	
Modified t	1.38665				
			MVU Estimate of Median	0.792334	
95	% Non-parametric UCL		MVU Estimate of Mean	1.025091	
CLT	1.348185		MVU Estimate of Std. Dev.	0.788137	
Jackknife	1.373314		MVU Estimate of SE of Mean	0.208573	
Standard Bootstrap	1.340405				
Bootstrap t	1.522116		UCL Assuming Lognormal Distribution		
Chebyshev (Mean, Std)	1.889109		95% H-UCL	1.68739	
			95% Chebyshev (MVUE) UCL	1.934242	
			99% Chebyshev (MVUE) UCL	3.100371	
			Recommended UCL to use:		
			H-UCL		

From File	C:\Documents and Settings\jkase.CH2MI				
Summary Statistics for		AS_WWTF	Summary Statistics for	ln(AS_WWTP)	
Number of Samples		16	Minimum	-1.80181	
Minimum		0.165	Maximum	0.09531	
Maximum		1.1	Mean	-1.247984	
Mean		0.347813	Standard Deviation	0.573141	
Median		0.235	Variance	0.328491	
Standard Deviation		0.275124			
Variance		0.075693	Shapiro-Wilk Test Statisitic	0.757258	
Coefficient of Variation		0.791012	Shapiro-Wilk 5% Critical Value	0.887	
Skewness		2.04963	Data Not Lognormal at 5% Significance Level		
			Try Normal or Non-parametric UCL		
Shapiro-Wilk Test Statisitic		0.631975			
Shapiro-Wilk 5% Critical Value		0.887	Estimates Assuming Lognormal Distribution		
Data Not Normal at 0.05 Significance Level			MLE Mean	0.338328	
Try Lognormal or Non-parametric UCL			MLE Standard Deviation	0.21098	
			MLE Coefficient of Variation	0.623595	
95	% UCL (Normal Data)		MLE Skewness	2.113283	
Student's t		0.468389	MLE Median	0.287083	
			MLE 80% Quantile	0.465949	
95	% UCL (Adjusted for Skewness)		MLE 90% Quantile	0.599597	
Adjusted CLT		0.498606	MLE 95% Quantile	0.737001	
Modified t		0.474263	MLE 99% Quantile	1.088873	
95	% Non-parametric UCL		MVU Estimate of Median	0.284149	
CLT		0.460947	MVU Estimate of Mean	0.334416	
Jackknife		0.468389	MVU Estimate of Std. Dev.	0.200315	
Standard Bootstrap		0.458265	MVU Estimate of SE of Mean	0.049852	
Bootstrap t		0.581201			
Chebyshev (Mean, Std)		0.647622	UCL Assuming Lognormal Distribution		
			95% H-UCL	0.463978	
			95% Chebyshev (MVUE) UCL	0.551718	
			99% Chebyshev (MVUE) UCL	0.830441	
			Recommended UCL to use:		
			H-UCL		

General Statistics

From File	C:\Documents and Settings\jkase.CH2N				
Summary Statistics for		MN_SWMU	Summary Statistics for		ln(MN_SWMU15)
Number of Samples		16	Minimum		5.913503
Minimum		370	Maximum		6.666957
Maximum		786	Mean		6.433908
Mean		631.6875	Standard Deviation		0.183112
Median		640.5	Variance		0.03353
Standard Deviation		103.1993			
Variance		10650.1	Shapiro-Wilk Test Statisitic		0.876597
Coefficient of Variation		0.163371	Shapiro-Wilk 5% Critical Value		0.887
Skewness		-0.985515	Data Not Lognormal at 5% Significance Level		
			Try Normal or Non-parametric UCL		
Shapiro-Wilk Test Statisitic		0.940744			
Shapiro-Wilk 5% Critical Value		0.887	Estimates Assuming Lognormal Distribution		
Data Are Normal at 0.05 Significance Level			MLE Mean		633.1285
Recommended UCL to use		Student's t	MLE Standard Deviation		116.9122
			MLE Coefficient of Variation		0.184658
95	% UCL (Normal Data)		MLE Skewness		0.56027
Student's t		676.9159	MLE Median		622.6025
			MLE 80% Quantile		726.7904
95	% UCL (Adjusted for Skewness)		MLE 90% Quantile		787.771
Adjusted CLT		667.3324	MLE 95% Quantile		841.4511
Modified t		675.8565	MLE 99% Quantile		953.2024
95	% Non-parametric UCL		MVU Estimate of Median		621.9505
CLT		674.1244	MVU Estimate of Mean		632.4563
Jackknife		676.9159	MVU Estimate of Std. Dev.		116.3456
Standard Bootstrap		672.821	MVU Estimate of SE of Mean		29.08486
Bootstrap t		670.9012			
Chebyshev (Mean, Std)		744.1463	UCL Assuming Lognormal Distribution		
			95% H-UCL		689.1057
			95% Chebyshev (MVUE) UCL		759.2342
			99% Chebyshev (MVUE) UCL		921.8469
			Recommended UCL to use:		
				Student's t or H-UCL	

Appendix I
Screening Criteria (PRGs and MCLs) and Background Information

Appendix I-1
EPA Region 9 PRG Tables (10/01/02)

Key : SFo,.. ..cer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation I=IRIS h=HEAST n=NCEA x=Withdrawn o=Other t.. . ..ource r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
++++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.			Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
8.7E-03	i	4.0E-03	i	8.7E-03	r	4.0E-03	r	0	0.10	30560-19-1		Acephate	5.6E+01	ca**	2.0E+02	ca*	7.7E-01	ca*	7.7E+00	ca*		
				7.7E-03	i	2.6E-03	i	1		75-07-0		Acetaldehyde	1.1E+01	ca**	2.3E+01	ca**	8.7E-01	ca*	1.7E+00	ca		
		2.0E-02	i			2.0E-02	r	0	0.10	34256-82-1		Acetochlor	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	I			1.0E-01	r	1		67-64-1		Acetone	1.6E+03	nc	6.0E+03	nc	3.7E+02	nc	6.1E+02	nc	1.6E+01	8.0E-01
		8.0E-04	h			8.0E-04	r	0	0.10	75-86-5		Acetone cyanohydrin	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc		
		1.7E-02	r			1.7E-02	i	1		75-05-8		**Acetonitrile**	4.2E+02	nc	1.8E+03	nc	6.2E+01	nc	1.0E+02	nc		
		2.0E-02	h			5.7E-06	i	1		107-02-8		Acrolein	1.0E-01	nc	3.4E-01	nc	2.1E-02	nc	4.2E-02	nc		
4.5E+00	i	2.0E-04	i	4.5E+00	i	2.0E-04	r	0	0.10	79-06-1		Acrylamide	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca		
		5.0E-01	i			2.9E-04	I	0	0.10	79-10-7		Acrylic acid	2.9E+04	nc	1.0E+05	max	1.0E+00	nc	1.8E+04	nc		
5.4E-01	i	1.0E-03	h	2.4E-01	i	5.7E-04	I	1		107-13-1		Acrylonitrile	2.1E-01	ca*	4.9E-01	ca*	2.8E-02	ca*	3.9E-02	ca*		
8.1E-02	h	1.0E-02	i	8.0E-02	r	1.0E-02	r	0	0.10	15972-60-8		Alachlor	6.0E+00	ca	2.1E+01	ca	8.4E-02	ca	8.4E-01	ca		
		1.5E-01	i			1.5E-01	r	0	0.10	1596-84-5		Alar	9.2E+03	nc	9.2E+04	nc	5.5E+02	nc	5.5E+03	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	116-06-3		Aldicarb	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	1646-88-4		Aldicarb sulfone	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
1.7E+01	i	3.0E-05	I	1.7E+01	I	3.0E-05	r	0	0.10	309-00-2		Aldrin	2.9E-02	ca*	1.0E-01	ca	3.9E-04	ca	4.0E-03	ca	5.0E-01	2.0E-02
		2.5E-01	i			2.5E-01	r	0	0.10	74223-64-6		Ally	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	107-18-6		Allyl alcohol	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		5.0E-02	h			2.9E-04	I	0	0.10	107-05-1		Allyl chloride	3.0E+03	nc	3.0E+04	nc	1.0E+00	nc	1.8E+03	nc		
		1.0E+00	n			1.4E-03	n	0		7429-90-5		Aluminum	7.6E+04	nc	1.0E+05	max	5.1E+00	nc	3.6E+04	nc		
		4.0E-04	I					0		20859-73-8		Aluminum phosphide	3.1E+01	nc	4.1E+02	nc			1.5E+01	nc		
		3.0E-04	i			3.0E-04	r	0	0.10	67485-29-4		Amdro	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
		9.0E-03	i			9.0E-03	r	0	0.10	834-12-8		Ametryn	5.5E+02	nc	5.5E+03	nc	3.3E+01	nc	3.3E+02	nc		
		7.0E-02	h			7.0E-02	r	0	0.10	591-27-5		m-Aminophenol	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-05	h			2.0E-05	r	0	0.10	504-24-5		4-Aminopyridine	1.2E+00	nc	1.2E+01	nc	7.3E-02	nc	7.3E-01	nc		
		2.5E-03	i			2.5E-03	r	0	0.10	33089-61-1		Amitraz	1.5E+02	nc	1.5E+03	nc	9.1E+00	nc	9.1E+01	nc		
						2.9E-02	I			7664-41-7		Ammonia					1.0E+02	nc				
		2.0E-01	i					0	0.10	7773-06-0		Ammonium sulfamate	1.2E+04	nc	1.0E+05	max			7.3E+03	nc		
5.7E-03	I	7.0E-03	n	5.7E-03	r	2.9E-04	I	0	0.10	62-53-3		Aniline	8.5E+01	ca**	3.0E+02	ca*	1.0E+00	nc	1.2E+01	ca*		
		4.0E-04	i					0		7440-36-0		Antimony and compounds	3.1E+01	nc	4.1E+02	nc			1.5E+01	nc	5.0E+00	3.0E-01
		5.0E-04	h					0		1314-60-9		Antimony pentoxide	3.9E+01	nc	5.1E+02	nc			1.8E+01	nc		
		9.0E-04	h					0		28300-74-5		Antimony potassium tartrate	7.0E+01	nc	9.2E+02	nc			3.3E+01	nc		
		4.0E-04	h					0		1332-81-6		Antimony tetroxide	3.1E+01	nc	4.1E+02	nc			1.5E+01	nc		
		4.0E-04	h			5.7E-05	i	0		1309-64-4		Antimony trioxide	3.1E+01	nc	4.1E+02	nc	2.1E-01	nc	1.5E+01	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	74115-24-5		Apollo	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
2.5E-02	i	5.0E-02	h	2.5E-02	I	5.0E-02	r	0	0.10	140-57-8		Aramite	1.9E+01	ca	6.9E+01	ca	2.7E-01	ca	2.7E+00	ca		
		3.0E-04	i					0	0.03	7440-38-2		Arsenic (noncancer endpoint)	2.2E+01	nc	2.6E+02	nc						

Key : SF_o,i=Cancer Slope Factor oral, inhalation RfD_o,i=Referenca Dose oral, Inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancar PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		VOC	skin abs. soils	CAS No.			Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
1.5E+00	i	3.0E-04	i	1.5E+01	i			0	0.03	7440-38-2		Arsenic (cancer endpoint)	3.9E-01	ca*	1.6E+00	ca	4.5E-04	ca	4.5E-02	ca	2.9E+01	1.0E+00
						1.4E-05	i	0		7784-42-1		Arsine (see arsenic for cancer endpoint)					5.2E-02	nc				
		9.0E-03	i			9.0E-03	r		0.10	76578-12-6		Assure	5.5E+02	nc	5.5E+03	nc	3.3E+01	nc	3.3E+02	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	3337-71-1		Asulam	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
2.2E-01	h	3.5E-02	h	2.2E-01	r	3.5E-02	r	0	0.10	1912-24-9		Atrazine	2.2E+00	ca	7.8E+00	ca	3.1E-02	ca	3.0E-01	ca		
		4.0E-04	i			4.0E-04	r	0	0.10	71751-41-2		Avermectin B1	2.4E+01	nc	2.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
1.1E-01	i			1.1E-01	i			0	0.10	103-33-3		Azobenzene	4.4E+00	ca	1.6E+01	ca	6.2E-02	ca	6.1E-01	ca		
		7.0E-02	i			1.4E-04	h	0		7440-39-3		Barium and compounds	5.4E+03	nc	6.7E+04	nc	5.2E-01	nc	2.6E+03	nc	1.6E+03	8.2E+01
		4.0E-03	i			4.0E-03	r	0	0.10	114-26-1		Baygon	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		3.0E-02	i			3.0E-02	r	0	0.10	43121-43-3		Bayleton	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	68359-37-5		Baythroid	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-01	i			3.0E-01	r	0	0.10	1861-40-1		Benefin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	17804-35-2		Benomyl	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		3.0E-02	i			3.0E-02	r	0	0.10	25057-89-0		Bentazon	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	100-52-7		Benzaldehyde	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
5.5E-02	i	3.0E-03	n	2.9E-02	i	1.7E-03	n	1		71-43-2		Benzene	6.0E-01	ca*	1.3E+00	ca*	2.3E-01	ca*	3.4E-01	ca*	3.0E-02	2.0E-03
2.3E+02	i	3.0E-03	i	2.3E+02	i	3.0E-03	r	0	0.10	92-87-5		Benzidine	2.1E-03	ca	7.5E-03	ca	2.9E-05	ca	2.9E-04	ca		
		4.0E+00	i			4.0E+00	r	0	0.10	65-85-0		Benzoic acid	1.0E+05	max	1.0E+05	max	1.5E+04	nc	1.5E+05	nc	4.0E+02	2.0E+01
1.3E+01	i			1.3E+01	r			0	0.10	98-07-7		Benzotrichloride	3.7E-02	ca	1.3E-01	ca	5.2E-04	ca	5.2E-03	ca		
		3.0E-01	h			3.0E-01	r	0	0.10	100-51-6		Benzyl alcohol	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
1.7E-01	i	2.9E-03	r	1.7E-01	r	2.9E-03	n	1		100-44-7		**Benzyl chloride**	8.9E-01	ca*	2.2E+00	ca	4.0E-02	ca	6.6E-02	ca		
		2.0E-03	i	8.4E+00	i	5.7E-06	i	0		7440-41-7		Beryllium and compounds	1.5E+02	nc	1.9E+03	ca**	8.0E-04	ca*	7.3E+01	nc	6.3E+01	3.0E+00
		1.0E-04	i			1.0E-04	r	0	0.10	141-66-2		Bidrin	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
		1.5E-02	i			1.5E-02	r	0	0.10	82657-04-3		Biphenthrin (Talstar)	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
		5.0E-02	i			5.0E-02	r	1		92-52-4		1,1-Biphenyl	3.5E+02	sat	3.5E+02	sat	1.8E+02	nc	3.0E+02	nc		
1.1E+00	i			1.2E+00	i			1		111-44-4		Bis(2-chloroethyl)ether	2.1E-01	ca	5.5E-01	ca	5.8E-03	ca	9.8E-03	ca	4.0E-04	2.0E-05
7.0E-02	x	4.0E-02	i	3.5E-02	x	4.0E-02	r	1		39638-32-9		Bis(2-chloroisopropyl)ether	2.9E+00	ca	7.4E+00	ca	1.9E-01	ca	2.7E-01	ca		
2.2E+02	i			2.2E+02	i			1		542-88-1		Bis(chloromethyl)ether	1.9E-04	ca	4.3E-04	ca	3.1E-05	ca	5.2E-05	ca		
7.0E-02	x	4.0E-02	i	3.5E-02	x	4.0E-02	r	1		108-60-1		Bis(2-chloro-1-methylethyl)ether	2.9E+00	ca	7.4E+00	ca	1.9E-01	ca	2.7E-01	ca		
1.4E-02	i	2.0E-02	i	1.4E-02	r	2.2E-02	r	0	0.10	117-81-7		Bis(2-ethylhexyl)phthalate (DEHP)	3.5E+01	ca*	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.0E-02	i			5.0E-02	r	0	0.10	80-05-7		Bisphenol A	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		2.0E-01	i			5.7E-03	x	0		7440-42-8		**Boron**	1.6E+04	nc	1.0E+05	max	2.1E+01	nc	7.3E+03	nc		
						2.0E-04	h	0		7637-07-2		Boron trifluoride					7.3E-01	nc				
		4.00E-03	i							15541-45-4		**Bromate**	3.1E+02	nc	4.1E+03	nc	0.0E+00		1.5E+02	nc		
		2.0E-02	n			2.9E-03	n	1		108-86-1		Bromobenzene	2.8E+01	nc	9.2E+01	nc	1.0E+01	nc	2.0E+01	nc		
6.2E-02	i	2.0E-02	i	6.2E-02	r	2.0E-02	r	1		75-27-4		Bromodichloromethane	8.2E-01	ca	1.8E+00	ca	1.1E-01	ca	1.8E-01	ca	6.0E-01	3.0E-02

Key: SFo, ...ancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other ... source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION											CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFI 1/(mg/kg-d)		RfDI (mg/kg-d)		VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
7.9E-03	i	2.0E-02	i	3.9E-03	i	2.0E-02	r	0	0.10	75-25-2	Bromoform (tribromomethane)	6.2E+01	ca*	2.2E+02	ca*	1.7E+00	ca*	8.5E+00	ca*	8.0E-01	4.0E-02
		1.4E-03	i			1.4E-03	i	1		74-63-9	Bromomethane (Methyl bromide)	3.9E+00	nc	1.3E+01	nc	5.2E+00	nc	8.7E+00	nc	2.0E-01	1.0E-02
		5.0E-03	h			5.0E-03	r	0	0.10	2104-96-3	Bromophos	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	1689-84-5	Bromoxynil	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	1689-99-2	Bromoxynil octanoate	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
9.8E-01	r			9.8E-01	i			1		106-99-0	**1,3-Butadiene**	6.5E-03	ca	1.4E-02	ca	6.9E-03	ca	1.1E-02	ca		
		1.0E-01	i			2.6E-03	n	0	0.10	71-36-3	**1-Butanol**	6.1E+03	nc	6.1E+04	nc	9.5E+00	nc	3.6E+03	nc	1.7E+01	9.0E-01
		5.0E-02	i			5.0E-02	r	0	0.10	2008-41-5	Butylate	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.00E-02	n			4.00E-02	r	1		104-51-8	**n-Butylbenzene**	2.4E+02	sat	2.4E+02	sat	1.5E+02	nc	2.4E+02	nc		
		4.00E-02	n			4.00E-02	r	1		135-9-88	**sec-Butylbenzene**	2.2E+02	sat	2.2E+02	sat	1.5E+02	nc	2.4E+02	nc		
		4.00E-02	n			4.00E-02	r	1		98-06-6	**tert-Butylbenzene**	3.9E+02	sat	3.9E+02	sat	1.5E+02	nc	2.4E+02	nc		
		2.0E-01	i			2.0E-01	r	0	0.10	85-68-7	Butyl benzyl phthalate	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc	9.3E+02	8.1E+02
		1.0E+00	i			1.0E+00	r	0	0.10	85-70-1	Butylphthalyl butylglycolate	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
2.5E-01	h	3.0E-04	h	2.5E-01	r	3.0E-04	r	0	0.10	75-60-5	**Cacodylic acid**	1.9E+00	ca**	6.9E+00	ca*	2.7E-02	ca*	2.7E-01	ca*		
		5.0E-04	i	6.3E+00	i			0	0.001	7440-43-9	Cadmium and compounds	3.7E+01	nc	4.5E+02	nc	1.1E-03	ca	1.8E+01	nc	8.0E+00	4.0E-01
		5.0E-01	i			5.0E-01	r	0	0.10	105-60-2	Caprolactam	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
8.6E-03	h	2.0E-03	i	8.6E-03	r	2.0E-03	r	0	0.10	2425-06-1	Captafol	5.7E+01	ca**	2.0E+02	ca**	7.8E-01	ca**	7.8E+00	ca**		
3.5E-03	h	1.3E-01	i	3.5E-03	r	1.3E-01	r	0	0.10	133-06-2	Captan	1.4E+02	ca*	4.9E+02	ca	1.9E+00	ca	1.9E+01	ca		
		1.0E-01	i			1.1E-01	r	0	0.10	83-25-2	Carbaryl	6.1E+03	nc	6.2E+04	nc	4.0E+02	nc	3.6E+03	nc		
2.0E-02	h			2.0E-02	r			0	0.10	86-74-8	Carbazole	2.4E+01	ca	8.6E+01	ca	3.4E-01	ca	3.4E+00	ca	6.0E-01	3.0E-02
		5.0E-03	i			5.0E-03	r	0	0.10	1563-66-2	Carbofuran	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		1.0E-01	i			2.0E-01	i	1		75-15-0	Carbon disulfide	3.6E+02	nc	7.2E+02	sat	7.3E+02	nc	1.0E+03	nc	3.2E+01	2.0E+00
1.3E-01	i	7.0E-04	i	5.3E-02	i	7.0E-04	r	1		56-23-5	Carbon tetrachloride	2.5E-01	ca**	5.5E-01	ca*	1.3E-01	ca*	1.7E-01	ca*	7.0E-02	3.0E-03
		1.0E-02	i			1.0E-02	r	0	0.10	55285-14-8	Carbosulfan	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	5234-68-4	Carboxin	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		1.5E-02	i			1.5E-02	r	0	0.10	133-90-4	Chloramben	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
4.0E-01	h			4.0E-01	r			0	0.10	118-75-2	Chloranil	1.2E+00	ca	4.3E+00	ca	1.7E-02	ca	1.7E-01	ca		
3.5E-01	i	5.0E-04	i	3.5E-01	i	2.0E-04	i	0	0.04	12789-03-6	Chlordane	1.6E+00	ca*	6.5E+00	ca*	1.9E-02	ca*	1.9E-01	ca*	1.0E+01	5.0E-01
		2.0E-02	i			2.0E-02	r	0	0.10	90982-32-4	Chlorimuron-ethyl	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i			5.71E-05	n			7782-50-5	Chlorine					2.1E-01	nc				
						5.7E-05	i			10049-04-4	Chlorine dioxide					2.1E-01	nc				
		2.0E-03	h			2.0E-03	r	0	0.10	79-11-8	Chloroacetic acid	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		8.6E-06	r			8.6E-06	i	1		532-27-4	2-Chloroacetophenone	3.3E-02	nc	1.1E-01	nc	3.1E-02	nc	5.2E-02	nc		
		4.0E-03	i			4.0E-03	r	0	0.10	106-47-8	4-Chloroaniline	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc	7.0E-01	3.0E-02
		2.0E-02	i			1.7E-02	n	1		108-90-7	Chlorobenzene	1.5E+02	nc	5.3E+02	nc	6.2E+01	nc	1.1E+02	nc	1.0E+00	7.0E-02

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION											CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
2.7E-01	h	2.0E-02	i	2.7E-01	h	2.0E-02	r	0	0.10	510-15-6	Chlorobenzilate	1.8E+00	ca	6.4E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-01	h			2.0E-01	r	0	0.10	74-11-3	p-Chlorobenzoic acid	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		2.0E-02	h			2.0E-02	r	0	0.10	98-56-6	4-Chlorobenzotrifluoride	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	h			2.0E-03	h	1		126-99-8	2-Chloro-1,3-butadiene	3.6E+00	nc	1.2E+01	nc	7.3E+00	nc	1.4E+01	nc		
		4.0E-01	h			4.0E-01	r	1		109-69-3	1-Chlorobutane	4.8E+02	sat	4.8E+02	sat	1.5E+03	nc	2.4E+03	nc		
		1.4E+01	r			1.4E+01	i	1		75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	3.4E+02	sat	3.4E+02	sat	5.2E+04	nc	8.7E+04	nc		
		1.4E+01	r			1.4E+01	i	1		75-45-6	Chlorodifluoromethane	3.4E+02	sat	3.4E+02	sat	5.1E+04	nc	8.5E+04	nc		
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	l	1		75-00-3	Chloroethane	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
		1.0E-02	i			8.6E-04	n	1		67-66-3	**Chloroform**	3.6E+00	ca/nc	1.2E+01	ca/nc	3.1E+00	ca/nc	6.2E+00	ca/nc	6.0E-01	3.0E-02
3.1E-02				1.9E-02				1			**Chloroform "CAL-Modified PRG"**	9.4E-01	ca	2.0E+00	ca	3.5E-01	ca	5.3E-01	ca		
1.3E-02	h			6.3E-03	h	8.6E-02	n	1		74-87-3	Chloromethane	1.2E+00	ca	2.6E+00	ca	1.1E+00	ca	1.5E+00	ca		
5.8E-01	h			5.8E-01	r			0	0.10	95-69-2	4-Chloro-2-methylaniline	8.4E-01	ca	3.0E+00	ca	1.2E-02	ca	1.2E-01	ca		
4.6E-01	h			4.6E-01	r			0	0.10	3165-93-3	4-Chloro-2-methylaniline hydrochloride	1.1E+00	ca	3.7E+00	ca	1.5E-02	ca	1.5E-01	ca		
		8.0E-02	i			8.0E-02	r	1		91-58-7	beta-Chloronaphthalene	4.9E+03	nc	2.3E+04	nc	2.9E+02	nc	4.9E+02	nc		
9.7E-03	h	1.0E-03	h	9.7E-03	r	2.0E-05	h	1		88-73-3	**o-Chloronitrobenzene**	1.4E+00	nc**	4.5E+00	nc**	7.3E-02	nc**	1.5E-01	nc**		
6.7E-03	h	1.0E-03	h	6.7E-03	r	1.7E-04	h	1		100-00-5	**p-Chloronitrobenzene**	1.0E+01	nc**	3.7E+01	nc**	6.2E-01	nc**	1.2E+00	nc**		
		5.0E-03	i			5.0E-03	r	1		95-57-8	2-Chlorophenol	6.3E+01	nc	2.4E+02	nc	1.8E+01	nc	3.0E+01	nc	4.0E+00	2.0E-01
		2.9E-02	r			2.9E-02	h	1		75-29-6	2-Chloropropane	1.7E+02	nc	5.9E+02	nc	1.0E+02	nc	1.7E+02	nc		
1.1E-02	h	1.5E-02	i	1.1E-02	r	1.5E-02	r	0	0.10	1897-45-6	Chlorothalonil	4.4E+01	ca*	1.6E+02	ca*	6.1E-01	ca*	6.1E+00	ca*		
		2.0E-02	i			2.0E-02	r	1		95-49-8	o-Chlorotoluene	1.6E+02	nc	5.6E+02	nc	7.3E+01	nc	1.2E+02	nc		
		2.0E-01	i			2.0E-01	r	0	0.10	101-21-3	Chlorpropham	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		3.0E-03	i			3.0E-03	r	0	0.10	2921-88-2	Chlorpyrifos	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		1.0E-02	h			1.0E-02	r	0	0.10	5598-13-0	Chlorpyrifos-methyl	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	64902-72-3	Chlorsulfuron	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		8.0E-04	h			8.0E-04	r	0	0.10	60238-56-4	Chlorthiophos	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc		
				4.2E+01	i			0			Total Chromium (1:6 ratio Cr VI:Cr III)+++	2.1E+02	ca	4.5E+02	ca	1.6E-04	ca			3.8E+01	2.0E+00
		1.5E+00	i							16065-83-1	Chromium III	1.0E+05	max	1.0E+05	max	0.0E+00		5.5E+04	nc		
		3.0E-03	i	2.9E+02	i	2.2E-06	i	0		18540-29-9	Chromium VI+++	3.0E+01	ca**	6.4E+01	ca	2.3E-05	ca	1.1E+02	nc	3.8E+01	2.0E+00
		2.00E-02	n	9.8E+00	n	5.7E-06	n			7440-48-4	**Cobalt**	9.0E+02	ca**	1.9E+03	ca*	6.9E-04	ca*	7.3E+02	nc		
				2.2E+00	i			0		8007-45-2	Coke Oven Emissions					3.1E-03	ca				
		4.00E-02	h					0		7440-50-8	Copper and compounds	3.1E+03	nc	4.1E+04	nc			1.5E+03	nc		
1.9E+00	h			1.9E+00	r			1		123-73-9	Crotonaldehyde	5.3E-03	ca	1.1E-02	ca	3.5E-03	ca	5.9E-03	ca		
		1.0E-01	i			1.1E-01	i	1		98-82-8	Cumene (isopropylbenzene)	5.7E+02	nc	2.0E+03	nc	4.0E+02	nc	6.6E+02	nc		
8.4E-01	h	2.0E-03	h	8.4E-01	r	2.0E-03	r	0	0.10	21725-46-2	Cyanazine	5.8E-01	ca	2.1E+00	ca	8.0E-03	ca	8.0E-02	ca		
		2.0E-02	i					0	0.10	57-12-5	Cyanide (free)	1.2E+03	nc	1.2E+04	nc			7.3E+02	nc		
		2.0E-02	i			8.6E-04	i	1		74-90-8	Cyanide (hydrogen)	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc		

Key : SFo, ..cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other ..r Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.			Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		4.0E-02	i			4.0E-02	r	1		460-19-5		Cyanogen	1.3E+02	nc	4.3E+02	nc	1.5E+02	nc	2.4E+02	nc		
		9.0E-02	i			9.0E-02	r	1		506-68-3		Cyanogen bromide	2.9E+02	nc	9.7E+02	nc	3.3E+02	nc	5.5E+02	nc		
		5.0E-02	i			5.0E-02	r	1		506-77-4		Cyanogen chloride	1.6E+02	nc	5.4E+02	nc	1.8E+02	nc	3.0E+02	nc		
		5.7E+00	r			5.7E+00	n	1		110-82-7		Cyclohexane	1.4E+02	sat	1.4E+02	sat	2.1E+04	nc	3.5E+04	nc		
		5.0E+00	i			5.0E+00	r	0	0.10	108-94-1		Cyclohexanone	1.0E+05	max	1.0E+05	max	1.8E+04	nc	1.8E+05	nc		
		2.0E-01	i			2.0E-01	r	0	0.10	108-91-8		Cyclohexylamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	68085-85-8		Cyhalothrin/Karate	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	52315-07-8		Cypermethrin	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		7.5E-03	i			7.5E-03	r	0	0.10	66215-27-8		Cyromazine	4.6E+02	nc	4.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	1861-32-1		Dacthal	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		3.0E-02	i			3.0E-02	r	0	0.10	75-99-0		Dalapon	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	39515-41-8		Danitol	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
2.4E-01	i			2.4E-01	r			0	0.03	72-54-8		DDD	2.4E+00	ca	1.0E+01	ca	2.8E-02	ca	2.8E-01	ca	1.6E+01	8.0E-01
3.4E-01	i			3.4E-01	r			0	0.03	72-55-9		DDE	1.7E+00	ca	7.0E+00	ca	2.0E-02	ca	2.0E-01	ca	5.4E+01	3.0E+00
3.4E-01	i	5.0E-04	i	3.4E-01	i	5.0E-04	r	0	0.03	50-29-3		DDT	1.7E+00	ca*	7.0E+00	ca*	2.0E-02	ca*	2.0E-01	ca*	3.2E+01	2.0E+00
		1.0E-02	i			1.0E-02	r	0	0.10	1163-19-5		Decabromodiphenyl ether	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		4.0E-05	i			4.0E-05	r	0	0.10	8065-48-3		Demeton	2.4E+00	nc	2.5E+01	nc	1.5E-01	nc	1.5E+00	nc		
6.1E-02	h			6.1E-02	r			0	0.10	2303-16-4		Diallate	8.0E+00	ca	2.8E+01	ca	1.1E-01	ca	1.1E+00	ca		
		9.0E-04	h			9.0E-04	r	0	0.10	333-41-5		Diazinon	5.5E+01	nc	5.5E+02	nc	3.3E+00	nc	3.3E+01	nc		
		4.0E-03	n			4.0E-03	r	1		132-64-9		Dibenzofuran	2.9E+02	nc	3.1E+03	nc	1.5E+01	nc	2.4E+01	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	106-37-6		1,4-Dibromobenzene	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
8.4E-02	i	2.0E-02	i	8.4E-02	r	2.0E-02	r	1		124-48-1		Dibromochloromethane	1.1E+00	ca	2.6E+00	ca	8.0E-02	ca	1.3E-01	ca	4.0E-01	2.0E-02
1.4E+00	h	5.7E-05	r	2.4E-03	x	5.7E-05	i	1		96-12-8		1,2-Dibromo-3-chloropropane	4.5E-01	ca**	2.0E+00	ca**	2.1E-01	nc	4.8E-02	ca**		
7.0E+00				7.0E+00				1		96-12-8		**"CAL-Modified PRG"**	1.9E-02	ca	4.6E-02	ca	9.6E-04	ca	1.6E-03	ca		
8.5E+01	i	5.7E-05	r	7.7E-01	i	5.7E-05	h	1		106-93-4		1,2-Dibromoethane	6.9E-03	ca	2.8E-02	ca*	8.7E-03	ca*	7.6E-04	ca		
		1.0E-01	i			1.0E-01	r	0	0.10	84-74-2		Dibutyl phthalate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc	2.3E+03	2.7E+02
		3.0E-02	i			3.0E-02	r	0	0.10	1918-00-9		Dicamba	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		9.0E-02	i			5.7E-02	h	1		95-50-1		1,2-Dichlorobenzene	3.7E+02	sat	3.7E+02	sat	2.1E+02	nc	3.7E+02	nc	1.7E+01	9.0E-01
		9.00E-04	n			9.00E-04	r	1		541-73-1		1,3-Dichlorobenzene	1.6E+01	nc	6.3E+01	nc	3.3E+00	nc	5.5E+00	nc		
2.4E-02	h	3.00E-02	n	2.2E-02	n	3.00E-02	i	1		106-46-7		1,4-Dichlorobenzene	3.4E+00	ca	7.9E+00	ca	3.1E-01	ca	5.0E-01	ca	2.0E+00	1.0E-01
4.5E-01	i			4.5E-01	r			0	0.10	91-94-1		3,3-Dichlorobenzidine	1.1E+00	ca	3.8E+00	ca	1.5E-02	ca	1.5E-01	ca	7.0E-03	3.0E-04
		3.00E-02	n			3.00E-02	r		0.10	90-98-2		4,4'-Dichlorobenzophenone	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
9.3E+00	r			9.3E+00	h			1		764-41-0		1,4-Dichloro-2-butene	7.9E-03	ca	1.8E-02	ca	7.2E-04	ca	1.2E-03	ca		
		2.0E-01	i			5.7E-02	h	1		75-71-6		Dichlorodifluoromethane	9.4E+01	nc	3.1E+02	nc	2.1E+02	nc	3.9E+02	nc		
		1.0E-01	h			1.4E-01	h	1		75-34-3		1,1-Dichloroethane	5.1E+02	nc	1.7E+03	nc	5.2E+02	nc	8.1E+02	nc	2.3E+01	1.0E+00
5.7E-03				5.7E-03				1				"CAL-Modified PRG"	2.8E+00	ca	6.0E+00	ca	1.2E+00	ca	2.0E+00	ca		

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.			Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
9.1E-02	i	3.0E-02	n	9.1E-02	i	1.4E-03	n	1		107-06-2		1,2-Dichloroethane (EDC)	2.8E-01	ca*	6.0E-01	ca*	7.4E-02	ca*	1.2E-01	ca*	2.0E-02	1.0E-03
		5.0E-02	i			5.7E-02	i	1		75-35-4		**1,1-Dichloroethylene**	1.2E+02	nc	4.1E+02	nc	2.1E+02	nc	3.4E+02	nc	6.0E-02	3.0E-03
		1.0E-02	h			1.0E-02	r	1		156-59-2		1,2-Dichloroethylene (cis)	4.3E+01	nc	1.5E+02	nc	3.7E+01	nc	6.1E+01	nc	4.0E-01	2.0E-02
		2.0E-02	i			2.0E-02	r	1		156-60-5		1,2-Dichloroethylene (trans)	6.9E+01	nc	2.3E+02	nc	7.3E+01	nc	1.2E+02	nc	7.0E-01	3.0E-02
		3.0E-03	i			3.0E-03	r	0	0.10	120-83-2		2,4-Dichlorophenol	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc	1.0E+00	5.0E-02
		8.0E-03	i			8.0E-03	r	0	0.10	94-82-6		4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.05	94-75-7		2,4-Dichlorophenoxyacetic Acid (2,4-D)	6.9E+02	nc	7.7E+03	nc	3.7E+01	nc	3.6E+02	nc		
6.8E-02	h	1.1E-03	r	8.8E-02	r	1.1E-03	i	1		78-87-5		1,2-Dichloropropane	3.4E-01	ca*	7.4E-01	ca*	9.9E-02	ca*	1.6E-01	ca*	3.0E-02	1.0E-03
1.0E-01	i	3.00E-02	i	1.4E-02	i	5.7E-03	i	1		542-75-6		1,3-Dichloropropene	7.8E-01	ca	1.8E+00	ca	4.8E-01	ca	4.0E-01	ca	4.0E-03	2.0E-04
		3.0E-03	i			3.0E-03	r	0	0.10	616-23-9		2,3-Dichloropropanol	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
2.9E-01	i	5.0E-04	i	2.9E-01	r	1.4E-04	i	0	0.10	62-73-7		Dichlorvos	1.7E+00	ca*	5.9E+00	ca*	2.3E-02	ca*	2.3E-01	ca*		
4.4E-01	x			4.4E-01	r			0	0.10	115-32-2		Dicofol	1.1E+00	ca	3.9E+00	ca	1.5E-02	ca	1.5E-01	ca		
		3.0E-02	h			5.7E-05	x	1		77-73-6		Dicyclopentadiene	5.4E-01	nc	1.8E+00	nc	2.1E-01	nc	4.2E-01	nc		
1.6E+01	i	5.0E-05	i	1.6E+01	i	5.0E-05	r	0	0.10	60-57-1		Dieldrin	3.0E-02	ca	1.1E-01	ca	4.2E-04	ca	4.2E-03	ca	4.0E-03	2.0E-04
		1.0E-02	h			5.7E-03	h	0	0.10	112-34-5		**Diethylene glycol, monobutyl ether**	6.1E+02	nc	6.2E+03	nc	2.1E+01	nc	3.6E+02	nc		
		8.0E-02	h			8.6E-04	h	0	0.10	111-90-0		**Diethylene glycol, monomethyl ether**	3.7E+03	nc	3.7E+04	nc	3.1E+00	nc	2.2E+03	nc		
		4.0E-03	h			4.0E-03	r	0	0.10	617-84-5		**Diethylformamide**	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
1.2E-03	i	6.0E-01	i	1.2E-03	r	6.0E-01	r	0	0.10	103-23-1		Di(2-ethylhexyl)adipate	4.1E+02	ca	1.4E+03	ca	5.6E+00	ca	5.6E+01	ca		
		8.0E-01	i			8.0E-01	r	0	0.10	84-66-2		Diethyl phthalate	4.9E+04	nc	1.0E+05	max	2.9E+03	nc	2.9E+04	nc		
4.7E+03	h			4.7E+03	r			0	0.10	56-53-1		Diethylstilbestrol	1.0E-04	ca	3.7E-04	ca	1.4E-06	ca	1.4E-05	ca		
		8.0E-02	i			8.0E-02	r	0	0.10	43222-48-6		Difenzoquat (Avenge)	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	35367-38-5		Diflubenzuron	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.1E+01	r			1.1E+01	i	1		75-37-6		1,1-Difluoroethane					4.2E+04	nc	6.9E+04	nc		
		2.00E-02	n			2.00E-02	r		0.10	28553-12-0		Diisononyl phthalate	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		8.0E-02	i			8.0E-02	r	0	0.10	1445-75-6		Diisopropyl methylphosphonate	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	55290-64-7		Dimethipin	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-04	i			2.0E-04	r	0	0.10	60-51-5		Dimethoate	1.2E+01	nc	1.2E+02	nc	7.3E-01	nc	7.3E+00	nc		
1.4E-02	h			1.4E-02	r			0	0.10	119-90-4		3,3'-Dimethoxybenzidine	3.5E+01	ca	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
		5.7E-06	r			5.7E-06	x	1		124-40-3		Dimethylamine	6.7E-02	nc	2.5E-01	nc	2.1E-02	nc	3.5E-02	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	121-69-7		N-N-Dimethylaniline	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
7.5E-01	h			7.5E-01	r			0	0.10	95-68-1		2,4-Dimethylaniline	6.5E-01	ca	2.3E+00	ca	9.0E-03	ca	9.0E-02	ca		
5.8E-01	h			5.8E-01	r			0	0.10	21436-96-4		2,4-Dimethylaniline hydrochloride	8.4E-01	ca	3.0E+00	ca	1.2E-02	ca	1.2E-01	ca		
9.2E+00	h			9.2E+00	r			0	0.10	119-93-7		3,3'-Dimethylbenzidine	5.3E-02	ca	1.9E-01	ca	7.3E-04	ca	7.3E-03	ca		
		1.0E-01	h			8.6E-03	i	0	0.10	68-12-2		N,N-Dimethylformamide	6.1E+03	nc	6.2E+04	nc	3.1E+01	nc	3.6E+03	nc		
		1.0E-03	n			1.0E-03	r	0	0.10	122-09-8		Dimethylphenethylamine	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	105-67-9		2,4-Dimethylphenol	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc	9.0E+00	4.0E-01

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		6.0E-04	i			6.0E-04	r	0	0.10	576-26-1	2,6-Dimethylphenol	3.7E+01	nc	3.7E+02	nc	2.2E+00	nc	2.2E+01	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	95-65-8	3,4-Dimethylphenol	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E+01	h			1.0E+01	r	0	0.10	131-11-3	Dimethyl phthalate	1.0E+05	max	1.0E+05	max	3.7E+04	nc	3.6E+05	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	120-61-6	Dimethyl terephthalate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	131-89-5	4,6-Dinitro-o-cyclohexyl phenol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.0E-04	h			1.0E-04	r	0	0.10	528-29-0	**1,2-Dinitrobenzene**	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
		1.0E-04	i			1.0E-04	r	0	0.10	99-65-0	1,3-Dinitrobenzene	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
		1.0E-04	h			1.0E-04	r	0	0.10	100-25-4	**1,4-Dinitrobenzene**	6.1E+00	nc	6.2E+01	nc	3.7E-01	nc	3.6E+00	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	51-28-5	2,4-Dinitrophenol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	3.0E-01	1.0E-02
6.8E-01	i			6.8E-01	r			0	0.10	25321-14-6	Dinitrotoluene mixture	7.2E-01	ca	2.5E+00	ca	9.9E-03	ca	9.9E-02	ca	8.0E-04	4.0E-05
		2.0E-03	i			2.0E-03	r	0	0.10	121-14-2	2,4-Dinitrotoluene (see DNT mixture for "ca")	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc	8.0E-04	4.0E-05
		1.0E-03	h			1.0E-03	r	0	0.10	606-20-2	2,6-Dinitrotoluene (see DNT mixture for "ca")	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc	7.0E-04	3.0E-05
		1.0E-03	i			1.0E-03	r	0	0.10	86-65-7	Dinoseb	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		4.0E-02	h			4.0E-02	r	0	0.10	117-84-0	**di-n-Octyl phthalate**	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc	1.0E+04	1.0E+04
1.1E-02	i			1.1E-02	r			0	0.10	123-91-1	1,4-Dioxane	4.4E+01	ca	1.6E+02	ca	6.1E-01	ca	6.1E+00	ca		
1.5E+05	h			1.5E+05	h			0	0.03	1746-01-6	Dioxin (2,3,7,8-TCDD)	3.9E-06	ca	1.6E-05	ca	4.5E-08	ca	4.5E-07	ca		
		3.0E-02	i			3.0E-02	r	0	0.10	957-51-7	Diphenamid	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	122-39-4	Diphenylamine	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.00E-04	n			3.00E-04	r		0.10	74-31-7	N,N-Diphenyl-1,4 benzenediamine (DPPD)	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
8.0E-01	i			7.7E-01	i			0	0.10	122-66-7	1,2-Diphenylhydrazine	6.1E-01	ca	2.2E+00	ca	8.7E-03	ca	8.4E-02	ca		
		3.0E-03	n			3.0E-03	r	0	0.10	127-63-9	**Diphenyl sulfone**	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		2.2E-03	i			2.2E-03	r	0	0.10	65-00-7	Diquat	1.3E+02	nc	1.4E+03	nc	8.0E+00	nc	8.0E+01	nc		
8.6E+00	h			8.6E+00	r			0	0.10	1937-37-7	Direct black 38	5.7E-02	ca	2.0E-01	ca	7.8E-04	ca	7.8E-03	ca		
8.1E+00	h			8.1E+00	r			0	0.10	2602-46-2	Direct blue 6	6.0E-02	ca	2.1E-01	ca	8.3E-04	ca	8.3E-03	ca		
9.3E+00	h			9.3E+00	r			0	0.10	16071-86-6	Direct brown 95	5.2E-02	ca	1.9E-01	ca	7.2E-04	ca	7.2E-03	ca		
		4.0E-05	i			4.0E-05	r	0	0.10	298-04-4	Disulfoton	2.4E+00	nc	2.5E+01	nc	1.5E-01	nc	1.5E+00	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	505-29-3	1,4-Dithiane	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	330-54-1	Diuron	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		4.0E-03	i			4.0E-03	r	0	0.10	2439-10-3	Dodine	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		2.0E-01	n							7429-91-6	Dysprosium	1.6E+04	nc	1.0E+05	max			7.3E+03	nc		
		6.0E-03	i			6.0E-03	r	0	0.10	115-29-7	Endosulfan	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc	1.8E+01	9.0E-01
		2.0E-02	i			2.0E-02	r	0	0.10	145-73-3	Endothall	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		3.0E-04	i			3.0E-04	r	0	0.10	72-20-8	Endrin	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc	1.0E+00	5.0E-02
9.9E-03	i	2.0E-03	h	4.2E-03	h	2.9E-04	i	1		106-89-6	Epichlorohydrin	7.6E+00	nc	2.6E+01	nc	1.0E+00	nc	2.0E+00	nc		
		5.7E-03	r			5.7E-03	i	0	0.10	106-88-7	1,2-Epoxybutane	3.5E+02	nc	3.5E+03	nc	2.1E+01	nc	2.1E+02	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	759-94-4	EPTC (S-Ethyl dipropylthiocarbamate)	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.			Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		5.0E-03	i			5.0E-03	r	0	0.10	16672-87-0		Ethephon (2-chloroethyl phosphonic acid)	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		5.0E-04	i			5.0E-04	r	0	0.10	563-12-2		Ethion	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
		4.0E-01	h			5.7E-02	i	0	0.10	110-80-5		2-Ethoxyethanol	2.4E+04	nc	1.0E+05	max	2.1E+02	nc	1.5E+04	nc		
		3.0E-01	h			3.0E-01	r	0	0.10	111-15-9		2-Ethoxyethanol acetate	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		9.0E-01	i			9.0E-01	r	1		141-78-6		Ethyl acetate	1.9E+04	nc	3.7E+04	sat	3.3E+03	nc	5.5E+03	nc		
4.8E-02	h			4.8E-02	r			1		140-88-5		Ethyl acrylate	2.1E-01	ca	4.5E-01	ca	1.4E-01	ca	2.3E-01	ca		
3.85E-03	r	1.0E-01	i	3.85E-03	n	2.9E-01	i	1		100-41-4		**Ethylbenzene**	8.9E+00	ca	2.0E+01	ca	1.7E+00	ca	2.9E+00	ca	1.3E+01	7.0E-01
2.9E-03	n	4.0E-01	n	2.9E-03	r	2.9E+00	i	1		75-00-3		Ethyl chloride	3.0E+00	ca	6.5E+00	ca	2.3E+00	ca	4.6E+00	ca		
		3.0E-01	h			3.0E-01	r	0	0.10	109-78-4		Ethylene cyanohydrin	1.8E+04	nc	1.0E+05	max	1.1E+03	nc	1.1E+04	nc		
		2.0E-02	h			2.0E-02	r	0	0.10	107-15-3		Ethylene diamine	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E+00	i			2.0E+00	r	0	0.10	107-21-1		Ethylene glycol	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		5.0E-01	i			3.7E+00	i	0	0.10	111-76-2		Ethylene glycol, monobutyl ether	3.1E+04	nc	1.0E+05	max	1.4E+04	nc	1.8E+04	nc		
1.0E+00	h			3.5E-01	h			1		75-21-8		Ethylene oxide	1.4E-01	ca	3.4E-01	ca	1.9E-02	ca	2.4E-02	ca		
1.1E-01	h	8.0E-05	i	1.1E-01	r	8.0E-05	r	0	0.10	96-45-7		Ethylene thiourea (ETU)	4.4E+00	ca**	1.6E+01	ca**	6.1E-02	ca**	6.1E-01	ca**		
		2.0E-01	i			2.0E-01	r	1		60-29-7		Ethyl ether	1.8E+03	sat	1.8E+03	sat	7.3E+02	nc	1.2E+03	nc		
		9.0E-02	h			9.0E-02	r	1		97-63-2		Ethyl methacrylate	1.4E+02	sat	1.4E+02	sat	3.3E+02	nc	5.5E+02	nc		
		1.0E-05	i			1.0E-05	r	0	0.10	2104-64-5		Ethyl p-nitrophenyl phenylphosphorothioate	6.1E-01	nc	6.2E+00	nc	3.7E-02	nc	3.6E-01	nc		
		3.0E+00	i			3.0E+00	r	0	0.10	84-72-0		Ethylphthalyl ethyl glycolate	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc		
		8.0E-03	i			8.0E-03	r	0	0.10	101200-48-0		Express	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc		
		2.5E-04	i			2.5E-04	r	0	0.10	22224-92-8		Fenamiphos	1.5E+01	nc	1.5E+02	nc	9.1E-01	nc	9.1E+00	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	2164-17-2		Fluometuron	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		6.0E-02	i					0	0.10	16984-48-8		Flouride	3.7E+03	nc	3.7E+04	nc			2.2E+03	nc		
		8.0E-02	i			8.0E-02	r	0	0.10	59756-60-4		Fluoridone	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	56425-91-3		Flurprimidol	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-02	i			6.0E-02	r	0	0.10	66332-96-5		Flutolanil	3.7E+03	nc	3.7E+04	nc	2.2E+02	nc	2.2E+03	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	69409-94-5		Fluvalinate	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
3.5E-03	i	1.0E-01	i	3.5E-03	r	1.0E-01	r	0	0.10	133-07-3		Folpet	1.4E+02	ca*	4.9E+02	ca	1.9E+00	ca	1.9E+01	ca		
1.9E-01	i			1.9E-01	r			0	0.10	72178-02-0		Fomesafen	2.6E+00	ca	9.1E+00	ca	3.5E-02	ca	3.5E-01	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	944-22-9		Fonofos	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		1.5E-01	i	4.5E-02	i			0	0.10	50-00-0		Formaldehyde	9.2E+03	nc	1.0E+05	nc	1.5E-01	ca	5.5E+03	nc		
		2.0E+00	h			2.0E+00	r	0	0.10	64-18-6		Formic Acid	1.0E+05	max	1.0E+05	max	7.3E+03	nc	7.3E+04	nc		
		3.0E+00	i			3.0E+00	r	0	0.10	39148-24-8		Fosetyl-al	1.0E+05	max	1.0E+05	max	1.1E+04	nc	1.1E+05	nc		
		3.0E+01	i			8.6E+00	h	1		76-13-1		Freon 113	5.6E+03	sat	5.6E+03	sat	3.1E+04	nc	5.9E+04	nc		
		1.0E-03	i			1.0E-03	r	1		110-00-9		Furan	2.5E+00	nc	8.5E+00	nc	3.7E+00	nc	6.1E+00	nc		
3.8E+00	h			3.8E+00	r			0	0.10	67-45-8		Furazolidone	1.3E-01	ca	4.5E-01	ca	1.8E-03	ca	1.8E-02	ca		
		3.0E-03	i			1.4E-02	h	0	0.10	98-01-1		Furfural	1.8E+02	nc	1.8E+03	nc	5.2E+01	nc	1.1E+02	nc		

Key : SF=Cancer Slope Factor oral, inhalation RfDo,i=Referanca Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other ...Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION										CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		VOC	skin abs. soils	CAS No.	Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
5.0E+01	h			5.0E+01	r			0	0.10	531-82-8	Furium	9.7E-03	ca	3.4E-02	ca	1.3E-04	ca	1.3E-03	ca		
3.0E-02	i			3.0E-02	r			0	0.10	60568-05-0	Furmecyclox	1.6E+01	ca	5.7E+01	ca	2.2E-01	ca	2.2E+00	ca		
		4.0E-04	i			4.0E-04	r	0	0.10	77182-82-2	Glufosinate-ammonium	2.4E+01	nc	2.5E+02	nc	1.5E+00	nc	1.5E+01	nc		
		4.0E-04	i			2.9E-04	h	0	0.10	765-34-4	Glycidaldehyde	2.4E+01	nc	2.5E+02	nc	1.0E+00	nc	1.5E+01	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	1071-83-6	Glyphosate	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		5.0E-05	i			5.0E-05	r	0	0.10	69806-40-2	Haloxyfop-methyl	3.1E+00	nc	3.1E+01	nc	1.8E-01	nc	1.8E+00	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	79277-27-3	Harmony	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
4.5E+00	i	5.0E-04	i	4.6E+00	i	5.0E-04	r	0	0.10	76-44-8	Heptachlor	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca	2.3E+01	1.0E+00
9.1E+00	i	1.3E-05	i	9.1E+00	i	1.3E-05	r	0	0.10	1024-57-3	Heptachlor epoxide	5.3E-02	ca*	1.9E-01	ca*	7.4E-04	ca*	7.4E-03	ca*	7.0E-01	3.0E-02
		2.0E-03	i			2.0E-03	r	0	0.10	87-82-1	Hexabromobenzene	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
1.6E+00	i	8.0E-04	i	1.6E+00	i	8.0E-04	r	0	0.10	118-74-1	Hexachlorobenzene	3.0E-01	ca	1.1E+00	ca	4.2E-03	ca	4.2E-02	ca	2.0E+00	1.0E-01
7.8E-02	i	3.00E-04	n	7.8E-02	i	3.00E-04	r	0	0.10	87-68-3	Hexachlorobutadiene	6.2E+00	ca**	2.2E+01	ca**	8.6E-02	ca*	8.6E-01	ca*	2.0E+00	1.0E-01
6.3E+00	i	5.0E-04	n	6.3E+00	i	5.0E-04	r	0	0.04	319-84-6	**HCH (alpha)**	9.0E-02	ca	3.6E-01	ca	1.1E-03	ca	1.1E-02	ca	5.0E-04	3.0E-05
1.8E+00	i	2.0E-04	n	1.8E+00	i	2.0E-04	r	0	0.04	319-85-7	**HCH (beta)**	3.2E-01	ca	1.3E+00	ca	3.7E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04
1.3E+00	h	3.0E-04	i	1.3E+00	r	3.0E-04	r	0	0.04	58-89-9	HCH (gamma) Lindane	4.4E-01	ca*	1.7E+00	ca	5.2E-03	ca	5.2E-02	ca	9.0E-03	5.0E-04
1.8E+00	i			1.8E+00	i			0	0.04	608-73-1	HCH-technical	3.2E-01	ca	1.3E+00	ca	3.8E-03	ca	3.7E-02	ca	3.0E-03	1.0E-04
		6.0E-03	i			5.7E-05	i	0	0.10	77-47-4	**Hexachlorocyclopentadiene**	3.7E+02	nc	3.7E+03	nc	2.1E-01	nc	2.2E+02	nc	4.0E+02	2.0E+01
1.4E-02	i	1.0E-03	i	1.4E-02	i	1.0E-03	r	0	0.10	67-72-1	Hexachloroethane	3.5E+01	ca**	1.2E+02	ca**	4.8E-01	ca**	4.8E+00	ca**	5.0E-01	2.0E-02
		3.0E-04	i			3.0E-04	r	0	0.10	70-30-4	Hexachlorophene	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0	0.10	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.4E+00	ca*	1.6E+01	ca	6.1E-02	ca	6.1E-01	ca		
		2.9E-06	r			2.9E-06	i	0	0.10	822-06-0	1,6-Hexamethylene diisocyanate	1.7E-01	nc	1.8E+00	nc	1.0E-02	nc	1.0E-01	nc		
		6.0E-02	h			5.7E-02	i	1		110-54-3	n-Hexane	1.1E+02	sat	1.1E+02	sat	2.1E+02	nc	3.5E+02	nc		
		3.3E-02	i			3.3E-02	r	0	0.10	51235-04-2	Hexazinone	2.0E+03	nc	2.0E+04	nc	1.2E+02	nc	1.2E+03	nc		
3.0E+00	i			1.7E+01	i			0	0.10	302-01-2	Hydrazine, hydrazine sulfate	1.6E-01	ca	5.7E-01	ca	3.9E-04	ca	2.2E-02	ca		
3.0E+00	n			1.7E+01	n				0.10	60-34-4	Hydrazine, monomethyl	1.6E-01	ca	5.7E-01	ca	4.0E-04	ca	2.2E-02	ca		
3.0E+00	n			1.7E+01	n				0.10	57-14-7	Hydrazine, dimethyl	1.6E-01	ca	5.7E-01	ca	4.0E-04	ca	2.2E-02	ca		
						5.7E-03	i			7647-01-0	Hydrogen chloride					2.1E+01	nc				
		2.0E-02	i			8.6E-04	i	1		74-90-8	Hydrogen cyanide	1.1E+01	nc	3.5E+01	nc	3.1E+00	nc	6.2E+00	nc		
		3.0E-03	i			2.9E-04	i			7783-06-4	Hydrogen sulfide					1.0E+00	nc	1.1E+02	nc		
		4.0E-02	h			4.0E-02	r	0	0.10	123-31-9	p-Hydroquinone	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	35554-44-0	Imazalil	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		2.5E-01	i			2.5E-01	r	0	0.10	81335-37-7	Imazaquin	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		4.0E-02	i			4.0E-02	r	0	0.10	36734-19-7	Iprodione	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
		3.0E-01	n					0		7439-89-6	Iron	2.3E+04	nc	1.0E+05	max			1.1E+04	nc		
		3.0E-01	i			3.0E-01	r	1		78-83-1	Isobutanol	1.3E+04	nc	4.0E+04	sat	1.1E+03	nc	1.8E+03	nc		
9.5E-04	i	2.0E-01	i	9.5E-04	r	2.0E-01	r	0	0.10	78-59-1	Isophorone	5.1E+02	ca*	1.8E+03	ca*	7.1E+00	ca	7.1E+01	ca	5.0E-01	3.0E-02

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFI 1/(mg/kg-d)		RfDI (mg/kg-d)		V O C	skin abs. soils	CAS No.			Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		1.5E-02	i			1.5E-02	r	0	0.10	33820-53-0		Isopropalin	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
		1.0E-01	i			1.1E-01	r	0	0.10	1832-54-8		Isopropyl methyl phosphonic acid	6.1E+03	nc	6.2E+04	nc	4.0E+02	nc	3.6E+03	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	82558-50-7		Isoxaben	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
8.0E+00	n	3.0E-04	n	8.0E+00	r	3.0E-04	r	0	0.10	143-50-0		**Kepone**	6.1E-02	ca	2.2E-01	ca	8.4E-04	ca	8.4E-03	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	77501-63-4		Lactofen	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
For info see:		www.epa.gov/oerrpage/superfund/programs/lead/prods.htm#guidance								7439-92-1		Lead+++	4.0E+02	nc	7.5E+02	nc						
For info see:		www.dtsc.ca.gov/ScienceTechnology/ledspred.html										**Lead "CAL-Modified PRG"+++**	1.5E+02									
		1.0E-07	i					0	0.10	78-00-2		Lead (tetraethyl)	6.1E-03	nc	6.2E-02	nc			3.6E-03	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	330-55-2		Linuron	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		2.0E-02	x					0		7439-93-2		Lithium	1.6E+03	nc	2.0E+04	nc			7.3E+02	nc		
		2.0E-01	i			2.0E-01	r	0	0.10	83055-99-6		Londax	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	121-75-5		Malathion	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	108-31-6		Maleic anhydride	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		5.0E-01	i			5.0E-01	r	1		123-33-1		Maleic hydrazide	1.7E+03	nc	2.4E+03	sat	1.8E+03	nc	3.0E+03	nc		
		2.0E-05	h			2.0E-05	r	0	0.10	109-77-3		Malononitrile	1.2E+00	nc	1.2E+01	nc	7.3E-02	nc	7.3E-01	nc		
		3.0E-02	h			3.0E-02	r	0	0.10	8018-01-7		Mancozeb	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
6.0E-02	o	5.0E-03	i	5.0E-02	r	5.0E-03	r	0	0.10	12427-38-2		Maneb	8.1E+00	ca*	2.9E+01	ca	1.1E-01	ca	1.1E+00	ca		
		2.4E-02	i			1.4E-05	i	0		7439-96-5		Manganese and compounds+++	1.8E+03	nc	1.9E+04	nc	5.1E-02	nc	8.8E+02	nc		
		9.0E-05	h			9.0E-05	r	0	0.10	950-10-7		Mephosfolan	5.5E+00	nc	5.5E+01	nc	3.3E-01	nc	3.3E+00	nc		
		3.0E-02	i			3.0E-02	r	0	0.10	24307-26-4		Mepiquat chloride	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
2.9E-02	n	1.0E-01	n	2.9E-02	r	1.0E-01	r	0	0.10	149-30-4		2-Mercaptobenzothiazole	1.7E+01	ca	5.9E+01	ca	2.3E-01	ca	2.3E+00	ca		
		3.0E-04	i					0		7487-94-7		Mercury and compounds	2.3E+01	nc	3.1E+02	nc			1.1E+01	nc		
						8.6E-05	i			7439-97-6		Mercury (elemental)					3.1E-01	nc				
		1.0E-04	i					0	0.10	22967-92-6		Mercury (methyl)	6.1E+00	nc	6.2E+01	nc			3.6E+00	nc		
		3.0E-05	i			3.0E-05	r	0	0.10	150-50-5		Merphos	1.8E+00	nc	1.8E+01	nc	1.1E-01	nc	1.1E+00	nc		
		3.0E-05	i			3.0E-05	r	0	0.10	78-48-8		Merphos oxide	1.8E+00	nc	1.8E+01	nc	1.1E-01	nc	1.1E+00	nc		
		6.0E-02	i			6.0E-02	r	0	0.10	57837-19-1		Metalaxyl	3.7E+03	nc	3.7E+04	nc	2.2E+02	nc	2.2E+03	nc		
		1.0E-04	i			2.0E-04	h	1		126-98-7		Methacrylonitrile	2.1E+00	nc	8.4E+00	nc	7.3E-01	nc	1.0E+00	nc		
		5.0E-05	i			5.0E-05	r	0	0.10	10265-92-6		Methamidophos	3.1E+00	nc	3.1E+01	nc	1.8E-01	nc	1.8E+00	nc		
		5.0E-01	i			5.0E-01	r	0	0.10	67-56-1		Methanol	3.1E+04	nc	1.0E+05	max	1.8E+03	nc	1.8E+04	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	950-37-8		Methidathion	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r	1		16752-77-5		Methomyl	4.4E+01	nc	1.5E+02	nc	9.1E+01	nc	1.5E+02	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	72-43-5		Methoxychlor	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc	1.6E+02	8.0E+00
		1.0E-03	h			5.7E-03	i	0	0.10	109-86-4		2-Methoxyethanol	6.1E+01	nc	6.2E+02	nc	2.1E+01	nc	3.6E+01	nc		
		2.0E-03	h			2.0E-03	r	0	0.10	110-49-6		2-Methoxyethanol acetate	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
4.6E-02	h			4.6E-02	r			0	0.10	99-59-2		2-Methoxy-5-nitroaniline	1.1E+01	ca	3.7E+01	ca	1.5E-01	ca	1.5E+00	ca		

Key: SFo, Cancer Slope Factor oral, inhalation RfDo,I=Reference Dose oral, inhalation I=IRIS h=HEAST n=NCEA x=Withdrawn o=Other ... Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFI 1/(mg/kg-d)		RfDI (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		1.0E+00	h			1.0E+00	r	1		79-20-9	Methyl acetate	2.2E+04	nc	9.2E+04	nc	3.7E+03	nc	6.1E+03	nc		
		3.0E-02	h			3.0E-02	r	1		96-33-3	Methyl acrylate	7.0E+01	nc	2.3E+02	nc	1.1E+02	nc	1.8E+02	nc		
2.4E-01	h			2.4E-01	r			0	0.10	95-53-4	2-Methylaniline (o-toluidine)	2.0E+00	ca	7.2E+00	ca	2.8E-02	ca	2.8E-01	ca		
1.8E-01	h			1.8E-01	r			0	0.10	636-21-5	2-Methylaniline hydrochloride	2.7E+00	ca	9.6E+00	ca	3.7E-02	ca	3.7E-01	ca		
		5.0E-04	I			5.0E-04	r	0	0.10	94-74-6	2-Methyl-4-chlorophenoxyacetic acid	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
		1.0E-02	I			1.0E-02	r	0	0.10	94-81-5	4-(2-Methyl-4-chlorophenoxy) butyric acid	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	93-65-2	2-(2-Methyl-4-chlorophenoxy) propionic acid	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	16484-77-8	2-(2-Methyl-1,4-chlorophenoxy) propionic acid	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		8.6E-01	r			8.6E-01	h	1		108-87-2	Methylcyclohexane	2.6E+03	nc	8.7E+03	nc	3.1E+03	nc	5.2E+03	nc		
2.5E-01	h			2.5E-01	r			0	0.10	101-77-9	4,4'-Methylenebisbenzeneamine	1.9E+00	ca	6.9E+00	ca	2.7E-02	ca	2.7E-01	ca		
1.3E-01	h	7.0E-04	h	1.3E-01	h	7.0E-04	r	0	0.10	101-14-4	4,4'-Methylene bis(2-chloroaniline)	3.7E+00	ca*	1.3E+01	ca*	5.2E-02	ca*	5.2E-01	ca*		
4.6E-02	i			4.6E-02	r			0	0.10	101-61-1	4,4'-Methylene bis(N,N'-dimethyl)aniline	1.1E+01	ca	3.7E+01	ca	1.5E-01	ca	1.5E+00	ca		
		1.0E-02	h			1.0E-02	r	1		74-95-3	Methylene bromide	6.7E+01	nc	2.3E+02	nc	3.7E+01	nc	6.1E+01	nc		
7.5E-03	i	6.0E-02	I	1.6E-03	I	6.6E-01	h	1		75-09-2	Methylene chloride	9.1E+00	ca	2.1E+01	ca	4.1E+00	ca	4.3E+00	ca	2.0E-02	1.0E-03
		1.7E-04	r			1.7E-04	I	0	0.10	101-68-8	4,4'-Methylene diphenyl diisocyanate	1.0E+01	nc	1.0E+02	nc	6.2E-01	nc	6.2E+00	nc		
		8.0E-01	I			2.9E-01	i	1		78-93-3	Methyl ethyl ketone	7.3E+03	nc	2.7E+04	nc	1.0E+03	nc	1.9E+03	nc		
		8.0E-02	h			2.3E-02	h	1		108-10-1	Methyl isobutyl ketone	7.9E+02	nc	2.8E+03	nc	8.3E+01	nc	1.6E+02	nc		
		5.7E-04	r			5.7E-04	n	0	0.10	74-93-1	Methyl Mercaptan	3.5E+01	nc	3.5E+02	nc	2.1E+00	nc	2.1E+01	nc		
		1.4E+00	i			2.0E-01	i	1		80-62-6	Methyl methacrylate	2.2E+03	nc	2.7E+03	sat	7.3E+02	nc	1.4E+03	nc		
3.3E-02	h			3.3E-02	r			0	0.10	99-55-8	2-Methyl-5-nitroaniline	1.5E+01	ca	5.2E+01	ca	2.0E-01	ca	2.0E+00	ca		
		2.5E-04	I			2.5E-04	r	0	0.10	298-00-0	Methyl parathion	1.5E+01	nc	1.5E+02	nc	9.1E-01	nc	9.1E+00	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	95-48-7	2-Methylphenol	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc	1.5E+01	8.0E-01
		5.0E-02	I			5.0E-02	r	0	0.10	108-39-4	3-Methylphenol	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		5.0E-03	h			5.0E-03	r	0	0.10	106-44-5	4-Methylphenol	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	n			2.0E-02	r	0	0.10	993-13-5	Methyl phosphonic acid	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		6.0E-03	h			1.1E-02	h	1		25013-15-4	Methyl styrene (mixture)	1.3E+02	nc	5.4E+02	nc	4.2E+01	nc	6.0E+01	nc		
		7.0E-02	h			7.0E-02	r	1		98-83-9	Methyl styrene (alpha)	6.8E+02	sat	6.8E+02	sat	2.6E+02	nc	4.3E+02	nc		
3.3E-03	n	8.6E-01	r	3.5E-04	n	8.6E-01	I	1		1634-04-4	**Methyl tertbutyl ether (MTBE)**	6.2E+01	ca*	1.6E+02	ca	1.9E+01	ca	1.3E+01	ca		
1.8E-03				1.8E-03				1			"CAL-Modified PRG"	1.7E+01	ca	3.6E+01	ca	3.7E+00	ca	6.2E+00	ca		
		1.5E-01	i			1.5E-01	r	0	0.10	51218-45-2	Metolaclor (Dual)	9.2E+03	nc	9.2E+04	nc	5.5E+02	nc	5.5E+03	nc		
		2.5E-02	I			2.5E-02	r	0	0.10	21087-64-9	Metribuzin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.8E+00	x	2.0E-04	I	1.8E+00	r	2.0E-04	r	0	0.10	2385-85-5	Mirex	2.7E-01	ca*	9.6E-01	ca	3.7E-03	ca	3.7E-02	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	2212-67-1	Molinate	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		5.0E-03	i					0		7439-98-7	Molybdenum	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	10599-90-3	Monochloramine	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	300-76-5	Naled	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		

Key : SFo,i=Cancar Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation I=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION														CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		1.0E-01	I			1.0E-01	r	0	0.10	15299-99-7	Napropamide	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
		2.0E-02	I					0		7440-02-0	Nickel (soluble salts)	1.6E+03	nc	2.0E+04	nc			7.3E+02	nc	1.3E+02	7.0E+00
				8.4E-01	i			0			Nickel refinery dust					8.0E-03	ca				
				1.7E+00	i			0		12035-72-2	Nickel subsulfide			1.1E+04	ca	4.0E-03	ca				
Tap Water PRG Based on Infant NOAEL (see IRIS)										14797-55-8	Nitrate+++							1.0E+04	nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)										14797-65-0	Nitrite+++							1.0E+03	nc		
		2.86E-05	r			2.86E-05	h	0	0.10	88-74-4	**2-Nitroaniline**	1.7E+00	nc	1.8E+01	nc	1.0E-01	nc	1.0E+00	nc		
		5.0E-04	i			5.7E-04	h	1		98-95-3	Nitrobenzene	2.0E+01	nc	1.0E+02	nc	2.1E+00	nc	3.4E+00	nc	1.0E-01	7.0E-03
		7.0E-02	h			7.0E-02	r	0	0.10	67-20-9	Nitrofurantoin	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
1.5E+00	h			1.5E+00	r			0	0.10	59-87-0	Nitrofurazone	3.2E-01	ca	1.1E+00	ca	4.5E-03	ca	4.5E-02	ca		
1.4E-02	n			1.4E-02	r			0	0.10	55-63-0	Nitroglycerin	3.5E+01	ca	1.2E+02	ca	4.8E-01	ca	4.8E+00	ca		
		1.0E-01	i			1.0E-01	r	0	0.10	556-88-7	Nitroguanidine	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc		
9.4E+00	r	5.7E-03	r	9.4E+00	h	5.7E-03	i	1		79-46-9	2-Nitropropane					7.2E-04	ca	1.2E-03	ca		
5.4E+00	i			5.6E+00	I			1		924-16-3	N-Nitrosodi-n-butylamine	2.4E-02	ca	5.8E-02	ca	1.2E-03	ca	2.0E-03	ca		
2.8E+00	i			2.8E+00	r			0	0.10	1116-54-7	N-Nitrosodiethanolamine	1.7E-01	ca	6.2E-01	ca	2.4E-03	ca	2.4E-02	ca		
1.5E+02	i			1.5E+02	i			0	0.10	55-18-5	N-Nitrosodiethylamine	3.2E-03	ca	1.1E-02	ca	4.5E-05	ca	4.5E-04	ca		
5.1E+01	I			4.9E+01	i			0	0.10	62-75-9	N-Nitrosodimethylamine	9.5E-03	ca	3.4E-02	ca	1.4E-04	ca	1.3E-03	ca		
4.9E-03	i			4.9E-03	r			0	0.10	86-30-6	N-Nitrosodiphenylamine	9.9E+01	ca	3.5E+02	ca	1.4E+00	ca	1.4E+01	ca	1.0E+00	6.0E-02
7.0E+00	I			7.0E+00	r			0	0.10	621-64-7	N-Nitroso di-n-propylamine	6.9E-02	ca	2.5E-01	ca	9.6E-04	ca	9.6E-03	ca	5.0E-05	2.0E-06
2.2E+01	i			2.2E+01	r			0	0.10	10595-95-6	N-Nitroso-N-methylethylamine	2.2E-02	ca	7.8E-02	ca	3.1E-04	ca	3.1E-03	ca		
2.1E+00	i			2.1E+00	i			0	0.10	930-55-2	N-Nitrosopyrrolidine	2.3E-01	ca	8.2E-01	ca	3.1E-03	ca	3.2E-02	ca		
		1.0E-02	h			1.0E-02	r	1		99-08-1	m-Nitrotoluene	3.7E+02	nc	1.0E+03	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	h			1.0E-02	r	1		99-08-1	o-Nitrotoluene	3.7E+02	nc	1.0E+03	sat	3.7E+01	nc	6.1E+01	nc		
		1.0E-02	h			1.0E-02	r	1		99-99-0	p-Nitrotoluene	3.7E+02	nc	1.0E+03	sat	3.7E+01	nc	6.1E+01	nc		
		4.0E-02	I			4.0E-02	r	0	0.10	27314-13-2	Norflurazon	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
		7.0E-04	i			7.0E-04	r	0	0.10	85509-19-9	NuStar	4.3E+01	nc	4.3E+02	nc	2.6E+00	nc	2.6E+01	nc		
		3.0E-03	I			3.0E-03	r	0	0.10	32536-52-0	Octabromodiphenyl ether	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		5.0E-02	I			5.0E-02	r	0	0.10	2691-41-0	Octahydro-1357-tetranitro-1357- tetrazocine (HMX)	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		2.0E-03	h			2.0E-03	r	0	0.10	152-16-9	Octamethylpyrophosphoramide	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		5.0E-02	I			5.0E-02	r	0	0.10	19044-88-3	Oryzalin	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	19666-30-9	Oxadiazon	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	23135-22-0	Oxamyl	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		3.0E-03	i			3.0E-03	r	0	0.10	42874-03-3	Oxyfluorfen	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		1.3E-02	I			1.3E-02	r	0	0.10	76738-62-0	Paclobutrazol	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		4.5E-03	I			4.5E-03	r	0	0.10	4685-14-7	Paraquat	2.7E+02	nc	2.8E+03	nc	1.6E+01	nc	1.6E+02	nc		
		6.0E-03	h			6.0E-03	r	0	0.10	56-38-2	Parathion	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc		

Key . SFo, ..ncer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other t... Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		5.0E-02	h			5.0E-02	r	0	0.10	1114-71-2	Pebulate	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-02	i			4.0E-02	r	0	0.10	40487-42-1	Pendimethalin	2.4E+03	nc	2.5E+04	nc	1.5E+02	nc	1.5E+03	nc		
2.3E-02	h			2.3E-02	r			0	0.10	87-84-3	Pentabromo-6-chloro cyclohexane	2.1E+01	ca	7.5E+01	ca	2.9E-01	ca	2.9E+00	ca		
		2.0E-03	i			2.0E-03	r	0	0.10	32534-81-9	Pentabromodiphenyl ether	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		8.0E-04	i			8.0E-04	r	0	0.10	608-93-5	Pentachlorobenzene	4.9E+01	nc	4.9E+02	nc	2.9E+00	nc	2.9E+01	nc		
2.6E-01	h	3.0E-03	i	2.6E-01	r	3.0E-03	r	0	0.10	82-68-8	Pentachloronitrobenzene	1.9E+00	ca*	6.6E+00	ca	2.6E-02	ca	2.6E-01	ca		
1.2E-01	i	3.0E-02	i	1.2E-01	r	3.0E-02	r	0	0.25	87-86-5	Pentachlorophenol	3.0E+00	ca	9.0E+00	ca	5.6E-02	ca	5.6E-01	ca	3.0E-02	1.0E-03
		1.00E-04	x					0		7601-90-3	Perchlorate	7.8E+00	ca/nc	1.0E+02	ca/nc			3.6E+00	ca/nc		
		5.0E-02	i			5.0E-02	r	0	0.10	52645-53-1	Permethrin	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		2.5E-01	i			2.5E-01	r	0	0.10	13684-63-4	Phenmedipham	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		6.0E-01	i			6.0E-01	r	0	0.10	108-95-2	Phenol	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc	1.0E+02	5.0E+00
		2.0E-03	n			2.0E-03	r	0	0.10	92-84-2	Phenothiazine	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		6.0E-03	i			6.0E-03	r	0	0.10	106-45-2	m-Phenylenediamine	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc		
		1.9E-01	h			1.9E-01	r	0	0.10	106-50-3	p-Phenylenediamine	1.2E+04	nc	1.0E+05	max	6.9E+02	nc	6.9E+03	nc		
		8.0E-05	i			8.0E-05	r	0	0.10	62-38-4	Phenylmercuric acetate	4.9E+00	nc	4.9E+01	nc	2.9E-01	nc	2.9E+00	nc		
1.9E-03	h			1.9E-03	r			0	0.10	90-43-7	2-Phenylphenol	2.5E+02	ca	8.9E+02	ca	3.5E+00	ca	3.5E+01	ca		
		2.0E-04	h			2.0E-04	r	0	0.10	298-02-2	Phorate	1.2E+01	nc	1.2E+02	nc	7.3E-01	nc	7.3E+00	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	732-11-6	Phosmet	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		3.0E-04	i			8.6E-05	i	0	0.10	7803-51-2	Phosphine	1.8E+01	nc	1.8E+02	nc	3.1E-01	nc	1.1E+01	nc		
						2.9E-03	i			7664-38-2	Phosphoric acid					1.0E+01	nc				
		2.0E-05	i					0		7723-14-0	Phosphorus (white)	1.6E+00	nc	2.0E+01	nc			7.3E-01	nc		
		1.0E+00	h			1.0E+00	r	0	0.10	100-21-0	p-Phthalic acid	6.1E+04	nc	1.0E+05	max	3.7E+03	nc	3.6E+04	nc		
		2.0E+00	i			3.4E-02	h	0	0.10	85-44-9	Phthalic anhydride	1.0E+05	max	1.0E+05	max	1.2E+02	nc	7.3E+04	nc		
		7.0E-02	i			7.0E-02	r	0	0.10	1918-02-1	Picloram	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	29232-93-7	Pirimiphos-methyl	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
6.9E+00	h	7.0E-06	h	8.9E+00	r	7.0E-06	r	0	0.10		Polybrominated biphenyls	5.5E-02	ca**	1.9E-01	ca*	7.6E-04	ca*	7.6E-03	ca*		
2.0E+00	i			2.0E+00	i			0	0.14	1336-36-3	Polychlorinated biphenyls (PCBs)	2.2E-01	ca	7.4E-01	ca	3.4E-03	ca	3.4E-02	ca		
7.0E-02	i	7.0E-05	i	7.0E-02	i	7.0E-05	r	0	0.14	12674-11-2	Aroclor 1016	3.9E+00	nc	2.1E+01	ca**	9.6E-02	ca**	9.6E-01	ca**		
2.0E+00	i			2.0E+00	i			0	0.14	11104-28-2	Aroclor 1221	2.2E-01	ca	7.4E-01	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i			2.0E+00	i			0	0.14	11141-16-5	Aroclor 1232	2.2E-01	ca	7.4E-01	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i			2.0E+00	i			0	0.14	53469-21-9	Aroclor 1242	2.2E-01	ca	7.4E-01	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i			2.0E+00	i			0	0.14	12672-29-6	Aroclor 1248	2.2E-01	ca	7.4E-01	ca	3.4E-03	ca	3.4E-02	ca		
2.0E+00	i	2.0E-05	i	2.0E+00	i	2.0E-05	r	0	0.14	11097-69-1	Aroclor 1254	2.2E-01	ca**	7.4E-01	ca*	3.4E-03	ca*	3.4E-02	ca*		
2.0E+00	i			2.0E+00	i			0	0.14	11096-82-5	Aroclor 1260	2.2E-01	ca	7.4E-01	ca	3.4E-03	ca	3.4E-02	ca		

Key: SFo,I=Cancer Slope Factor oral, inhalation RfDo,I=Reference Dose oral, inhalation I=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFI 1/(mg/kg-d)		RfDI (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
4.5E+00	n			4.5E+00	r				0.10	61788-33-8	**Polychlorinated terphenyls**	1.1E-01	ca	3.8E-01	ca	1.5E-03	ca	1.5E-02	ca		
									0.13		Polynuclear aromatic hydrocarbons (PAHs)										
		6.0E-02	i			6.0E-02	r	1		83-32-9	Acenaphthene	3.7E+03	nc	2.9E+04	nc	2.2E+02	nc	3.7E+02	nc	5.7E+02	2.9E+01
		3.0E-01	i			3.0E-01	r	1		120-12-7	Anthracene	2.2E+04	nc	1.0E+05	max	1.1E+03	nc	1.8E+03	nc	1.2E+04	5.9E+02
7.3E-01	n			7.3E-01	r			0	0.13	56-55-3	**Benz[a]anthracene**	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca	2.0E+00	8.0E-02
7.3E-01	n			7.3E-01	r			0	0.13	205-99-2	**Benzo[b]fluoranthene**	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca	5.0E+00	2.0E-01
7.3E-02	n			7.3E-02	r			0	0.13	207-08-9	**Benzo[k]fluoranthene**	6.2E+00	ca	2.1E+01	ca	9.2E-02	ca	9.2E-01	ca	4.9E+01	2.0E+00
1.2E+00				3.9E-01					0.13	207-08-9	**"CAL-Modified PRG"**	3.8E-01	ca	1.3E+00	ca	1.7E-02	ca	5.6E-02	ca		
7.3E+00	i			7.3E+00	r			0	0.13	50-32-8	**Benzo[a]pyrene**	6.2E-02	ca	2.1E-01	ca	9.2E-04	ca	9.2E-03	ca	8.0E+00	4.0E-01
7.3E-03	n			7.3E-03	r			0	0.13	218-01-9	**Chrysene**	6.2E+01	ca	2.1E+02	ca	9.2E-01	ca	9.2E+00	ca	1.6E+02	8.0E+00
1.2E-01				3.9E-02					0.13		**"CAL-Modified PRG"**	3.8E+00	ca	1.3E+01	ca	1.7E-01	ca	5.6E-01	ca		
7.3E+00	n			7.3E+00	r			0	0.13	53-70-3	**Dibenz[ah]anthracene**	6.2E-02	ca	2.1E-01	ca	9.2E-04	ca	9.2E-03	ca	2.0E+00	8.0E-02
		4.0E-02	i			4.0E-02	r	0	0.13	206-44-0	Fluoranthene	2.3E+03	nc	2.2E+04	nc	1.5E+02	nc	1.5E+03	nc	4.3E+03	2.1E+02
		4.0E-02	i			4.0E-02	r	1		86-73-7	Fluorene	2.7E+03	nc	2.6E+04	nc	1.5E+02	nc	2.4E+02	nc	5.6E+02	2.8E+01
7.3E-01	n			7.3E-01	r			0	0.13	193-39-5	**Indeno[1,2,3-cd]pyrene**	6.2E-01	ca	2.1E+00	ca	9.2E-03	ca	9.2E-02	ca	1.4E+01	7.0E-01
		2.0E-02	i			8.6E-04	i	1		91-20-3	Naphthalene	5.6E+01	nc	1.9E+02	nc	3.1E+00	nc	6.2E+00	nc	8.4E+01	4.0E+00
		3.0E-02	i			3.0E-02	r	1		129-00-0	Pyrene	2.3E+03	nc	2.9E+04	nc	1.1E+02	nc	1.8E+02	nc	4.2E+03	2.1E+02
1.5E-01	i	9.0E-03	i	1.5E-01	r	9.0E-03	r	0	0.10	67747-09-5	Prochloraz	3.2E+00	ca	1.1E+01	ca	4.5E-02	ca	4.5E-01	ca		
		6.0E-03	h			6.0E-03	r	0	0.10	26399-36-0	Profluralin	3.7E+02	nc	3.7E+03	nc	2.2E+01	nc	2.2E+02	nc		
		1.5E-02	i			1.5E-02	r	0	0.10	1610-18-0	Prometon	9.2E+02	nc	9.2E+03	nc	5.5E+01	nc	5.5E+02	nc		
		4.0E-03	i			4.0E-03	r	0	0.10	7287-19-6	Prometryn	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		7.5E-02	i			7.5E-02	r	0	0.10	23950-58-5	Pronamide	4.6E+03	nc	4.6E+04	nc	2.7E+02	nc	2.7E+03	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	1918-16-7	Propachlor	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	709-98-8	Propanil	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	2312-35-8	Propargite	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-03	i			2.0E-03	r	0	0.10	107-19-7	Propargyl alcohol	1.2E+02	nc	1.2E+03	nc	7.3E+00	nc	7.3E+01	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	139-40-2	Propazine	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		2.0E-02	i			2.0E-02	r	0	0.10	122-42-9	Propham	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	60207-90-1	Propiconazole	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		4.00E-02	n			4.00E-02	r	1		103-65-1	**n-Propylbenzene**	2.4E+02	sat	2.4E+02	sat	1.5E+02	nc	2.4E+02	nc		
		5.0E-01	h			8.6E-04	h	0	0.10	57-55-6	**Propylene glycol**	3.0E+04	nc	1.0E+05	max	3.1E+00	nc	1.8E+04	nc		
		7.0E-01	h			7.0E-01	r	0	0.10	52125-53-8	Propylene glycol, monoethyl ether	4.3E+04	nc	1.0E+05	max	2.6E+03	nc	2.6E+04	nc		
		7.0E-01	h			5.7E-01	i	0	0.10	107-98-2	Propylene glycol, monomethyl ether	4.3E+04	nc	1.0E+05	max	2.1E+03	nc	2.6E+04	nc		
2.4E-01	i	8.6E-03	r	1.3E-02	i	8.6E-03	i	1		75-56-9	Propylene oxide	1.9E+00	ca*	6.6E+00	ca*	5.2E-01	ca*	2.2E-01	ca		

Key: SFo, Cancer Slope Factor oral, Inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
++++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION														CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		2.5E-01	i			2.5E-01	r	0	0.10	81335-77-5	Pursuit	1.5E+04	nc	1.0E+05	max	9.1E+02	nc	9.1E+03	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	51630-58-1	Pydrin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	110-86-1	Pyridine	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		5.0E-04	i			5.0E-04	r	0	0.10	13593-03-8	Quinalphos	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
3.0E+00	i			3.0E+00	r			0	0.10	91-22-5	**Quinoline**	1.6E-01	ca	5.7E-01	ca	2.2E-03	ca	2.2E-02	ca		
1.1E-01	i	3.0E-03	i	1.1E-01	r	3.0E-03	r	0	0.10	121-82-4	RDX (Cyclonite)	4.4E+00	ca*	1.6E+01	ca	6.1E-02	ca	6.1E-01	ca		
		3.0E-02	i			3.0E-02	r	0	0.10	10453-86-8	Resmethrin	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		5.0E-02	h			5.0E-02	r	0	0.10	299-84-3	Ronnel	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		
		4.0E-03	i			4.0E-03	r	0	0.10	83-79-4	Rotenone	2.4E+02	nc	2.5E+03	nc	1.5E+01	nc	1.5E+02	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	78587-05-0	Savey	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		5.0E-03	i					0	0.10	7783-00-8	Selenious Acid	3.1E+02	nc	3.1E+03	nc			1.8E+02	nc		
		5.0E-03	i					0		7782-49-2	Selenium	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc	5.0E+00	3.0E-01
		5.0E-03	h					0	0.10	630-10-4	Selenourea	3.1E+02	nc	3.1E+03	nc			1.8E+02	nc		
		9.0E-02	i			9.0E-02	r	0	0.10	74051-80-2	Sethoxydim	5.5E+03	nc	5.5E+04	nc	3.3E+02	nc	3.3E+03	nc		
		5.0E-03	i					0		7440-22-4	Silver and compounds	3.9E+02	nc	5.1E+03	nc			1.8E+02	nc	3.4E+01	2.0E+00
1.2E-01	h	5.0E-03	i	1.2E-01	r	2.0E-03	r	0	0.10	122-34-9	Simazine	4.1E+00	ca*	1.4E+01	ca	5.6E-02	ca	5.6E-01	ca		
		4.0E-03	i							26628-22-8	Sodium azide										
2.7E-01	h	3.0E-02	i	2.7E-01	r	3.0E-02	r	0	0.10	148-18-5	Sodium diethyldithiocarbamate	1.8E+00	ca	6.4E+00	ca	2.5E-02	ca	2.5E-01	ca		
		2.0E-05	i			2.0E-05	r	0	0.10	62-74-8	Sodium fluoroacetate	1.2E+00	nc	1.2E+01	nc	7.3E-02	nc	7.3E-01	nc		
		1.0E-03	h			1.0E-03	r	0	0.10	13718-26-8	Sodium metavanadate	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		6.0E-01	i					0		7440-24-6	Strontium, stable	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		3.0E-04	i			3.0E-04	r	0	0.10	57-24-9	Strychnine	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
		2.0E-01	i			2.9E-01	i	1		100-42-5	Styrene	1.7E+03	sat	1.7E+03	sat	1.1E+03	nc	1.6E+03	nc	4.0E+00	2.0E-01
		1.00E-03	n			1.00E-03	r			80-07-9	1,1'-Sulfonylbis (4-chlorobenzene)	7.8E+01	nc	1.0E+03	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	88671-89-0	Systhane	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
1.5E+05	h			1.5E+05	h			0	0.03	1746-01-6	2,3,7,8-TCDD (dioxin)	3.9E-06	ca	1.6E-05	ca	4.5E-08	ca	4.5E-07	ca		
		7.0E-02	i			7.0E-02	r	0	0.10	34014-18-1	Tebuthiuron	4.3E+03	nc	4.3E+04	nc	2.6E+02	nc	2.6E+03	nc		
		2.0E-02	h			2.0E-02	r	0	0.10	3383-96-8	Temephos	1.2E+03	nc	1.2E+04	nc	7.3E+01	nc	7.3E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	5902-51-2	Terbacil	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		2.5E-05	h			2.5E-05	r	0	0.10	13071-79-9	Terbufos	1.5E+00	nc	1.5E+01	nc	9.1E-02	nc	9.1E-01	nc		
		1.0E-03	i			1.0E-03	r	0	0.10	886-50-0	Terbutryn	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		3.0E-04	i			3.0E-04	r	0	0.10	95-94-3	1,2,4,5-Tetrachlorobenzene	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
2.6E-02	i	3.0E-02	i	2.6E-02	i	3.0E-02	r	1		630-20-6	1,1,1,2-Tetrachloroethane	3.2E+00	ca	7.3E+00	ca	2.6E-01	ca	4.3E-01	ca		
2.0E-01	i	6.00E-02	n	2.0E-01	i	6.00E-02	r	1		79-34-5	1,1,2,2-Tetrachloroethane	4.1E-01	ca	9.3E-01	ca	3.3E-02	ca	5.5E-02	ca	3.0E-03	2.0E-04
5.2E-02	n	1.0E-02	i	1.00E-02	n	1.7E-01	n	1		127-18-4	**Tetrachloroethylene (PCE)**	1.5E+00	ca*	3.4E+00	ca*	6.7E-01	ca	6.6E-01	ca	6.0E-02	3.0E-03
		3.0E-02	i			3.0E-02	r	0	0.10	58-90-2	2,3,4,6-Tetrachlorophenol	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		

Key: SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
+++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
2.0E+01	h			2.0E+01	r			0	0.10	5216-25-1	p,a,a,a-Tetrachlorotoluene	2.4E-02	ca	8.6E-02	ca	3.4E-04	ca	3.4E-03	ca		
2.4E-02	h	3.0E-02	i	2.4E-02	r	3.0E-02	r	0	0.10	961-11-5	Tetrachlorovinphos	2.0E+01	ca*	7.2E+01	ca	2.8E-01	ca	2.8E+00	ca		
		5.0E-04	i			5.0E-04	r	0	0.10	3689-24-5	Tetraethyldithiopyrophosphate	3.1E+01	nc	3.1E+02	nc	1.8E+00	nc	1.8E+01	nc		
7.6E-03	n	2.1E-01	n	6.8E-03	n	8.6E-02	n	1		109-99-9	**Tetrahydrofuran**	9.4E+00	ca	2.1E+01	ca	9.9E-01	ca	1.6E+00	ca		
		6.6E-05	i					0		7440-28-0	Thallium and compounds+++	5.2E+00	nc	6.7E+01	nc			2.4E+00	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	28249-77-6	Thiobencarb	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-02	n			5.0E-02	r	0	0.10	N/A	**Thiocyanate**	3.1E+03	nc	1.0E+05	max	1.8E+02	nc	1.8E+03	nc		
		3.0E-04	h			3.0E-04	r	0	0.10	39196-18-4	Thiofanox	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
		8.0E-02	i			8.0E-02	r	0	0.10	23564-05-8	Thiophanate-methyl	4.9E+03	nc	4.9E+04	nc	2.9E+02	nc	2.9E+03	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	137-26-8	Thiram	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		6.0E-01	h					0			Tin (inorganic, see tributyltin oxide for organic tin)	4.7E+04	nc	1.0E+05	max			2.2E+04	nc		
		2.0E-01	i			1.1E-01	i	1		108-88-3	Toluene	5.2E+02	sat	5.2E+02	sat	4.0E+02	nc	7.2E+02	nc	1.2E+01	6.0E-01
3.2E+00	h			3.2E+00	r			0	0.10	95-80-7	Toluene-2,4-diamine	1.5E-01	ca	5.4E-01	ca	2.1E-03	ca	2.1E-02	ca		
		6.0E-01	h			6.0E-01	r	0	0.10	95-70-5	Toluene-2,5-diamine	3.7E+04	nc	1.0E+05	max	2.2E+03	nc	2.2E+04	nc		
		2.0E-01	h			2.0E-01	r	0	0.10	823-40-5	Toluene-2,6-diamine	1.2E+04	nc	1.0E+05	max	7.3E+02	nc	7.3E+03	nc		
2E-01	i			2E-01	r			0	0.10	106-49-0	p-Toluidine	2.6E+00	ca	9.1E+00	ca	3.5E-02	ca	3.5E-01	ca		
1.1E+00	i			1.1E+00	i			0	0.10	8001-35-2	Toxaphene	4.4E-01	ca	1.6E+00	ca	6.0E-03	ca	6.1E-02	ca	3.1E+01	2.0E+00
		7.5E-03	i			7.5E-03	r	0	0.10	66841-25-6	Tralomethrin	4.6E+02	nc	4.6E+03	nc	2.7E+01	nc	2.7E+02	nc		
		1.3E-02	i			1.3E-02	r	0	0.10	2303-17-5	Triallate	7.9E+02	nc	8.0E+03	nc	4.7E+01	nc	4.7E+02	nc		
		1.0E-02	i			1.0E-02	r	0	0.10	82097-50-5	Triasulfuron	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		5.0E-03	i			5.0E-03	r	0	0.10	615-54-3	1,2,4-Tribromobenzene	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
		3.0E-04	i					0	0.10	56-35-9	Tributyltin oxide (TBTO)	1.8E+01	nc	1.8E+02	nc			1.1E+01	nc		
3.4E-02	h			3.4E-02	r			0	0.10	634-93-5	2,4,6-Trichloroaniline	1.4E+01	ca	5.1E+01	ca	2.0E-01	ca	2.0E+00	ca		
2.9E-02	h			2.9E-02	r			0	0.10	33663-50-2	2,4,6-Trichloroaniline hydrochloride	1.7E+01	ca	5.9E+01	ca	2.3E-01	ca	2.3E+00	ca		
		1.0E-02	i			5.7E-02	h	1		120-82-1	1,2,4-Trichlorobenzene	6.5E+02	nc	3.0E+03	sat	2.1E+02	nc	1.9E+02	nc	5.0E+00	3.0E-01
		2.8E-01	n			6.3E-01	n	1		71-55-6	**1,1,1-Trichloroethane**	1.2E+03	sat	1.2E+03	sat	2.3E+03	nc	3.2E+03	nc	2.0E+00	1.0E-01
5.7E-02	i	4.0E-03	i	5.6E-02	i	4.0E-03	r	1		79-00-5	1,1,2-Trichloroethane	7.3E-01	ca*	1.6E+00	ca*	1.2E-01	ca	2.0E-01	ca	2.0E-02	9.0E-04
4.00E-01	n	3.00E-04	n	4.00E-01	n	1.00E-02	n	1		79-01-6	**Trichloroethylene (TCE)**	5.3E-02	ca	1.1E-01	ca	1.7E-02	ca	2.8E-02	ca	6.0E-02	3.0E-03
		3.0E-01	i			2.0E-01	h	1		75-69-4	Trichlorofluoromethane	3.9E+02	nc	2.0E+03	sat	7.3E+02	nc	1.3E+03	nc		
		1.0E-01	i			1.0E-01	r	0	0.10	95-95-4	2,4,5-Trichlorophenol	6.1E+03	nc	6.2E+04	nc	3.7E+02	nc	3.6E+03	nc	2.7E+02	1.4E+01
1.1E-02	i	1.0E-04	n	1.1E-02	i	1.0E-04	r	0	0.10	88-06-2	**2,4,6-Trichlorophenol**	6.1E+00	nc**	6.2E+01	nc**	3.7E-01	nc**	3.6E+00	nc**	2.0E-01	8.0E-03
7.0E-02				7.0E-02					0.10	88-06-2	**"CAL-Modified PRG"**	6.9E+00	ca	2.5E+01	ca	9.6E-02	ca	9.6E-01	ca		
		1.0E-02	i			1.0E-02	r	0	0.10	93-76-5	2,4,5-Trichlorophenoxyacetic Acid	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
		8.0E-03	i			8.0E-03	r	0	0.10	93-72-1	2-(2,4,5-Trichlorophenoxy) propionic acid	4.9E+02	nc	4.9E+03	nc	2.9E+01	nc	2.9E+02	nc		
		5.0E-03	i			5.0E-03	r	1		598-77-6	1,1,2-Trichloropropane	1.5E+01	nc	5.1E+01	nc	1.8E+01	nc	3.0E+01	nc		
2.0E+00	n	8.0E-03	i	2.0E+00	r	1.4E-03	n	1		96-18-4	**1,2,3-Trichloropropane**	5.0E-03	ca	1.1E-02	ca	3.4E-03	ca	5.6E-03	ca		

Key : SFo,i=Cancer Slope Factor oral, inhalation RfDo,i=Reference Dose oral, inhalation i=IRIS h=HEAST n=NCEA x=Withdrawn o=Other EPA Source r=Route-extrapolation ca=Cancer PRG nc=Noncancer PRG ca* (where: nc < 100X ca) ca**(where: nc < 10X ca)
++++=Non-Standard Method Applied (See Section 2.3 of the "Region 9 PRGs Table User's Guide") sat=Soil Saturation (See Section 4.5) max=Ceiling limit (See Section 2.1) DAF=Dilution Attenuation Factor (See Section 2.5) CAS=Chemical Abstract Services

TOXICITY INFORMATION												CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs) "Direct Contact Exposure Pathways"								SOIL SCREENING LEVELS "Migration to Ground Water"	
SFo 1/(mg/kg-d)		RfDo (mg/kg-d)		SFi 1/(mg/kg-d)		RfDi (mg/kg-d)		V O C	skin abs. soils	CAS No.		Residential Soil (mg/kg)		Industrial Soil (mg/kg)		Ambient Air (ug/m^3)		Tap Water (ug/l)		DAF 20 (mg/kg)	DAF 1 (mg/kg)
		5.0E-03	h			5.0E-03	r	1		96-19-5	1,2,3-Trichloropropene	1.2E+01	nc	3.8E+01	nc	1.8E+01	nc	3.0E+01	nc		
		3.0E-03	i			3.0E-03	r	0	0.10	58138-08-2	Tridiphane	1.8E+02	nc	1.8E+03	nc	1.1E+01	nc	1.1E+02	nc		
		2.0E-03	r			2.0E-03	i	1		121-44-8	Triethylamine	2.3E+01	nc	8.6E+01	nc	7.3E+00	nc	1.2E+01	nc		
7.7E-03	i	7.5E-03	i	7.7E-03	r	7.5E-03	r	0	0.10	1582-09-8	Trifluralin	6.3E+01	ca**	2.2E+02	ca*	8.7E-01	ca*	8.7E+00	ca*		
		1.400E-04	r			1.400E-04	n		0.10	552-30-7	Trimellitic Anhydride (TMAN)	8.6E+00	nc	8.6E+01	nc	5.1E-01	nc	5.1E+00			
		5.0E-02	n			1.7E-03	n	1		95-63-6	1,2,4-Trimethylbenzene	5.2E+01	nc	1.7E+02	nc	6.2E+00	nc	1.2E+01	nc		
		5.0E-02	n			1.7E-03	n	1		108-67-8	1,3,5-Trimethylbenzene	2.1E+01	nc	7.0E+01	nc	6.2E+00	nc	1.2E+01	nc		
3.7E-02	h			3.7E-02	r			0	0.10	512-56-1	Trimethyl phosphate	1.3E+01	ca	4.7E+01	ca	1.8E-01	ca	1.8E+00	ca		
		3.0E-02	i			3.0E-02	r	0	0.10	99-35-4	1,3,5-Trinitrobenzene	1.8E+03	nc	1.8E+04	nc	1.1E+02	nc	1.1E+03	nc		
		1.0E-02	h			1.0E-02	r	0	0.10	479-45-8	Trinitrophenylmethylnitramine	6.1E+02	nc	6.2E+03	nc	3.7E+01	nc	3.6E+02	nc		
3E-02	i	5.0E-04	i	3E-02	r	5.0E-04	r	0	0.10	118-96-7	2,4,6-Trinitrotoluene	1.6E+01	ca**	5.7E+01	ca**	2.2E-01	ca**	2.2E+00	ca**		
		5.00E-03	n			5.00E-03	r		0.10	791-28-6	**Triphenylphosphine oxide**	3.1E+02	nc	3.1E+03	nc	1.8E+01	nc	1.8E+02	nc		
3.2E-03	n	1.1E-01	n	3.2E-03	r	1.1E-01	r		0.10	115-96-8	**Tris(2-chloroethyl) phosphate**	1.5E+02	ca*	5.4E+02	ca	2.1E+00	ca	2.1E+01	ca		
		2.00E-04	n							7440-61-0	Uranium (chemical toxicity only)	1.6E+01	nc	2.0E+02	nc			7.3E+00	nc		
		7.0E-03	h					0		7440-62-2	Vanadium and compounds	5.5E+02	nc	7.2E+03	nc			2.6E+02	nc	6.0E+03	3.0E+02
		1.0E-03	i			1.0E-03	r	0	0.10	1929-77-7	Vernam	6.1E+01	nc	6.2E+02	nc	3.7E+00	nc	3.6E+01	nc		
		2.5E-02	i			2.5E-02	r	0	0.10	50471-44-8	Vinclozolin	1.5E+03	nc	1.5E+04	nc	9.1E+01	nc	9.1E+02	nc		
		1.0E+00	h			5.7E-02	i	1		108-05-4	Vinyl acetate	4.3E+02	nc	1.4E+03	nc	2.1E+02	nc	4.1E+02	nc	1.7E+02	8.0E+00
1.1E-01	r	8.6E-04	r	1.1E-01	h	8.6E-04	i	1		593-60-2	Vinyl bromide (bromoethene)	1.9E-01	ca*	4.2E-01	ca*	6.1E-02	ca*	1.0E-01	ca*		
1.5E+00	i	3.00E-03	i	3.1E-02	i	2.86E-02	i	1		75-01-4	**Vinyl chloride (child/adult)+++**	7.9E-02	ca			1.1E-01	ca	2.0E-02	ca	1.0E-02	7.0E-04
7.5E-01	i	3.00E-03	i	1.6E-02	i	2.86E-02	i	1		75-01-4	Vinyl chloride (adult)			7.5E-01	ca						
		3.0E-04	i			3.0E-04	r	0	0.10	81-61-2	Warfarin	1.8E+01	nc	1.8E+02	nc	1.1E+00	nc	1.1E+01	nc		
		7.0E-01	i			2.9E-02	i	1	0.10	1330-20-7	**Xylenes**	2.7E+02	nc	4.2E+02	sat	1.1E+02	nc	2.1E+02	nc	2.1E+02	1.0E+01
		3.0E-01	i					0		7440-66-6	Zinc	2.3E+04	nc	1.0E+05	max			1.1E+04	nc	1.2E+04	6.2E+02
		3.0E-04	i					0		1314-84-7	Zinc phosphide	2.3E+01	nc	3.1E+02	nc			1.1E+01	nc		
		5.0E-02	i			5.0E-02	r	0	0.10	12122-87-7	Zineb	3.1E+03	nc	3.1E+04	nc	1.8E+02	nc	1.8E+03	nc		

Appendix I-2
EPA 2002 Edition of the Drinking Water Standards and Health Advisories

United States
Environmental Protection
Agency

2002 Edition of the Drinking Water Standards and Health Advisories

2002 Edition of the Drinking Water Standards and Health Advisories

EPA 822-R-02-038

Office of Water
U.S. Environmental Protection Agency
Washington, DC

Summer 2002

Recycled/Recyclable
Printed on paper that contains
at least 50% recycled fiber.

The *Drinking Water Standards and Health Advisories* tables are revised periodically by EPA's Office of Water on an "as needed" basis. The Summer 2002 edition of the tables has retained the content and format changes introduced in the Summer 2000 edition and has added the Chemical Abstracts Service Registry Numbers (CASRN) for the chemical contaminants. The following changes should be kept in mind when using the Tables:

Reference dose (RfD) values have been updated to reflect the values in the Integrated Risk Information System (IRIS), and the Drinking Water Equivalent Level (DWEL) has been calculated accordingly. Thus, both the RfD and DWEL will differ from the values in the Health Advisory document if the IRIS RfD is more recent than the Health Advisory value. The RfD values from IRIS that differ from the values in the Health Advisory documents are given in **BOLD** type. For unregulated chemicals with a new IRIS RfD, the lifetime Health Advisory was calculated from the DWEL using the relative source contribution value published in the Health Advisory. For regulated chemicals, where the revised lifetime value differed from the Maximum Contaminant Level Goal (MCLG), no lifetime value was provided in the Table.

For regulated chemicals, the cancer group designation and 10^{-4} cancer risk reflect the status at the time of regulation. For unregulated chemicals, the cancer group designation and 10^{-4} cancer risk reflect the values presently on IRIS. New cancer group designations and 10^{-4} cancer risk values are given in **BOLD** type.

Several pesticides listed in IRIS have been re-evaluated by the Office of Pesticide Programs (OPP) resulting in an RfD other than that in IRIS. For these pesticides, the IRIS value is listed in the Table, and the newer OPP value is given in a footnote.

In some cases there is a Health Advisory value for a contaminant but there is no reference to a Health Advisory document. These Health Advisory values can be found in the Drinking Water Criteria Document for the contaminant.

With a few exceptions, the Health Advisory values have been rounded to one significant figure.

The *Drinking Water Standards and Health Advisories* tables may be reached from the Water Science home page at

http://www.epa.gov/waterscience

The tables are accessed under the Health Advisories heading.

Copies may be ordered free of charge from

SAFE DRINKING WATER HOTLINE
1-800-426-4791
Monday thru Friday, 9:00 AM to 5:30 PM EST

Copies of the supporting technical documentation for the health advisories can be ordered for a fee on the Internet at

http://www.epa.gov/OST/orderpubs.html

or from

Educational Resources Information Center (ERIC)
1929 Kenny Road
Columbus, OH 43210-1080
Telephone number 614-292-6717; 1-800-276-0462
FAX 614-292-0263
e-mail ERICSE@osu.edu
Payment by Purchase Order/Check/Visa or Mastercard

For further information regarding the *Drinking Water Standards and Health Advisories*, call the Safe Drinking Water Hotline at 1-800-426-4791 or 703-285-1093.

DEFINITIONS

The following definitions for terms used in the Tables are not all-encompassing, and should not be construed to be "official" definitions. They are intended to assist the user in understanding terms found on the following pages.

Action Level: The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow. For lead or copper it is the level which, if exceeded in over 10% of the homes tested, triggers treatment.

Cancer Group: A qualitative weight-of-evidence judgement as to the likelihood that a chemical may be a carcinogen for humans. Each chemical is placed into one of the following five categories:

Group	Category
A	Human carcinogen
B	Probable human carcinogen: B1 indicates limited human evidence B2 indicates sufficient evidence in animals and inadequate or no evidence in humans
C	Possible human carcinogen
D	Not classifiable as to human carcinogenicity
E	Evidence of noncarcinogenicity for humans

This categorization is based on EPA's 1986 *Guidelines for Carcinogen Risk Assessment.* The *Proposed Guidelines for Carcinogen Risk Assessment* which were published in 1996, when final, will replace the 1986 cancer guidelines.

10^{-4} Cancer Risk: The concentration of a chemical in drinking water corresponding to an excess estimated lifetime cancer risk of 1 in 10,000.

Drinking Water Advisory: A nonregulatory concentration of a contaminant in water that is likely to be without adverse effects on both health and aesthetics.

DWEL: Drinking Water Equivalent Level. A lifetime exposure concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a contaminant is from drinking water.

HA: Health Advisory. An estimate of acceptable drinking water levels for a chemical substance based on health effects information; a Health Advisory is not a legally enforceable Federal standard, but serves as technical guidance to assist Federal, State, and local officials.

One-Day HA: The concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for up to one day of exposure. The One-Day HA is normally designed to protect a 10-kg child consuming 1 liter of water per day.

Ten-Day HA: The concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for up to ten days of exposure. The Ten-Day HA is also normally designed to protect a 10-kg child consuming 1 liter of water per day.

Lifetime HA: The concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effects for a lifetime of exposure. The Lifetime HA is based on exposure of a 70-kg adult consuming 2 liters of water per day. The Lifetime HA for Group C carcinogens includes an adjustment for possible carcinogenicity.

LED_{10}: Lower Limit on Effective $Dose_{10}$. The 95% lower confidence limit of the dose of a chemical needed to produce an adverse effect in 10% of those exposed to the chemical, relative to the control.

MCLG: Maximum Contaminant Level Goal. A non-enforceable health goal which is set at a level at which no known or anticipated adverse effect on the health of persons occurs and which allows an adequate margin of safety.

MCL: Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. MCLs are enforceable standards.

RfD: Reference Dose. An estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime.

SDWR: Secondary Drinking Water Regulations. Non-enforceable Federal guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water.

TT: Treatment Technique. A required process intended to reduce the level of a contaminant in drinking water.

ABBREVIATIONS

D	Draft
F	Final
NA	Not Applicable
NOAEL	No-Observed-Adverse-Effect Level
OPP	Office of Pesticide Programs
P	Proposed
Reg	Regulation
TT	Treatment Technique

Drinking Water Standards and Health Advisories

Chemicals	CASRN Number	Standards			Status HA Document	Health Advisories						Cancer Group
		Status Reg.	MCLG (mg/L)	MCL (mg/L)		10-kg Child						
						One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
ORGANICS												
Acenaphthene	83-32-9	-	-	-	-	-	-	0.06	2	-	-	-
Acifluorfen (sodium)	62476-59-9				F '88	2	2	0.01	0.4		0.1	B2
Acrylamide	79-06-1	F	zero	TT[1]	F '87	1.5	0.3	0.0002	0.007	-	**0.0008**	B2
Acrylonitrile	107-13-1										0.006	B1
Alachlor	15972-60-8	F	zero	0.002	F '88	0.1	0.1	0.01	0.4	-	0.04[2]	B2
Aldicarb[3]	116-06-3	F	0.001	0.003	F '95	0.01	0.01	0.001	0.04			D
Aldicarb sulfone[3]	1646-88-4	F[4]	0.001	0.003	F '95	0.01	0.01	0.001	0.04	-	-	D
Aldicarb sulfoxide[3]	1646-87-3	F[4]	0.001	0.004	F '95	0.01	0.01	0.001	0.04			D
Aldrin	309-00-2	-	-	-	F '92	0.0003	0.0003	0.00003	0.001	-	0.0002	B2
Ametryn	834-12-8	-	-	-	F '88	9	9	0.009	0.3	0.06	-	D
Ammonium sulfamate	7773-06-0	-	-	-	F '88	20	20	0.2	8	2	-	D
Anthracene (PAH)[5]	120-12-7							0.3	10			D
Atrazine[6]	1912-24-9	F	0.003	0.003	F '88	-	-	0.035	1		-	C
Baygon	114-26-1				F '88	0.04	0.04	0.004	0.1	0.003		C
Bentazon	25057-89-0	-	-	-	F '99	0.3	0.3	0.03	1	0.2	-	E
Benz[a]anthracene (PAH)	56-55-3											B2
Benzene	71-43-2	F	zero	0.005	F '87	0.2	0.2	-	-	-	0.1	A
Benzo[a]pyrene (PAH)	50-32-8	F	zero	0.0002							**0.0005**	B2
Benzo[b]fluoranthene (PAH)	205-99-2	-	-	-	-	-	-	-	-	-	-	B2
Benzo[g,h,i]perylene (PAH)	191-24-2	-	-	-	-	-	-	-	-	-	-	D
Benzo[k]fluoranthene (PAH)	207-08-9	-	-	-	-	-	-	-	-	-	-	B2
bis-2-Chloroisopropyl ether	39638-32-9				F '89	4	4	0.04	1	0.3	-	D
Bromacil	314-40-9	-	-	-	F '88	5	5	0.1	5	0.09	-	C
Bromobenzene	108-86-1	-	-	-	D '86	4	4	-	-	-	-	D

[1] When acrylamide is used in drinking water systems, the combination (or product) of dose and monomer level shall not exceed that equivalent to a polyacrylamide polymer containing 0.05% monomer dosed at 1 mg/L.
[2] Determined not to be carcinogenic at low doses by OPP.
[3] The MCL value for any combination of two or more of these three chemicals should not exceed 0.007 mg/L because of similar mode of action.
[4] Administrative stay of the effective date.
[5] PAH = Polycyclic aromatic hydrocarbon.
[6] Under review.

Chemicals	CASRN Number	Standards			Status HA Document	Health Advisories						Cancer Group
		Status Reg	MCLG (mg/L)	MCL (mg/L)		10-kg Child						
						One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
Bromochloromethane	74-97-5	-	-	-	F '89	50	1	0.01	0.5	0.09	-	D
Bromodichloromethane[1] (THM)	75-27-4	F	zero	0.08[2]	D '93	6	6	0.02	0.7	-	0.06	B2
Bromoform (THM)	75-25-2	F	zero	0.08[2]	D '93	5	2	0.02	0.7	-	0.4	B2
Bromomethane	74-83-9	-	-	-	D '89	0.1	0.1	0.001	0.05	0.01	-	D
Butyl benzyl phthalate (PAE)[3]	85-68-7	-	-	-	-	-	-	0.2	7	-	-	C
Butylate	2008-41-5	-	-	-	F '89	2	2	0.05	2	0.4	-	D
Carbaryl	63-25-2	-	-	-	F '88	1	1	0.1	4	0.7	-	D
Carbofuran[1]	1563-66-2	F	0.04	0.04	F '87	0.05	0.05	0.005	0.2	0.04	-	E
Carbon tetrachloride	56-23-5	F	zero	0.005	F '87	4	0.2	0.0007	0.03	-	0.03	B2
Carboxin	5234-68-4	-	-	-	F '88	1	1	0.1	4	0.7	-	D
Chloramben	133-90-4	-	-	-	F '88	3	3	0.015	0.5	0.1	-	D
Chlordane	57-74-9	F	zero	0.002	F '87	0.06	0.06	0.0005	0.02	-	0.01	B2
Chloroform (THM)	67-66-3	F	zero	0.08[1]	D '93	4	4	0.01	0.4	-	-	B2[4]
Chloromethane	74-87-3	-	-	-	F '89	9	0.4	0.004	0.1	0.03	-	D
Chlorophenol (2-)	95-57-8	-	-	-	D '94	0.5	0.5	0.005	0.2	0.04	-	D
Chlorothalonil	1897-45-6	-	-	-	F '88	0.2	0.2	0.015	0.5	-	0.15	B2
Chlorotoluene o-	95-49-8	-	-	-	F '89	2	2	0.02	0.7	0.1	-	D
Chlorotoluene p-	106-43-4	-	-	-	F '89	2	2	0.02	0.7	0.1	-	D
Chlorpyrifos[5]	2921-88-2	-	-	-	F '92	0.03	0.03	0.003	0.1	0.02	-	D
Chrysene (PAH)	218-01-9	-	-	-	-	-	-	-	-	-	-	B2
Cyanazine	21725-46-2	-	-	-	D '96	0.1	0.1	0.002	0.07	0.001	-	

[1] Under review.
[2] 1998 Final Rule for Disinfectants and Disinfection By-products: The total for trihalomethanes is 0.08 mg/L.
[3] PAE = phthalate acid ester.
[4] By the 1999 Draft Guidelines for Carcinogen Risk Assessment, chloroform is *likely to be carcinogenic to humans* by all routes of exposure under high-dose conditions that lead to cytotoxicity and regenerative hyperplasia in susceptible tissues. Chloroform is *not likely to be carcinogenic to humans* by all routes of exposures at a dose level that does not cause cytotoxicity and cell regeneration
[5] New OPP RfD = 0.0003 mg/kg/day.

Drinking Water Standards and Health Advisories

Chemicals	CASRN Number	Standards			Status HA Document	Health Advisories						Cancer Group
		Status Reg.	MCLG (mg/L)	MCL (mg/L)		10-kg Child						
						One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
Cyanogen chloride[1]	506-77-4	-	-	-	-	0.05	0.05	0.05	2	-	-	D
2,4-D (2,4-dichlorophenoxyacetic acid)	94-75-7	F	0.07	0.07	F '87	1	0.3	0.01	0.4	0.07	-	D
DCPA (Dacthal)	1861-32-1	-	-	-	F '88	80	80	0.01	0.4	0.07	-	D
Dalapon (sodium salt)	75-99-0	F	0.2	0.2	F '89	3	3	0.03	0.9	0.2	-	D
Di(2-ethylhexyl)adipate	103-23-1	F	0.4	0.4	-	20	20	0.6	20	0.4	3	C
Di(2-ethylhexyl)phthalate (PAE)	117-81-7	F	zero	0.006	-	-	-	0.02	0.7	-	0.3	B2
Diazinon	333-41-5	-	-	-	F '88	0.02	0.02	0.00009	0.003	0.0006	-	E
Dibromochloromethane[1] (THM)	124-48-1	F	0.06	0.08[2]	D '93	6	6	0.02	0.7	0.06	0.04	C
Dibromochloropropane (DBCP)	96-12-8	F	zero	0.0002	F '87	0.2	0.05	-	-	-	0.003	B2
Dibutyl phthalate (PAE)	84-74-2	-	-	-	-	-	-	0.1	4	-	-	D
Dicamba	1918-00-9	-	-	-	F '88	0.3	0.3	0.03	1	0.2	-	D
Dichloroacetic acid[1]	76-43-6	F	zero	0.06[3]	D '95	5	5	0.004	0.1	-	[4]	B2
Dichlorobenzene o-	95-50-1	F	0.6	0.6	F '87	9	9	0.09	3	0.6	-	D
Dichlorobenzene m-[5]	541-73-1	-	-	-	F '87	9	9	0.09	3	0.6	-	D
Dichlorobenzene p-	106-46-7	F	0.075	0.075	F '87	11	11	0.1	4	0.075	-	C
Dichlorodifluoromethane	75-71-8	-	-	-	F '89	40	40	0.2	5	1	-	D
Dichloroethane (1,2-)	107-06-2	F	zero	0.005	F '87	0.7	0.7	-	-	-	0.04	B2
Dichloroethylene (1,1-)	75-35-4	F	0.007	0.007	F '87	2	1	0.009	0.3	0.006	0.006	C
Dichloroethylene (cis-1,2-)	156-59-2	F	0.07	0.07	F '90	4	1	0.01	0.4	0.07	-	D
Dichloroethylene (trans-1,2-)	156-60-5	F	0.1	0.1	F '87	20	1	0.02	0.7	0.1	-	D
Dichloromethane	75-09-2	F	zero	0.005	D '93	10	2	0.06	2	-	0.5	B2
Dichlorophenol (2,4-)	120-83-2	-	-	-	D '94	0.03	0.03	0.003	0.1	0.02	-	E
Dichloropropane (1,2-)	78-87-5	F	zero	0.005	F '87	-	0.09	-	-	-	0.06	B2
Dichloropropene (1,3-)	542-75-6	-	-	-	F '88	0.03	0.03	0.03	1	-	0.04	B2
Dieldrin	60-57-1	-	-	-	F '88	0.0005	0.0005	0.00005	0.002	-	0.0002	B2
Diethyl phthalate (PAE)	84-66-2	-	-	-	-	-	-	0.8	30	-	-	D

[1] Under review.
[2] 1998 Final Rule for Disinfectants and Disinfection By-products: The total for trihalomethanes is 0.08 mg/L.
[3] 1998 Final Rule for Disinfectants and Disinfection By-products: The total for five haloacetic acids is 0.06 mg/L.
[4] A quantitative risk estimate has not been determined.
[5] The values for m-dichlorobenzene are based on data for o-dichlorobenzene.

Chemicals	CASRN Number	Standards			Status HA Document	Health Advisories						Cancer Group
						10-kg Child						
		Status Reg.	MCLG (mg/L)	MCL (mg/L)		One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
Diisopropyl methylphosphonate	1445-75-6	-	-	-	F '89	8	8	0.08	3	0.6	-	D
Dimethrin	70-38-2	-	-	-	F '88	10	10	0.3	10	2	-	D
Dimethyl methylphosphonate	756-79-6	-	-	-	F '92	2	2	0.2	7	0.1	0.7	C
Dimethyl phthalate (PAE)	131-11-3	-	-	-	-	-	-	-	-	-	-	D
Dinitrobenzene (1,3-)	99-65-0	-	-	-	F '91	0.04	0.04	0.0001	0.005	0.001	-	D
Dinitrotoluene (2,4-)	121-14-2	-	-	-	F '92	0.50	0.50	0.002	0.1	-	0.005	B2
Dinitrotoluene (2,6-)	606-20-2	-	-	-	F '92	0.40	0.40	0.001	0.04	-	0.005	B2
Dinitrotoluene (2,6 & 2,4)[1]		-	-	-	F '92	-	-	-	-	-	0.005	B2
Dinoseb	88-85-7	F	0.007	0.007	F '88	0.3	0.3	0.001	0.04	0.007	-	D
Dioxane p-	123-91-1	-	-	-	F '87	4	0.4	-	-	-	**0.3**	B2
Diphenamid	957-51-7	-	-	-	F '88	0.3	0.3	0.03	1	0.2	-	D
Diquat	85-00-7	F	0.02	0.02	-	-	-	**0.002**[2]	0.07	-	-	D
Disulfoton	298-04-4	-	-	-	F '88	0.01	0.01	0.00004	0.001	0.0003	-	E
Dithiane (1,4-)	505-29-3	-	-	-	F '92	0.4	0.4	0.01	0.4	0.08	-	D
Diuron	330-54-1	-	-	-	F '88	1	1	0.002[3]	0.07	0.01	-	D
Endothall	145-73-3	F	0.1	0.1	F '88	0.8	0.8	0.02	0.7	0.1	-	D
Endrin	72-20-8	F	0.002	0.002	F '87	0.02	0.005	**0.0003**	0.01	0.002	-	D
Epichlorohydrin	106-89-8	F	zero	TT[4]	F '87	0.1	0.1	0.002	0.07	-	**0.3**	B2
Ethylbenzene	100-41-4	F	0.7	0.7	F '87	30	3	0.1	3	0.7	-	D
Ethylene dibromide (EDB)[5]	106-93-4	F	zero	0.00005	F '87	0.008	0.008	-	-	-	**0.00004**	B2
Ethylene glycol	107-21-1	-	-	-	F '87	20	6	2	70	14	-	D
Ethylene Thiourea (ETU)	96-45-7	-	-	-	F '88	0.3	0.3	**0.00008**	0.003	-	0.02	B2
Fenamiphos	22224-92-6	-	-	-	F '88	0.009	0.009	0.00025	0.009	0.002	-	D

[1] Technical grade.
[2] New OPP RfD = 0.005 mg/kg/day
[3] New OPP RfD = 0.003 mg/kg/day.
[4] When epichlorohydrin is used in drinking water systems, the combination (or product) of dose and monomer level shall not exceed that equivalent to an epichlorohydrin-based polymer containing 0.01% monomer dosed at 20 mg/L.
[5] 1,2-dibromoethane.

Chemicals	CAS Number	Standards			Status HA Standards	Health Advisories						Cancer Group
		Status Reg.	MCLG (mg/L)	MCL (mg/L)		10-kg Child						
						One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
Fluometuron	2164-17-2	-	-	-	F '88	2	2	0.01	0.5	0.09		D
Fluorene (PAH)	86-73-7	-	-	-	-	-	-	0.04	1	-	-	D
Fonofos	944-22-9	-	-	-	F '88	0.02	0.02	0.002	0.07	0.01	-	D
Formaldehyde	50-00-0	-	-	-	D '93	10	5	0.2	7	1	-	B1[1]
Glyphosate	1071-83-6	F	0.7	0.7	F '88	20	20	0.1[2]	4	0.7	-	D
Heptachlor	76-44-8	F	zero	0.0004	F '87	0.01	0.01	0.0005	0.02	-	0.0008	B2
Heptachlor epoxide	1024-57-3	F	zero	0.0002	F '87	0.01	-	0.00001	0.0004	-	0.0004	B2
Hexachlorobenzene	118-74-1	F	zero	0.001	F '87	0.05	0.05	0.0008	0.03	-	0.002	B2
Hexachlorobutadiene[3]	87-68-3	-	-	-	D '98	0.3	0.3	**0.0002[4]**	**0.007**	0.001	0.05	C
Hexachlorocyclopentadiene	77-47-4	F	0.05	0.05	-	-	-	0.006	0.2	-	-	E
Hexachloroethane	67-72-1	-	-	-	F '91	5	5	0.001	0.04	0.001	**0.3**	C
Hexane (n-)	110-54-3	-	-	-	F '87	10	4	-	-	-	-	D
Hexazinone	51235-04-2	-	-	-	F '96	3	2	0.05[5]	2	0.4	-	D
HMX[6]	2691-41-0	-	-	-	F '88	5	5	0.05	2	0.4	-	D
Indeno[1,2,3,-c,d]pyrene (PAH)	193-39-5	-	-	-	-	-	-	-	-	-	-	B2
Isophorone	78-59-1	-	-	-	F '92	15	15	0.2	7	0.1	4	C
Isopropyl methylphosphonate	1832-54-8	-	-	-	F '92	30	30	0.1	4	0.7	-	D
Isopropylbenzene (cumene)	98-82-8	-	-	-	D '87	11	11	0.1	4	-	-	D
Lindane[7]	58-89-9	F	0.0002	0.0002	F '87	1	1	0.0003	0.01	0.0002	-	C
Malathion	121-75-5	-	-	-	F '92	0.2	0.2	0.02	0.8	0.7	-	D
Maleic hydrazide	123-33-1	-	-	-	F '88	10	10	0.5	20	4	-	D
MCPA[8]	94-74-6	-	-	-	F '88	0.1	0.1	0.0005[9]	0.02	0.004	-	D
Methomyl	16752-77-5	-	-	-	F '88	0.3	0.3	0.025	0.9	0.2	-	E
Methoxychlor	72-43-5	F	0.04	0.04	F '87	0.05	0.05	0.005	0.2	0.04	-	D
Methyl ethyl ketone	78-93-3	-	-	-	F '87	75	7.5	**0.6**	**20**	**4**	-	D
Methyl parathion	298-00-0	-	-	-	F '88	0.3	0.3	0.00025	0.009	0.002	-	D

[1] Carcinogenicity based on inhalation exposure.
[2] New OPP RfD = 2 mg/kg/day.
[3] Under review.
[4] Draft Ambient Water Quality Criteria for the protection of human health (EPA 822-R-98-004)
[5] The Health Advisory is based on a new OPP RfD rather than the IRIS RfD.
[6] HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
[7] Lindane = γ – hexachlorocyclohexane.
[8] MCPA = 4(chloro-2-methoxyphenoxy)acetic acid.
[9] OPP RfD = 0.0015 mg/kg/day.

Chemicals	CASRN Number	Standards			Status HA Document	Health Advisories						Cancer Group
						10-kg Child						
		Status Reg.	MCLG (mg/L)	MCL (mg/L)		One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
Metolachlor	51218-45-2	-	-	-	F '88	2	2	**0.15**[1]	5	0.1	-	C
Metribuzin	21087-64-9	-	-	-	F '88	5	5	0.025[2]	0.9	0.2	-	D
Monochloroacetic acid[3]	79-11-8	F	-	0.06[4]	-	-	-	-	-	-	-	-
Monochlorobenzene	108-90-7	F	0.1	0.1	F '87	4	4	**0.02**	0.7	0.1	-	D
Naphthalene	91-20-3	-	-	-	F '90	0.5	0.5	**0.02**	0.7	0.1	-	C
Nitrocellulose[5]	9004-70-0	-	-	-	F '88	-	-	-	-	-	-	-
Nitroguanidine	556-88-7	-	-	-	F '90	10	10	0.1	4	0.7	-	D
Nitrophenol p-	100-02-7	-	-	-	F '92	0.8	0.8	0.008	0.3	0.06	-	D
Oxamyl (Vydate)	23135-22-0	F	0.2	0.2	F '87	0.2	0.2	0.025[6]	0.9	0.2	-	E
Paraquat	1910-42-5	-	-	-	F '88	0.1	0.1	0.0045	0.2	0.03	-	C
Pentachlorophenol	87-86-5	F	zero	0.001	F '87	1	0.3	0.03	1	-	0.03	B2
Phenanthrene (PAH)	85-01-8	-	-	-	-	-	-	-	-	-	-	D
Phenol	108-95-2	-	-	-	D '92	6	6	0.6	20	4	-	D
Picloram	1918-02-1	F	0.5	0.5	F '88	20	20	0.07[7]	2	0.5	-	D
Polychlorinated biphenyls (PCBs)	1336-36-3	F	zero	0.0005	D '93	-	-	-	-	-	0.01	B2
Prometon	1610-18-0	-	-	-	F '88	0.2	0.2	0.015	0.5	0.1	-	D
Pronamide	23950-58-5	-	-	-	F '88	0.8	0.8	0.075	3	0.05	-	C
Propachlor	1918-16-7	-	-	-	F '88	0.5	0.5	0.01	0.5	0.09	-	D
Propazine	139-40-2	-	-	-	F '88	1	1	0.02	0.7	0.01	-	C
Propham	122-42-9	-	-	-	F '88	5	5	0.02	0.6	0.1	-	D
Pyrene (PAH)	129-00-0	-	-	-	-	-	-	0.03	-	-	-	D
RDX[8]	121-82-4	-	-	-	F '88	0.1	0.1	0.003	0.1	0.002	0.03	C
Simazine	122-34-9	F	0.004	0.004	F '88	0.5	0.5	0.005	0.2	0.004	-	C
Styrene	100-42-5	F	0.1	0.1	F '87	20	2	0.2	7	0.1	-	C
2,4,5-T (Trichlorophenoxy-acetic acid)	93-76-5	-	-	-	F '88	0.8	0.8	0.01	0.4	0.07	-	D

[1] New OPP RfD = 0.1 mg/kg/day.
[2] New OPP RfD = 0.013 mg/kg/day.
[3] Under review.
[4] 1998 Final Rule for Disinfectants and Disinfection By-products: the total for five haloacetic acids is 0.06mg/L.
[5] The Health Advisory Document for nitrobenzene does not include HA values and describes this compounds as relatively nontoxic.
[6] New OPP RfD = 0.001 mg/kg/day.
[7] New OPP RfD = 0.2 mg/kg/day.
[8] RDX = hexahydro -1,3,5-trinitro-1,3,5-triazine.

Drinking Water Standards and Health Advisories

Chemicals	CASRN Number	Standards			Status HA Document	Health Advisories						Cancer Group
						10-kg Child						
		Status Reg.	MCLG (mg/L)	MCL (mg/L)		One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
2,3,7,8-TCDD (Dioxin)	1746-01-6	F	zero	3E-08	F '87	1E-06	1E-07	1E-09	4E-08	-	2E-08	B2
Tebuthiuron	34014-18-1	-	-	-	F '88	3	3	0.07	2	0.5	-	D
Terbacil	5902-51-2	-	-	-	F '88	0.3	0.3	0.01	0.4	0.09	-	E
Terbufos	13071-79-9	-	-	-	F '88	0.005	0.005	0.0001	0.005	0.0009	-	D
Tetrachloroethane (1,1,1,2-)	630-20-6	-	-	-	F '89	2	2	0.03	1	0.07	0.1	C
Tetrachloroethane (1,1,2,2-)	79-34-5	-	-	-	F '89	0.04	0.04	0.00005	0.002	0.0003	0.02	C
Tetrachloroethylene	127-18-4	F	zero	0.005	F '87	2	2	0.01	0.5	0.01	-	-
Trichlorofluoromethane	75-69-4	-	-	-	F '89	7	7	0.3	10	2	-	D
Toluene	108-88-3	F	1	1	D '93	20	2	0.2	7	1	-	D
Toxaphene	8001-35-2	F	zero	0.003	F '96	0.004	0.004	0.0004	0.01	-	0.003	B2
2,4,5-TP (Silvex)	93-72-1	F	0.05	0.05	F '88	0.2	0.2	0.008	0.3	0.05	-	D
Trichloroacetic acid[1]	76-03-9	F	0.3	0.06[2]	D '96	4	4	0.1	4.0	0.3	-	C
Trichlorobenzene (1,2,4-)	120-82-1	F	0.07	0.07	F '89	0.1	0.1	**0.01**	0.4	0.07	-	D
Trichlorobenzene (1,3,5-)	108-70-3	-	-	-	F '89	0.6	0.6	0.006	0.2	0.04	-	D
Trichloroethane (1,1,1-)	71-55-6	F	0.2	0.2	F '87	100	40	0.035	1	0.2	-	D
Trichloroethane (1,1,2-)	79-00-5	F	0.003	0.005	F '89	0.6	0.4	0.004	0.1	0.003	0.06	C
Trichloroethylene [1]	79-01-6	F	zero	0.005	F '87	-	-	0.007	0.2	-	0.3	B2
Trichlorophenol (2,4,6-)	88-06-2	-	-	-	D '94	0.03	0.03	0.0003	0.01	-	0.3	B2
Trichloropropane (1,2,3-)	96-18-4	-	-	-	F '89	0.6	0.6	0.006	0.2	0.04	-	-
Trifluralin	1582-09-8	-	-	-	F '90	0.08	0.08	0.0075[3]	0.3	0.005	0.5	C
Trimethylbenzene (1,2,4-)	95-63-6	-	-	-	D '87	-	-	-	-	-	-	D
Trimethylbenzene (1,3,5-)	108-67-8	-	-	-	D '87	10	-	-	-	-	-	D
Trinitroglycerol	55-63-0	-	-	-	F '87	0.005	0.005	-	-	0.005	0.2	-
Trinitrotoluene (2,4,6-)	118-96-7	-	-	-	F '89	0.02	0.02	0.0005	0.02	0.002	0.1	C
Vinyl chloride	75-01-4	F	zero	0.002	F '87	3	3	**0.003**	0.1	-	**0.002**	A
Xylenes	1330-20-7	F	10	10	D '93	40	40	2	70	10	-	D

[1] Under review.
[2] 1998 Final Rule for Disinfectants and Disinfection By-products: The total for five haloacetic acids is 0.06 mg/L.
[3] New OPP RfD = 0.024 mg/kg/day.

Chemicals	CASRN Number	Standards			Health Advisories							Cancer Group
						10-kg Child						
		Status Reg.	MCLG (mg/L)	MCL (mg/L)	Status HA Document	One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
INORGANICS												
Ammonia	7664-41-7	-	-	-	D '92	-	-	-	-	30	-	D
Antimony	7440-36-0	F	0.006	0.006	F '92	0.01	0.01	0.0004	0.01	0.006	-	D
Arsenic	7440-38-2	F	zero	0.01	D '95	-	-	**0.0003**	0.01	-	-	A
Asbestos (fibers/l >10μm length)	1332-21-4	F	7 MFL[1]	7 MFL	-	-	-	-	-	-	700-MFL	A[2]
Barium	7440-39-3	F	2	2	D '93	0.7	0.7	**0.07**	2	2	-	D
Beryllium	7440-41-7	F	0.004	0.004	F '92	30	30	**0.002**	0.07	-	-	-
Boron[3]	7440-42-8	-	-	-	D '92	4	0.9	0.09	3	0.6	-	D
Bromate	7789-38-0	F	zero	0.01	D '98	0.2	-	**0.004**	0.14	-	0.005	B2
Cadmium	7440-43-9	F	0.005	0.005	F '87	0.04	0.04	0.0005	0.02	0.005	-	D
Chloramine[4]	10599-90-3	F	4[5]	4[5]	D '95	1	1	0.1	3.5	3.0	-	-
Chlorine	7782-50-5	F	4[5]	4[5]	D '95	3	3	0.1	5	4	-	D
Chlorine dioxide	10049-04-4	F	0.8[5]	0.8[5]	D '98	0.84	0.84	0.03	1	0.8	-	D
Chlorite	7758-19-2	F	0.8	1	D '98	0.84	0.84	0.03	1	0.8	-	D
Chromium (total)	7440-47-3	F	0.1	0.1	F '87	1	1	**0.003[6]**	0.1	-	-	D
Copper (at tap)	7440-50-8	F	1.3	TT[7]	D '98	-	-	-	-	-	-	D
Cyanide[3]	143-33-9	F	0.2	0.2	F '87	0.2	0.2	0.02[8]	0.8	0.2	-	D
Fluoride	7681-49-4	F	4	4	-	-	-	**0.06[9]**	-	-	-	-
Lead (at tap)	7439-92-1	F	zero	TT[7]	-	-	-	-	-	-	-	B2
Manganese	7439-96-5	-	-	-	-	-	-	0.14[10]	-	-	-	D
Mercury (inorganic)	7487-94-7	F	0.002	0.002	F '87	0.002	0.002	**0.0003**	0.01	0.002	-	D
Molybdenum	7439-98-7	-	-	-	D '93	0.08	0.08	0.005	0.2	0.04	-	D
Nickel	7440-02-0	F	-	-	F '95	1	1	0.02	0.7	0.1	-	-

[1] MFL = million fibers per liter.
[2] Carcinogenicity based on inhalation exposure.
[3] Under review.
[4] Monochloramine; measured as free chlorine.
[5] 1998 Final Rule for Disinfectants and Disinfection By-products: MRDLG=Maximum Residual Disinfection Level Goal; and MRDL=Maximum Residual Disinfection Level.
[6] IRIS value for chromium VI.
[7] Copper action level 1.3 mg/L; lead action level 0.015 mg/L.
[8] This RfD is for hydrogen cyanide.
[9] Based on dental fluorosis in children, a cosmetic effect. MCLG based on skeletal fluorosis.
[10] Dietary manganese.

Chemicals	CASRN Number	Standards			Status HA Document	Health Advisories						Cancer Group
						10 kg Child						
		Status Reg.	MCLG (mg/L)	MCL (mg/L)		One-day (mg/L)	Ten-day (mg/L)	RfD (mg/kg/day)	DWEL (mg/L)	Life-time (mg/L)	mg/L at 10^{-4} Cancer Risk	
Nitrate (as N)	14797-55-8	F	10	10	D '93	10[1]	10[1]	1.6	-	-	-	-
Nitrite (as N)	14797-65-0	F	1	1	D '93	1[1]	1[1]	0.16	-	-	-	-
Nitrate + Nitrite (both as N)		F	10	10	D '93	-	-	-	-	-	-	-
Selenium	7782-49-2	F	0.05	0.05	-	-	-	0.005	0.2	0.05	-	D
Silver	7440-22-4	-	-	-	F '92	0.2	0.2	0.005[2]	0.2	0.1	-	D
Strontium	7440-24-6	-	-	-	D '93	25	25	0.6	20	4	-	D
Thallium	7440-28-0	F	0.0005	0.002	F '92	0.007	0.007	0.00007	0.002	0.0005	-	-
White phosphorous	7723-14-0	-	-	-	F '90	-	-	0.00002	0.0005	0.0001		D
Zinc	7440-66-6	-	-	-	D '93	6	6	0.3	10	2	-	D
RADIONUCLIDES												
Beta particle and photon activity (formerly man-made radionuclides)		F	zero	4 mrem/yr		-	-	-	-	-	4 mrem/yr	A
Gross alpha particle activity		F	zero	15 pCi/L	-	-	-	-	-	-	15 pCi/L	A
Combined Radium 226 & 228	7440-14-4	F	zero	5 pCi/L	-	-	-	-	-	-	-	A
Radon	10043-92-2	P	zero	300 pCi/L AMCL[3] 4000 pCi/L	-	-	-	-	-	-	150 pCi/L	A
Uranium	7440-61-1	F	zero	30 µg/L	-	-	-	0.003[4]	0.1	-	-	A

[1] These values are calculated for a 4-kg infant and are protective for all age groups.
[2] Based on a cosmetic effect.
[3] AMCL = Alternative Maximum Contaminant Level
[4] Soluble uranium salts.

Secondary Drinking Water Regulations

Chemicals	CAS Number	Status	SDWR
Aluminum	7429-90-5	F	0.05 to 0.2 mg/L
Chloride	7647-14-5	F	250 mg/L
Color	NA	F	15 color units
Copper	7440-50-8	F	1.0 mg/L
Corrosivity	NA	F	non-corrosive
Fluoride	7681-49-4	F	2.0 mg/L
Foaming agents	NA	F	0.5 mg/L
Iron	7439-89-6	F	0.3 mg/L
Manganese	7439-96-5	F	0.05 mg/L
Odor	NA	F	3 threshold odor numbers
pH	NA	F	6.5 – 8.5
Silver	7440-22-4	F	0.1 mg/L
Sulfate	7757-82-6	F	250 mg/L
Total dissolved solids (TDS)	NA	F	500 mg/L
Zinc	7440-66-6	F	5 mg/L

Microbiology

	Status Reg.	Status HA Document	MCLG	MCL	Treatment Technique
Cryptosporidium	F	F 01	-	TT	Systems that filter must remove 99% of *Cryptosporidium*
Giardia lamblia	F	F 98	-	TT	99.9% killed/inactivated
Legionella	F[1]	F 98	zero	TT	No limit; EPA believes that if *Giardia* and viruses are inactivated, *Legionella* will also be controlled
Heterotrophic Plate Count (HPC)	F[1]	-	NA	TT	No more than 500 bacterial colonies per milliliter.
Total Coliforms	F	-	zero	5%	No more than 5.0% samples total coliform-positive in a month. Every sample that has total coliforms must be analyzed for fecal coliforms; no fecal coliforms are allowed.
Turbidity	F	-	NA	TT	At no time can turbidity go above 5 NTU (nephelometric turbidity units)
Viruses	F[1]	-	zero	TT	99.99% killed/inactivated

[1] Final for systems using surface water; also being considered for regulation under groundwater disinfection rule.

Drinking Water Advisory Table

Chemicals	Status	Health-based Value	Taste Threshold	Odor Threshold
Ammonia	D '92	Not Available	30 mg/L	
Methyl tertiary butyl ether (MtBE)	F '98	Not Available	40 µg/L	20 µg/L
Sodium	D '02	20 mg/L (for individuals on a 500 mg/day restricted sodium diet).	30-60 mg/L	
Sulfate	D '02	500 mg/L	250 mg/L	

Taste Threshold: Concentration at which the majority of consumers do not notice an adverse taste in drinking water; it is recognized that some sensitive individuals may detect a chemical at levels below this threshold.

Odor Threshold: Concentration at which the majority of consumers do not notice an adverse odor in drinking water; it is recognized that some sensitive individuals may detect a chemical at levels below this threshold.

Appendix I-3
Background Values Information

SECTION 4

Background Values Estimation and Sampling Results

Various statistical evaluations can be conducted on the validated data for selection of a representative background data set and values. The rationale for the statistical evaluation is that a single sample result may not represent true background conditions. However, a set of data with an adequate number of samples could provide a range of background concentrations for the various constituents that are representative of a typical background distribution.

Tables 4-1 through 4-7 represent a statistical summary of detected sample parameters for groundwater, surface soil, subsurface soil, combined surface and subsurface soil, rock, surface water, and sediment samples, respectively. The "Average Detect" value included in these tables represent the mean of only detected concentrations, where as the "Arithmetic Mean" value includes detected concentrations and non-detected concentrations at half the detection limit value.

A representative background data set, when developed, may have multiple and varied uses at a site. A site-representative data set can be considered similar to a background data set when the following criteria are similar for both:

- Number of samples per data set from background and the site
- Frequency of detects
- Range of detected concentrations (as presented by boxplots in Appendix F)
- Calculated mean concentrations (see Appendix E, tables)
- Calculated Upper Tolerance Limit 95 percent (UTL95%) and upper 95 percent confidence limit (UCL95%) concentrations (see Appendix E and Tables 4-8 to 4-12)

Individual data points (point-estimates or individual sample result) from a site should be compared to background UTL95% values. Alternatively, when comparing a site maximum detected concentration with a background value to determine whether the site has been affected by the NASD operations, an upper-bound (maximum) detected value in the background is useful. Both UTL95% and UCL95% values can be used for this purpose.

Methods used for estimating the background concentrations are recommended by the USEPA. Details of the statistical tests conducted and results produced are presented in Appendix F. USEPA guidance recommends use of UTL95% concentrations as a background data set. USEPA, during its review, recommended inclusion of UCL95% estimates for future site comparisons. Thus, both UTL95% and UCL95% concentrations estimated following USEPA guidance are included in Tables 4-8 through 4-12.

TABLE 4-1
Statistical Summary of Detected Groundwater Sample Parameters
Former NASD Background Analysis

Constituent	Units	Number of Samples	Frequency of Detection	Minimum Detected Value	Maximum Detected Value	Average Detect	Arithmetic Mean*	Minimum Non-detect Value	Maximum Non-detect Value
Aluminum	µg/L	4	100%	130	3,500	1,645	1,645	--	--
Antimony	µg/L	5	40%	5.1	5.2	5.2	2.8	1.2	1.2
Arsenic	µg/L	5	0%	--	--	--	1.5	1.5	1.5
Barium	µg/L	5	100%	180	960	398	398	--	--
Beryllium	µg/L	5	40%	1.4	1.8	1.6	0.74	0.17	0.17
Cadmium	µg/L	5	20%	1.0	1.0	1.0	0.31	0.14	0.14
Calcium	µg/L	5	100%	120,000	660,000	382,000	382,000	--	--
Chromium, Total	µg/L	5	80%	3.7	6.8	5.3	4.3	0.44	0.44
Cobalt	µg/L	5	80%	5.4	20	12	9.2	0.22	0.22
Copper	µg/L	5	80%	2.8	15	8.6	6.9	0.40	0.40
Iron	µg/L	5	100%	480	4,800	2,616	2,616	--	--
Lead	µg/L	5	0%	--	--	--	0.80	0.80	0.80
Magnesium	µg/L	3	100%	76,000	290,000	172,000	172,000	--	--
Manganese	µg/L	5	100%	400	17,000	6,022	6,022	--	--
Mercury	µg/L	5	0%	--	--	--	0.013	0.013	0.013
Nickel	µg/L	5	100%	2.4	19	7.5	7.5	--	--
Potassium	µg/L	4	100%	6,000	490,000	140,500	140,500	--	--
Selenium	µg/L	5	0%	--	--	--	2.3	2.3	2.3
Silver	µg/L	5	0%	--	--	--	0.29	0.29	0.29
Sodium	µg/L	2	100%	210,000	350,000	280,000	280,000	--	--
Thallium	µg/L	5	80%	4.8	18	9.4	7.9	1.7	1.7
Vanadium	µg/L	5	100%	3.5	75	23	23	--	--
Zinc	µg/L	3	33%	60	60	60	22	2.5	2.5
Aluminum, Dissolved	µg/L	5	0%	--	--	--	48	48	48
Antimony, Dissolved	µg/L	5	40%	3.8	9.1	6.5	3.3	1.2	1.2
Arsenic, Dissolved	µg/L	5	20%	5.5	5.5	5.5	2.3	1.5	1.5
Barium, Dissolved	µg/L	5	100%	120	870	364	364	--	--
Beryllium, Dissolved	µg/L	5	40%	1.0	2.2	1.6	0.74	0.17	0.17
Cadmium, Dissolved	µg/L	5	20%	1.1	1.1	1.1	0.33	0.14	0.14
Calcium, Dissolved	µg/L	5	100%	110,000	660,000	386,000	386,000	--	--
Chromium, Total, Dissolved	µg/L	5	40%	2.9	4.6	3.8	1.8	0.44	0.44
Cobalt, Dissolved	µg/L	5	60%	5.5	11	7.4	4.5	0.22	0.22
Copper, Dissolved	µg/L	5	0%	--	--	--	0.40	0.40	0.40
Iron, Dissolved	µg/L	5	60%	410	490	440	269	13	13
Lead, Dissolved	µg/L	5	0%	--	--	--	0.80	0.80	0.80
Magnesium, Dissolved	µg/L	3	100%	71,000	310,000	177,000	177,000	--	--
Manganese, Dissolved	µg/L	5	100%	190	18,000	6,218	6,218	--	--
Mercury, Dissolved	µg/L	5	0%	--	--	--	0.013	0.013	0.013
Nickel, Dissolved	µg/L	5	80%	2.1	12	4.9	4.0	0.47	0.47
Potassium, Dissolved	µg/L	4	100%	5,800	400,000	119,700	119,700	--	--
Selenium, Dissolved	µg/L	5	0%	--	--	--	2.3	2.3	2.3
Silver, Dissolved	µg/L	5	0%	--	--	--	0.28	0.28	0.29
Sodium, Dissolved	µg/L	2	100%	200,000	360,000	280,000	280,000	--	--
Thallium, Dissolved	µg/L	5	60%	5.5	16	9.5	6.4	1.7	1.7
Vanadium, Dissolved	µg/L	5	100%	2.8	32	9.7	9.7	--	--
Zinc, Dissolved	µg/L	3	33%	15	15	15	6.7	2.5	2.5

Note:

* Arithmetic Mean includes non-detects at one-half the detection limit, and represents the detection limit value when all samples are non-detects

.ABLE 4-2
Statistical Summary of Detected Surface Soil Sample Parameters
Former NASD Background Analysis

Parameter	Units	Number of Samples	Frequency of Detection	Minimum Non-Detect Value	Maximum Non-Detect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean*	Geometric Mean	Standard Deviation
Aluminum	mg/kg	26	100.0%	--	--	1,900	24,000	9,212	7,540	5,530
Antimony	mg/kg	26	65.4%	0.26	0.35	0.35	2.3	0.65	0.56	0.44
Arsenic	mg/kg	26	80.8%	0.31	0.39	0.57	2.2	0.89	0.78	0.48
Barium	mg/kg	26	100.0%	--	--	6.7	190	62	45	48
Beryllium	mg/kg	26	80.8%	0.034	0.041	0.13	0.41	0.19	0.16	0.10
Cadmium	mg/kg	26	0.0%	0.028	0.040	--	--	0.033	-3.421	0.0034
Calcium	mg/kg	25	100.0%	--	--	1,900	210,000	26,728	10,722	46,273
Chromium, Total	mg/kg	26	100.0%	--	--	2.2	57	15	8.3	17
Cobalt	mg/kg	26	100.0%	--	--	1.0	22	8.1	5.9	5.6
Copper	mg/kg	26	100.0%	--	--	2.6	68	24	18	16
Iron	mg/kg	26	100.0%	--	--	3,000	38,000	16,385	13,640	8,605
Lead**	mg/kg	25	100.0%	--	--	1.1	7	3.6	3.2	2.4
Magnesium	mg/kg	26	100.0%	--	--	1,200	16,000	4,112	3,311	3,254
Manganese	mg/kg	26	100.0%	--	--	48	1,200	507	377	326
Mercury	mg/kg	26	100.0%	--	--	0.0037	0.031	0.014	0.012	0.0077
Nickel	mg/kg	26	100.0%	--	--	0.67	31	6.7	3.5	8.5
Potassium	mg/kg	26	100.0%	--	--	380	1,700	937	872	351
Selenium	mg/kg	26	19.2%	0.48	0.68	0.73	2.0	0.66	0.62	0.32
Silver	mg/kg	26	0.0%	0.059	0.084	--	--	0.069	-2.674	0.0072
Sodium	mg/kg	26	100.0%	--	--	25	4,000	762	240	1,275
Thallium	mg/kg	26	11.5%	0.35	0.50	0.45	0.67	0.43	0.42	0.066
Vanadium	mg/kg	26	100.0%	--	--	9.0	120	48	40	27
Zinc	mg/kg	26	100.0%	--	--	6.0	71	32	26	18

Notes:

* Arithmetic Mean includes non-detects at one-half the detection limit, and represents the detection limit value when all samples are non-detects

** Lead result from sample with Station ID QS-SS05 (sample ID BKG010) was not included in the analysis

TABLE 4-3
Statistical Summary of Detected Subsurface Soil Sample Parameters
Former NASD Background Analysis

Parameter	Units	Number of Samples	Frequency of Detection	Minimum Non-Detect Value	Maximum Non-Detect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean*	Geometric Mean	Standard Deviation
Aluminum	mg/kg	11	100.0%	--	--	1,600	29,000	10,427	7,676	8,208
Antimony	mg/kg	11	81.8%	0.30	0.31	0.48	1.4	0.72	0.65	0.35
Arsenic	mg/kg	11	72.7%	0.31	0.37	0.71	2.5	1.0	0.85	0.67
Barium	mg/kg	11	100.0%	--	--	6.4	320	71	35	93
Beryllium	mg/kg	11	90.9%	0.043	0.043	0.13	0.46	0.26	0.22	0.12
Cadmium	mg/kg	11	0.0%	0.029	0.039	--	--	0.033	-3.41	0.0038
Calcium	mg/kg	10	100.0%	--	--	1,700	200,000	37,650	11,398	63,817
Chromium, total	mg/kg	11	100.0%	--	--	3.6	74	19	11	23
Cobalt	mg/kg	11	100.0%	--	--	1.2	25	8.4	5.7	7.2
Copper	mg/kg	11	100.0%	--	--	1.8	46	22	16	15
Iron	mg/kg	11	100.0%	--	--	2,500	39,000	18,064	13,394	12,030
Lead	mg/kg	11	100.0%	--	--	0.30	5.9	2.5	1.9	1.7
Magnesium	mg/kg	11	100.0%	--	--	1,300	8,300	4,227	3,754	1,988
Manganese	mg/kg	11	100.0%	--	--	55	970	409	282	311
Mercury	mg/kg	11	63.6%	0.0027	0.0032	0.0048	0.025	0.0089	0.0067	0.0071
Nickel	mg/kg	11	100.0%	--	--	0.77	40	8.3	4.1	12
Potassium	mg/kg	11	100.0%	--	--	500	1,600	873	831	301
Selenium	mg/kg	11	27.3%	0.49	0.66	0.68	1.1	0.66	0.63	0.21
Silver	mg/kg	11	0.0%	0.061	0.082	--	--	0.070	-2.67	0.0080
Sodium	mg/kg	11	100.0%	--	--	81	6,300	1,795	724	2,239
Thallium	mg/kg	11	0.0%	0.36	0.49	--	--	0.42	-0.88	0.049
Vanadium	mg/kg	11	100.0%	--	--	9.8	130	54	42	38
Zinc	mg/kg	11	100.0%	--	--	3.5	36	21	16	12

Note:

* Arithmetic Mean includes non-detects at one-half the detection limit, and represents the detection limit value when all samples are non-detects

TABLE 4-4
Statistical Summary of Detected Combined Surface and Subsurface Soil Sample Parameters
Former NASD Background Analysis

Parameter	Units	Number of Samples	Frequency of Detection	Minimum Non-Detect Value	Maximum Non-Detect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean*	Geometric Mean	Standard Deviation
Aluminum	mg/kg	37	100.0%	--	--	1,600	29,000	9,573	7,580	6,346
Antimony	mg/kg	37	70.3%	0.26	0.35	0.35	2.3	0.67	0.58	0.41
Arsenic	mg/kg	37	78.4%	0.31	0.39	0.57	2.5	0.93	0.80	0.54
Barium	mg/kg	37	100.0%	--	--	6.4	320	65	42	63
Beryllium	mg/kg	37	83.8%	0.034	0.043	0.13	0.46	0.21	0.17	0.11
Cadmium	mg/kg	37	0.0%	0.028	0.040	--	--	0.033	-3.42	0.0035
Calcium	mg/kg	35	100.0%	--	--	1,700	210,000	29,849	10,911	51,132
Chromium, Total	mg/kg	37	100.0%	--	--	2.2	74	16	9.1	19
Cobalt	mg/kg	37	100.0%	--	--	1.0	25	8.2	5.8	6.0
Copper	mg/kg	37	100.0%	--	--	1.8	68	23	17	15
Iron	mg/kg	37	100.0%	--	--	2,500	39,000	16,884	13,567	9,604
Lead**	mg/kg	36	100.0%	--	--	0.30	7	3.3	2.9	2.3
Magnesium	mg/kg	37	100.0%	--	--	1,200	16,000	4,146	3,437	2,908
Manganese	mg/kg	37	100.0%	--	--	48	1,200	478	346	321
Mercury	mg/kg	37	89.2%	0.0027	0.0032	0.0037	0.031	0.013	0.010	0.0078
Nickel	mg/kg	37	100.0%	--	--	0.67	40	7.2	3.6	9.4
Potassium	mg/kg	37	100.0%	--	--	380	1,700	918	860	334
Selenium	mg/kg	37	21.6%	0.48	0.68	0.68	2.0	0.66	0.63	0.28
Silver	mg/kg	37	0.0%	0.059	0.084			0.069	-2.67	0.0073
Sodium	mg/kg	37	100.0%	--	--	25	6,300	1,069	333	1,658
Thallium	mg/kg	37	8.1%	0.35	0.50	0.45	0.67	0.42	0.42	0.061
Vanadium	mg/kg	37	100.0%	--	--	9.0	130	50	40	30
Zinc	mg/kg	37	100.0%	--	--	3.5	71	29	23	17

Notes:

* Arithmetic Mean includes non-detects at one-half the detection limit, and represents the detection limit value when all samples are non-detects

** Results from Station ID QA-SS05 (sample BKG010) were not included in the analysis

TABLE 4-5
Statistical Summary of Detected Rock Sample Parameters
Former NASD Background Analysis

Parameter	Units	Number of Samples	Frequency of Detection	Minimum Non-Detect	Maximum Non-Detect	Minimum Detect	Maximum Detect	Arithmetic Mean*	Standard Deviation
Aluminum	mg/kg	6	100%	--	--	2,000	5,600	4,017	1,351
Antimony	mg/kg	6	0%	0.24	0.25	--	--	0.24	0.0041
Arsenic	mg/kg	6	0%	0.29	0.30	--	--	0.29	0.0041
Barium	mg/kg	6	100%			18	160	70	52
Beryllium	mg/kg	6	33%	0.033	0.033	0.16	0.20	0.082	0.077
Cadmium	mg/kg	6	0%	0.027	0.028	--	--	0.027	0.0004
Calcium	mg/kg	6	100%	--	--	2,000	38,000	8,717	14,360
Chromium, total	mg/kg	6	100%	--	--	0.86	2.5	1.6	0.61
Cobalt	mg/kg	6	100%	--	--	2.2	6.9	4.7	1.7
Copper	mg/kg	6	100%	--	--	2.5	59	17	21
Iron	mg/kg	6	100%	--	--	4,800	10,000	8,300	2,426
Lead	mg/kg	6	83%	0.16	0.16	0.96	3.0	1.4	0.99
Magnesium	mg/kg	6	100%	--	--	910	4,300	2,935	1,178
Manganese	mg/kg	6	100%	--	--	320	840	607	214
Mercury	mg/kg	6	50%	0.0025	0.0026	0.0030	0.0063	0.0035	0.0015
Nickel	mg/kg	6	100%	--	--	0.69	2.5	1.3	0.69
Potassium	mg/kg	6	100%	--	--	170	530	345	136
Selenium	mg/kg	6	0%	0.46	0.47	--	--	0.46	0.0041
Silver	mg/kg	6	0%	0.057	0.058	--	--	0.057	0.0005
Sodium	mg/kg	6	100%	--	--	54	670	294	278
Thallium	mg/kg	6	0%	0.34	0.35	--	--	0.34	0.0041
Vanadium	mg/kg	6	100%	--	--	7.0	24	19	6.9
Zinc	mg/kg	6	100%	--	--	12	43	32	12

Note:

* Arithmetic Mean includes non-detects at one-half the detection limit, and represents the detection limit value when all samples are non-detects

TABLE 4-6
Statistical Summary of Detected Surface Water Sample Parameters
Former NASD Background Analysis

Parameter	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum Non-Detect Value	Maximum Non-Detect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean*
Aluminum	µg/L	2	2	100%	--	--	530	5000	2,765
Antimony	µg/L	1	2	50%	1.2	1	3.3	3.3	2.3
Arsenic	µg/L	1	2	50%	1.5	1	15.0	15.0	8
Barium	µg/L	2	2	100%	--	--	17	37	27
Beryllium	µg/L	2	2	100%	--	--	1.1	2.5	1.8
Cadmium	µg/L	1	2	50%	--	--	1.1	1.1	0.6
Calcium	µg/L	2	2	100%	--	--	390,000	480,000	435,000
Chromium, total	µg/L	1	2	50%	0.4	0.4	4.3	4.3	2.4
Cobalt	µg/L	1	2	50%	0.2	0.2	2.0	2.0	1.1
Copper	µg/L	1	2	50%	--	--	14	14	7.2
Iron	µg/L	2	2	100%	--	--	590	4900	2,745
Lead	µg/L	0	2	0%	0.8	0.8	--	--	ND(0.8)
Manganese	µg/L	2	2	100%	--	--	28	85	57
Mercury	µg/L	0	2	0%	--	--	--	--	0.013
Nickel	µg/L	2	2	100%	--	--	3	5.2	4
Selenium	µg/L	0	2	0%	2	2	--	--	ND(2.3)
Silver	µg/L	0	2	0%	0.3	0.3	--	--	ND(0.285)
Thallium	µg/L	2	2	100%	--	--	5.1	9.7	7.4
Vanadium	µg/L	2	2	100%	--	--	3	8	6
Zinc	µg/L	0	2	0%	3	3	--	--	ND(2.5)

Notes:

ND(XX) - Constituent not detected (arithmetic mean includes non-detects at the detection limit)

* Arithmetic Mean includes non-detects at one-half the detection limit, and represents the detection limit value when all samples are non-detects

TABLE 4-7
Statistical Summary of Detected Sediment Sample Parameters
Former NASD Background Analysis

Parameter	Units	Number of Samples	Frequency of Detection	Minimum Non-Detect Value	Maximum Non-Detect Value	Minimum Detected Value	Maximum Detected Value	Arithmetic Mean*	Geometric Mean	Standard Deviation
Aluminum	mg/kg	6	100.0%	--	--	2,600	10,000	5,867	5,016	3,479
Antimony	mg/kg	6	16.7%	0.36	1.3	0.59	0.59	0.61	0.54	0.35
Arsenic	mg/kg	6	0.0%	0.44	1.5	--	--	0.69	-0.48	0.41
Barium	mg/kg	6	100.0%	--	--	6.9	69	28	20	25
Beryllium	mg/kg	6	50.0%	0.051	0.17	0.17	0.24	0.16	0.13	0.081
Cadmium	mg/kg	6	0.0%	0.041	0.14	--	--	0.064	-2.86	0.038
Calcium	mg/kg	6	100.0%	--	--	8,900	160,000	79,483	59,991	49,747
Chromium, total	mg/kg	6	100.0%	--	--	2.3	7.8	4.5	4.2	2.0
Cobalt	mg/kg	6	100.0%	--	--	0.96	4.7	2.5	2.1	1.7
Copper	mg/kg	6	100.0%	--	--	3.3	26	14	11	9.6
Iron	mg/kg	6	100.0%	--	--	2,300	14,000	7,300	6,007	4,749
Lead	mg/kg	6	100.0%	--	--	0.56	8.0	4.4	3.2	3.0
Magnesium	mg/kg	6	100.0%	--	--	2,200	14,000	8,317	7,110	4,344
Manganese	mg/kg	6	100.0%	--	--	24	350	118	81	121
Mercury	mg/kg	6	33.3%	0.0038	0.0054	0.013	0.052	0.014	0.0078	0.019
Nickel	mg/kg	6	100.0%	--	--	0.50	4.1	1.7	1.3	1.3
Potassium	mg/kg	6	100.0%	--	--	1,300	5,200	2,867	2,465	1,651
Selenium	mg/kg	6	33.3%	0.72	2.4	0.78	1.1	1.1	1.0	0.64
Silver	mg/kg	6	0.0%	0.086	0.30	--	--	0.14	-2.11	0.082
Sodium	mg/kg	6	100.0%	--	--	7,800	67,000	22,217	16,406	22,493
Thallium	mg/kg	6	0.0%	0.51	1.8	--	--	0.81	-0.32	0.49
Vanadium	mg/kg	6	100.0%	--	--	7.2	40	21	17	13
Zinc	mg/kg	6	100.0%	--	--	4.9	48	22	17	16

Note:

* Arithmetic mean includes non-detects at 1/2 detection limit, and represents the detection limit value when all samples are non-detects

Table 4-8

Vieques Soil Sample Background Concentration Estima

NASD Background Analysis

Parameter	Units	Dist	N	UCL	OA Soil Type					
					Dist	N	Min	Max	Mean	95th UTL
Aluminum	mg/kg	L	3	13,053						
Antimony	mg/kg	NP	3	0.8						
Arsenic	mg/kg	L	3	0.9						
Arsenic (SUBSURFACE SOIL)	mg/kg	N	1	NA						
Arsenic (SURFACE SOIL)	mg/kg	L	2	0.9						
Barium	mg/kg	L	3	129						
Beryllium	mg/kg	N	3	0.02						
Cadmium	mg/kg	NP	3	0.016 *						
Calcium	mg/kg	NP	3	5,742						
Chromium, TOTAL	mg/kg	NP	3	29						
Cobalt	mg/kg	NP	3	10						
Copper	mg/kg	NP	3	34						
Iron	mg/kg	N	3	23,118						
Lead	mg/kg	L	3	4						
Magnesium	mg/kg	L	3	4,810						
Manganese	mg/kg	N	3	738						
Mercury	mg/kg	L	3	0.014						
Nickel	mg/kg	NP	3	10						
Potassium	mg/kg	L	3	1,019						
Selenium	mg/kg	NP	3	0.35						
Silver	mg/kg	NP	3	0.034 *						
Sodium	mg/kg	NP	3	0,204						
Thallium	mg/kg	NP	3	0.28						
Vanadium	mg/kg	L	3	61						
Zinc	mg/kg	N	3	40						

Note:

* Value exceeds the maximum detected value, it is the dete

NA = not available – sample size too small

ND– Not detected in background soil media

Range of detection limits for pooled samples without detect

Cadmium: 0.028-0.04 mg/kg

Silver: 0.059-0.084 mg/kg

Dist = type of data distribution

95th UTL(UCL) = 95th percentile Upper Tolerance Limit (9

NP = nonparametric

N = normal

L = lognormal

4.1 Statistical Procedures Used and Their Purpose

Background data from NASD were evaluated through a series of statistical procedures described in the following paragraphs. Analytical data are included in Appendix D. Appendix E presents the results of the statistical analysis for each sample medium. Appendix G presents a more detailed account of the statistical procedures. Figure 4-1 presents a flow chart of the statistical evaluation process.

1. Internal consistency evaluation was performed to determine whether the data reproducibility is adequate in the analytical results. All background data were used for the final data analysis, since the relative percentage differences (RPD) between normal samples and duplicate samples were within acceptable limits for all the data (see Appendix H).

2. The graphical data distribution type was determined through descriptive statistics using the boxplots method. These boxplots also identified whether any outliers existed in the data sets. Results indicated that no extreme values existed that required elimination from consideration as representative of background.

3. Following the submittal of the Draft Background Investigative Report, field review of background sample locations was conducted in July 2002 by representatives of USEPA, EQB, DOI, MOV, and the community. The review comments and discussions with the CTC resulted in elimination of some of the data points from the background data set for surface soil, groundwater, and surface water (see Appendix J). No changes, however, were made to the subsurface soil, rock samples, or sediment data sets. Six sediment samples (four from Laguna Playa Grande and two from Laguna Kiani) were included in the background data set. Changes made based on elimination of some of the data for surface soil, groundwater, and surface water samples are summarized here, and presented in the tables in this section.

   - The surface soil sample (QA-SS05) had lead concentrations that could be considered an "outlier." Therefore, this surface soil sample value for lead was eliminated from final background data evaluation, and all other data were included for establishing background values for soils.

   - Some of the groundwater data were removed from the background data set from former water supply wells because of the presence of metal casings on these wells. All of these wells are located in soil type KTd. Wells not included in the data analysis were KTD-NAVY01, KTD-NAVY07, and KTD-NAVY08.

   - Surface water samples from Laguna Playa Grande detected elevated concentrations for some of the inorganic constituents, possibly as a result of high turbidity in the water samples. Therefore, all surface water samples from Laguna Playa Grande were eliminated from inclusion in the background data set. Since all sediment samples from this Laguna had similar inorganic levels, all six sediment samples were retained as representative of background.

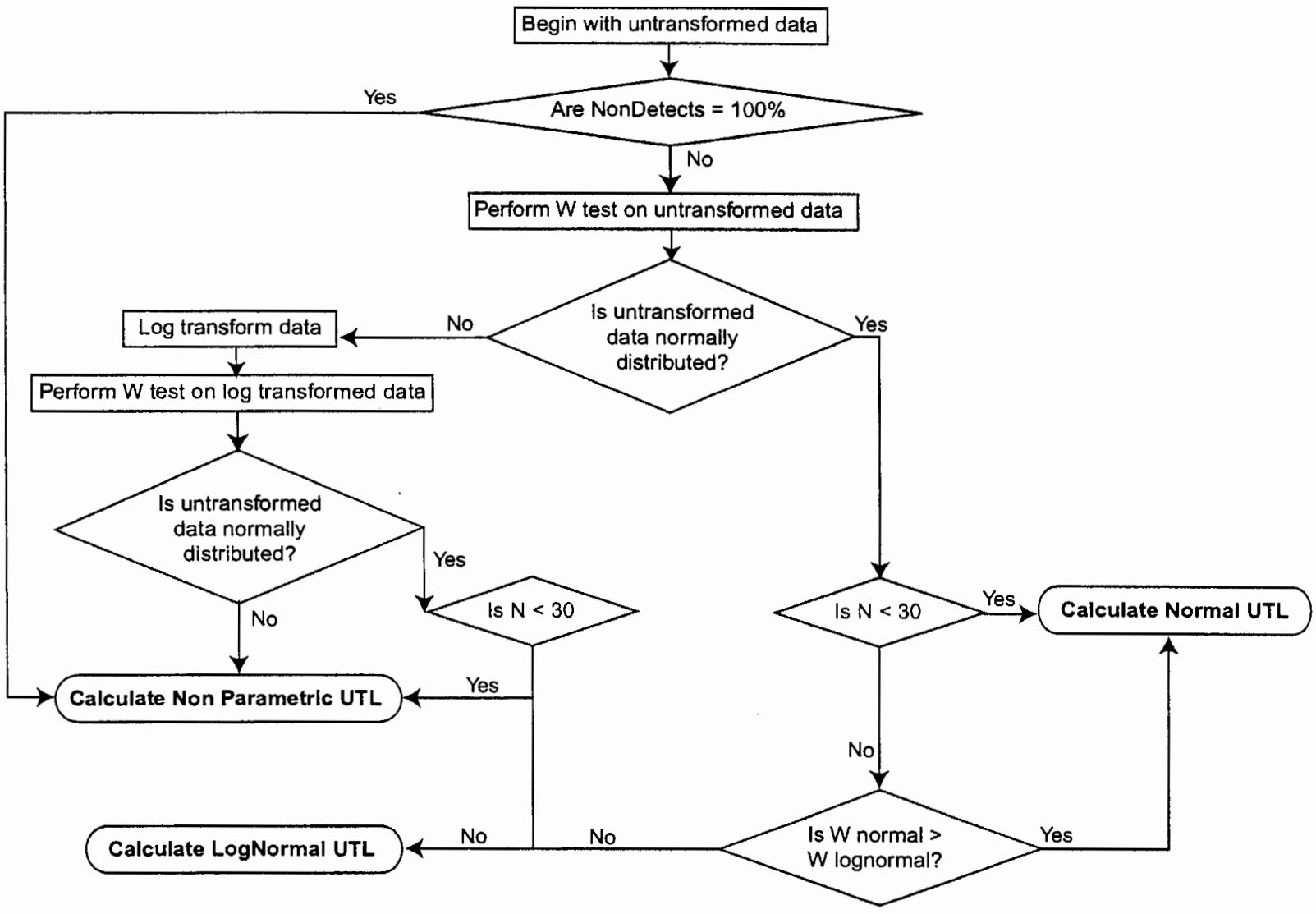


FIGURE 4-1
Decision Flowchart for UTL Calculations

4. In accordance with USEPA guidance, the theoretical data distribution type was determined using the Shapiro-Wilk test method, which calculated a W-statistic value. This W-statistic was used to compare against a critical value from a look-up table. This test helped determine whether data were normal, log normal, or non-normal in distribution using a theoretical distribution standard. All three distribution types were identified for individual constituents and matrix types. Therefore, UTL95% and UCL95% values were calculated according to the type of distribution identified in procedures (see Appendix G for procedure description and Appendix E for results of the statistical analysis).

5. Analysis of variance (ANOVA) tests were used to determine whether all soil data would be combined into one data set or kept separately. The differences and similarities in background constituent concentrations between different soil types, between soil depths, and groundwater data from wells finished in different soil types were evaluated using a Mann-Whitney test (two sample data sets) and a Kruskal-Wallis test (more than two data sets). Soil data were combined, since only two constituents showed a difference in one or two soil types. Groundwater showed a significant difference between natural soil formations from which water was collected. During review of the draft report, comments indicated that some of the variability might have been attributed to metal casings used for the Navy wells. Therefore, data from the three former Navy supply wells were removed from the background data analysis. All the remaining five background wells with PVC casings were retained in one data set for groundwater.

6. A UTL95% concentration was calculated per media (i.e., soil, rock, sediments, surface water and groundwater) and per constituent detected for each media, according to the results of the tests described herein.

7. A UCL95% value also was estimated for the background data sets, where sample size was adequate, using data distribution test results described herein.

A statistical estimate based on the data distribution type was selected for future comparisons with single data points or maximum site concentrations for various sites within the Former NASD. The ULT95% value was estimated for use as background value for point estimate comparisons with the site data. A UCL95% value also may be used for comparison with single sample results or with UCL95% estimates for the site data. The type of statistical procedures used for UTL95% and UCL95% estimates are either normal (when data are normally distributed), log normal (when log-transformed data are normally distributed), or non-parametric procedures (when data distribution type could not be determined by the statistical tests). The procedure selected and used per constituent is listed adjacent to the value in Tables 4-8 through 4-12.

4.2 Summary Statistics for Final Data Set

Appendix J presents all the comments received from the regulators and the Technical Subcommittee and the ultimate responses made by consensus to these comments. The executive summary includes a synopsis of these decisions. Based on these decisions, a final data set was developed to represent background conditions at the Former NASD. A final data set included the soil data collected from background locations within the Former

NASD, except for one surface soil lead result from location QA-SS05. Groundwater data from three former Navy water supply wells (KTD-NAVY01, KTD-NAVY07, and KTD-NAVY08) were not included in the final background data set because of potential for metal well casings to have influenced metal concentrations in the water samples. Laguna Playa Grande surface water samples reported elevated metals concentrations, which were likely attributable to elevated turbidity levels. Sediment samples from Laguna Playa Grande were similar to other sediment samples from Laguna Kiani, and therefore all four sediment samples were retained as background sediment samples. Four samples were originally planned for collection from Laguna Kiani. However, because of their proximity to SWMU 6, only two were collected as part of the background data set (see Appendix K). Tables 4-8 through 4-12 present the background data by media. The analytical data used in this evaluation are included in Appendix D. Sampling locations were presented previously in Figure 2-1 and Appendix K. Appendix E contains a technical memorandum discussing detailed results of the statistical analysis.

4.2.1 Soils

Surface soils were represented by the first 6 inches of soil. A total of 26 surface soil samples were collected for analysis for inorganic constituents. For lead analysis, only 25 samples were available because sample QA-SS05 was not included in the background data set. Common soil inorganic constituents were measured in soil samples collected from soil types KTd, QS, and QA. The UTL95% and UCL95% concentrations were estimated for the 21 inorganic elements detected in soil matrix. Table 4-8 includes a statistical summary of the detected concentrations including the minimum, mean, maximum, UTL95%, and UCL95% values.

The ANOVA tests indicated that soil constituent concentrations in surface and subsurface soils were similar for most elements. However, approximately 15 constituents appeared to be present in different concentrations when compared among soil types. For constituents indicating a difference in concentration levels among the three soil types, a separate listing of UTL95%, UCL95% and mean values also are provided in Table 4-8.

A background (UTL95%) value was not estimated for constituents not detected in any samples. A detection limit value is provided, however, for comparison with site data analytical results and detection limits.

4.2.2 Rock

A total of five samples and one field duplicate sample were collected from plutonic rock that is part of the surface formation within Vieques Island. Because all of the rock sample data were one population, no ANOVA tests were conducted for this data. Distribution types were determined, however, and are listed in Table 4-9. Table 4-9 also summarizes the data and the recommended background values (UTL95%).

TABLE 4-9
Vieques Rock Sample Background Estimates
NASD Background Analysis

Parameter	Units	Dist.	Sample Number	Minimum Detect	Maximum Detect	Mean	UTL	
Aluminum	mg/kg	N	6	2,000	5,600	4,017	5,600	*
Antimony	mg/kg	NP	6	--	--	0.24	0.25	*
Arsenic	mg/kg	NP	6	--	--	0.29	0.30	*
Barium	mg/kg	N	6	18	160	70	160	*
Beryllium	mg/kg	NP	6	0.16	0.20	0.082	0.2	
Cadmium	mg/kg	NP	6	--	--	0.027	0.028	*
Calcium	mg/kg	NP	6	2,000	38,000	8,717	38,000	
Chromium, total	mg/kg	N	6	0.86	2.5	1.6	2.5	*
Cobalt	mg/kg	N	6	2.2	6.9	4.7	6.9	*
Copper	mg/kg	L	6	2.5	59	17	59	
Iron	mg/kg	NP	6	4,800	10,000	8,300	10,000	
Lead	mg/kg	N	6	0.96	3.0	1.4	3.0	*
Magnesium	mg/kg	N	6	910	4,300	2,935	4,300	*
Manganese	mg/kg	N	6	320	840	607	840	*
Mercury	mg/kg	L	6	0.0030	0.0063	0.0035	0.0063	
Nickel	mg/kg	N	6	0.69	2.5	1.3	2.5	*
Potassium	mg/kg	N	6	170	530	345	530	*
Selenium	mg/kg	NP	6	--	--	0.46	0.47	*
Silver	mg/kg	NP	6	--	--	0.057	0.058	*
Sodium	mg/kg	N	6	54	670	294	670	*
Thallium	mg/kg	NP	6	--	--	0.34	0.35	*
Vanadium	mg/kg	N	6	7.0	24	19	24	*
Zinc	mg/kg	N	6	12	43	32	43	*

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects
Dist = type of data distribution
95th UTL = 95/95 Upper Tolerance Limit (95% upper confidence bound of the 95th percentile)
NP = nonparametric
N = normal
L = lognormal

4.2.3 Groundwater

In total, 19 inorganic constituents were detected in groundwater samples. Three of the former Navy water supply wells were eliminated from consideration as background wells because these wells were identified to have metal casings that might have affected inorganic constituent levels from these wells. Table 4-10 includes the estimated statistical background values (UTL95%) for the remaining five wells (four newly installed wells and one upgradient well installed during IR [station ID AOC-K-MW03]). A UCL95% value could not be calculated because all of the values defaulted to the maximum concentration. Each groundwater sample was also analyzed for filtered metals to provide an indication of the dissolved metals within the groundwater. These results are also included in the tables.

4.2.4 Sediment

Six sediment samples (four from Laguna Playa Grande and two from Laguna Kiani) were collected and analyzed for the same 23 constituents as the other media in this analysis. Because concentration ranges of inorganic constituents in both sediment data sets were similar, they were retained as representative of background conditions. Table 4-11 includes constituents detected and background values calculated based on listed distribution type.

4.2.5 Surface Water

Six surface water samples and six sediment background samples were collected. Two of the surface water samples from Laguna Playa Grande were determined to contain elevated levels of inorganic constituents, possibly as a result of the more turbid nature of the surface water in Laguna Playa Grande. Therefore, the four surface water samples from Laguna Playa Grande were not included in this background data set. As a result, the background surface water data set consisted of only two samples. Table 4-12 includes a statistical summary of the analytical results and estimated background values for these two data points.

4.3 Use of Background Concentrations

The background concentrations (Tables 4-8 to 4-12) estimated will be used for comparisons with site-specific sample data from the site investigations at the Former NASD. Both surface and subsurface soil samples collected from any of the sites investigated can be compared with the same set of background values. The rock samples also may be used for site-specific comparisons if site samples are collected from rock.

The groundwater data evaluated is representative of two types of soils (no background wells in KTd soil type). Therefore, where site groundwater data is collected from these soil types, data included in this report can be used for comparison. However, if a site-specific upgradient well was available for background comparison, such a well would likely provide more suitable reference/background comparison data.

The surface water sediment data set is useful for providing a general comparison to site-specific data. Where possible, however, site-specific upstream background surface water and sediment data will be collected as needed for comparisons with site-specific data for inorganic constituents.

TABLE 4-10
Vieques Groundwater Sample Background Estimates
NASD Background Analysis

Parameter	Units	Dist.	Sample Number	Minimum Detect	Maximum Detect	Mean	95th UTL	
Aluminum	µg/L	N	4	130	3,500	1645	3,500	*
Antimony	µg/L	NP	5	5.1	5.2	5.2	5.2	
Arsenic	µg/L	NP	5	--	--	--	--	
Barium	µg/L	L	5	180	960	398	960	*
Beryllium	µg/L	NP	5	1.4	1.8	1.60	1.8	
Cadmium	µg/L	NP	5	1.0	1.0	1.00	1.0	
Calcium	µg/L	L	5	120,000	660,000	382,000	660,000	*
Chromium, total	µg/L	N	5	3.7	6.8	5.3	6.8	*
Cobalt	µg/L	N	5	5.4	20	11.5	20	*
Copper	µg/L	L	5	2.8	15	8.6	15	*
Iron	µg/L	N	5	480	4,800	2,616	4,800	*
Lead	µg/L	NP	5	--	--	--	--	
Magnesium	µg/L	L	3	76,000	290,000	172,000	290,000	*
Manganese	µg/L	L	5	400	17,000	6,022	17,000	*
Mercury	µg/L	N	5	--	--	--	--	*
Nickel	µg/L	L	5	2.4	19	7.5	19	*
Potassium	µg/L	L	4	6,000	490,000	140,500	490,000	*
Selenium	µg/L	N	5	--	--	--	2.3	*
Silver	µg/L	NP	5	--	--	--	--	
Sodium	µg/L	NP	2	210,000	350,000	280,000	350,000	
Thallium	µg/L	L	5	4.8	18	9.4	18	*
Vanadium	µg/L	L	5	3.5	75	23	75	*
Zinc	µg/L	NP	3	60.0	60	60	60	
Dissolved Inorganic Chemicals								
Aluminum, dissolved	µg/L	NP	5	--	--	--	--	
Antimony, dissolved	µg/L	L	5	4	9	6.5	9	*
Arsenic, dissolved	µg/L	NP	5	6	6	5.5	5.5	
Barium, dissolved	µg/L	L	5	120	870	364	870	*
Beryllium, dissolved	µg/L	L	5	1	2	1.60	2	*
Cadmium, dissolved	µg/L	NP	5	1	1	1.10	1	
Calcium, dissolved	µg/L	L	5	110,000	660,000	386,000	660,000	*
Chromium, total, dissolved	µg/L	N	5	3	5	3.8	5	*
Cobalt, dissolved	µg/L	N	5	6	11	7.4	11	*
Copper, dissolved	µg/L	NP	5	--	--	--	--	
Iron, dissolved	µg/L	N	5	410	490	0,440	490	*
Lead, dissolved	µg/L	NP	5	--	--	--	--	
Magnesium, dissolved	µg/L	L	3	71,000	310,000	177,000	310,000	*
Manganese, dissolved	µg/L	L	5	190	18000	6,218	18,000	*
Mercury, dissolved	µg/L	NP	5	--	--	--	--	
Nickel, dissolved	µg/L	L	5	2	12	4.9	12	*
Potassium, dissolved	µg/L	L	4	5,800	400,000	119,700	400,000	*
Selenium, dissolved	µg/L	NP	5	--	--	--	--	
Silver, dissolved	µg/L	NP	5	--	--	--	--	
Sodium, dissolved	µg/L	NP	2	200,000	360,000	280,000	360,000	
Thallium, dissolved	µg/L	L	5	6	16	9.5	16	*
Vanadium, dissolved	µg/L	L	5	3	32	9.7	32	*
Zinc, dissolved	µg/L	NP	3	15	15	15.0	15	

Note:
Dist = type of data distribution
95th UTL = 95/95 Upper Tolerance Limit (95% upper confidence bound of the 95th percentile)
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects
NP = nonparametric
N = normal
L = lognormal
NA = Not applicable – Sample size too small to calculate

TABLE 4-11
Vieques Sediment Sample Background Estimates
NASD Background Analysis

Parameter	Units	Dist.	Sample Number	Minimum Detect	Maximum Detect	Mean	95th UTL	
Aluminum	mg/kg	N	6	2,600	10,000	5,867	10,000	
Antimony	mg/kg	L	6	0.59	0.59	0.61	0.59	
Arsenic	mg/kg	NP	6	–	--	0.69	1.5	*
Barium	mg/kg	N	6	6.9	69	28	69	
Beryllium	mg/kg	N	6	0.17	0.24	0.16	0.24	*
Cadmium	mg/kg	NP	6	--	--	0.064	0.14	*
Calcium	mg/kg	N	6	8,900	160,000	79,483	160,000	*
Chromium, total	mg/kg	N	6	2.3	7.8	4.5	7.8	
Cobalt	mg/kg	N	6	0.96	4.7	2.5	4.7	
Copper	mg/kg	N	6	3.3	26	14	26	
Iron	mg/kg	N	6	2,300	14,000	7,300	14,000	
Lead	mg/kg	N	6	0.56	8.0	4.4	8.0	*
Magnesium	mg/kg	N	6	2,200	14,000	8,317	14,000	*
Manganese	mg/kg	L	6	24	350	118	350	
Mercury	mg/kg	NP	6	0.013	0.052	0.014	0.052	
Nickel	mg/kg	N	6	0.50	4.1	1.7	4.1	
Potassium	mg/kg	N	6	1,300	5,200	2,867	5,200	*
Selenium	mg/kg	L	6	0.78	1.1	1.1	1.1	
Silver	mg/kg	NP	6	–	--	0.14	0.30	*
Sodium	mg/kg	L	6	7,800	67,000	22,217	67,000	
Thallium	mg/kg	NP	6	--	--	0.81	1.8	*
Vanadium	mg/kg	N	6	7.2	40	21	40	
Zinc	mg/kg	N	6	4.9	48	22	48	

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects
Dist. = type of data distribution
95th UTL = 95/95 Upper Tolerance Limit (95% upper confidence bound of the 95th percentile)
NP = nonparametric
N = normal
L = lognormal

TABLE 4-12
Vieques Surface Water Sample Background Estimates
NASD Background Analysis

Parameter	Units	Dist	Sample Number	Minimum Detect	Maximum Detect	Mean	95th UTL
Aluminum	µg/L	NA	2	530	5,000	2,765	NA
Antimony	µg/L	NA	2	3.3	3.3	2.3	NA
Arsenic	µg/L	NA	2	15	15	8	NA
Barium	µg/L	NA	2	17	37	27	NA
Beryllium	µg/L	NA	2	1.1	2.5	1.8	NA
Cadmium	µg/L	NA	2	1.1	1.1	0.6	NA
Calcium	µg/L	NA	2	390,000	480,000	435,000	NA
Chromium, total	µg/L	NA	2	4.3	4.3	2	NA
Cobalt	µg/L	NA	2	2.0	2.0	1	NA
Copper	µg/L	NA	2	14	14	7	NA
Iron	µg/L	NA	2	590	4,900	2,745	NA
Lead	µg/L	NA	2	--	--	1	NA
Manganese	µg/L	NA	2	28	85	57	NA
Mercury	µg/L	NA	2	--	--	0.013	NA
Nickel	µg/L	NA	2	3.1	5	4	NA
Selenium	µg/L	NA	2	--	--	2.3	NA
Silver	µg/L	NA	2	--	--	0.29	NA
Thallium	µg/L	NA	2	5.1	9.7	7.4	NA
Vanadium	µg/L	NA	2	2.7	8	6	NA
Zinc	µg/L	NA	2	--	--	3	NA

Note:
NA - A value not estimated due to small sample size

Whenever a site contaminant concentration is below or near the estimated background (UTL95%) value, the background concentration distribution range should be considered for decision making. The range of soil sample concentrations from a site may be compared with the range of background concentrations. If the minimum, mean, and maximum concentrations of the site-specific constituent concentrations are below UTL95% background concentration, then, the constituent is likely not specific to site operations. A detection limit value was included in these tables so if future detection limits are lowered, constituents may be detected.

Where appropriate, two data sets occasionally may be compared using other additional statistical tests. These evaluations could include comparisons of data distributions by different statistical methods such as UCL95%, and the site data population should be compared with the background population using statistical methods such as Students t-test, ANOVA, Wilcoxon-Rank Sum (WRS) test, Mann-Whitney test, and/or Kruskall-Wallis test. These additional comparisons could be used for future data evaluations if a UTL95%-based background value is exceeded for a specific site, and if other site-specific information indicates contamination is not likely to be site-related. If these test results indicate that differences between data sets are not significant, site concentrations are not likely to be different from background values.