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CTO-059

VOLUMES I – IV

Prepared for:

Comprehensive Long-Term
Environmental Action Navy (Clean)
Naval Air Station
Pensacola, Florida

Prepared by:

EnSafe Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134
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The Contractor, EnSafe/Allen & Hoshall, hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0318 is complete, accurate, and complies with all requirements of the contract.

Date: October 10, 1997
Signature:
Name: Henry H. Beiro
Title: Task Order Manager

REMEDIAL INVESTIGATION REPORT
OU 2
NAVAL AIR STATION
PENSACOLA, FLORIDA

SOUTHNAVFACENGCOM
CONTRACT NUMBER:
N62467-89-D-0318

CTO-059

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SECTIONS 1-13 AND
APPENDICES A-D

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October 10, 1997

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19. Abstract

A remedial investigation was conducted for Operable Unit 2 (OU 2) — Sites 11 (North Chevalier Disposal Area), 12 (Scrap Bins), 25 (Radium Spill Area), 26 (Supply Department Outside Storage Area), 27 (Radium Dial Shop), and 30 (Building 649 Complex). The investigation also included a portion of the former Industrial Waste Water Treatment Plant (IWTP) sewer line (Site 36) serving the OU 2 area. The assessments were conducted to evaluate the nature and extent of contamination in these areas

Site 11 is a former landfill where trenching revealed evidence of a "seam" of blackened debris at the water table containing oily metallic debris. The Baseline Risk Assessment (BRA) identified soil Chemicals of Concern (COCs) to include aluminum, arsenic, cadmium, chromium, Aroclor-1260, and benzo(a)pyrene equivalents (BEQs). Groundwater COCs include aluminum, arsenic, barium, beryllium, cadmium, chromium, manganese, nickel, vanadium, 1,2-dichloroethene (1,2-DCE), aldrin, chloroform, 1,2-dichloroethane (1,2-DCA), dieldrin, 1,1,2,2-tetrachloroethane, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride.

At Site 12, a storage area for scrap materials, soil exceedances mainly included primary/secondary metals, polychlorinated-biphenyls (PBS), and semivolatile organic compounds (SVOCs). The BRA identified soil COCs to include aluminum, antimony, arsenic, cadmium, chromium, copper, Aroclor-1254, Aroclor-1260, and BEQs. In addition, soil samples contained radium four times the standard in 40 CFR 192.12. COCs identified in groundwater included Aroclor-1260, chloroform, 1,1-DCE, dieldrin, heptachlor epoxide, and PCE.

At Site 25, a radium spill area that includes the area surrounding Building 780, no radium was found. However, Building 780, which currently houses the Joint Oil Analysis Laboratory, is the source of contamination found at Site 25. Soil samples collected at this building revealed a wide range of primary/secondary metals and SVOC contamination. Adjacent wells contained primary and secondary metals, chlorinated solvents, benzene and xylene. Another location of concern at Site 25 is the storage yard behind Building 225, used as a metal prefabricating shop by the NAS Pensacola PWC. Wells located here contained numerous primary and secondary metals exceedances, as well as PCE and TCE. The BRA identified soil COCs at Site 25 to include arsenic, beryllium, cadmium, chromium, zinc, Aroclor-1254, Aroclor-1260, and BEQs. The only inorganic COC is mercury. Groundwater organic COCs include chlorinated VOCs (1,1-DCE, chloroform, PCE, TCE, and vinyl chloride).

No significant contamination was detected at Site 26. No inorganics contributed to risk at Site 26 soil. Organic COCs were limited to BEQs. Groundwater COCs include arsenic, cadmium, dieldrin, PCE, and vinyl chloride.

At Site 27, the Radium Dial Shop at the former Building 709, SVOC exceedances were noted from wells previously installed by ABB, Inc., in support of underground storage tank (UST) removals at this location. The former UST locations are likely contributors of contamination in these wells. The BRA identified soil COCs to include arsenic, beryllium, and BEQs. In groundwater, chromium, and manganese contributed to a cumulative hazard index. Groundwater organic COCs were chlorinated solvents, including 1,4-dichlorobenzene, 1,1-DCE, 1,2-DCA, dieldrin, chloroform, PCE, TCE, and vinyl chloride (risk projections ranging from 1E-06 to 6E-04).

At Site 30 (the Building 649 complex, and Buildings 3220, and 3450), numerous former ABB, Inc., wells which were associated with previous UST removals at the site revealed the presence of chlorinated solvents, benzene, and phenols. Above ground storage tanks, the former USTs, and associate buried piping are considered sources for this contamination. 30GS154, installed north Building 3450, exhibited vinyl chloride and xylene. The BRA identified soil COCs at Site 30 to include arsenic, beryllium, and BEQs. Groundwater COCs include arsenic, barium, cadmium, chromium, lead, manganese, benzene, chloroform, 1,1-DCE, 1,4-dichlorobenzene, PCE, and 1,1,1-trichloroethane, vinyl chloride, and others. The BRA noted the risk associated with the previous UST removals. Also, at 30GS154, vinyl chloride in groundwater lends to elevated risk.

For Site 36, 30GI111, adjacent to Building 3189, had chlorinated solvents, benzene, iron, manganese, and sodium. Activities at this building (a former hazardous materials accumulation area) contributed to this contamination. Well 30GS103, installed north of Building 3644 (a former NADEP building), contained primary/secondary metals contamination and chlorobenzene. Nearby well 30GS101 contained xylene and benzene. Chlorobenzene and toxaphene were detected at well 30GS123, near a lift station for the IWTP sewer line. The BRA noted that at 30GI111/30GS111, arsenic, benzene, 1,4-dichlorobenzene, and vinyl chloride contribute to risk, while chlorobenzene and iron lend to elevated hazard indices.

Potential ecological impacts on wetland areas adjacent to OU 2 and Bayou Grande, will be addressed in separate upcoming RI/FSs for Bayou Grande (Site 40), and the NAS Pensacola Wetlands (Site 41). No data gaps were noted that require additional fieldwork or analysis to complete this investigation and provide the basis for the feasibility study. RASO will be responsible for the removal and disposal of the low-level radiological wastes encountered at Sites 12 and 27.

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List of Acronyms

°C	Degrees Celsius
μg/kg	Micrograms per kilogram
μg/L	Micrograms per liter
μg/dL	Micrograms per decaliter
%D	Percent difference
%RSD	Percent relative standard deviation
ABF	Dermal to absorbed dose adjustment factor
ABS	Absorption factor
AF	Adherence factor
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
AT	Average time
AT_C	Averaging time (carcinogen)
AT_{NC-A}	Averaging time (noncarcinogen adult)
AT_{NC-C}	Averaging time (noncarcinogen child)
BEHP	Bis(2-ethylhexyl)Phthalate
BEQ	Benzo(a)pyrene equivalent
bls	Below land surface
BNAs	Base-neutral/acid extractable organic compounds
BRA	Baseline Risk Assessment
BRAC	Base realignment and closure
BW	Body weight
Bw_{adult}	Average adult body weight (kg)
Bw_{child}	Average child body weight (ages 1-6) (kg)
C_s	Chemical concentration in surface soil (mg/kg)
C_8	Concentration of contaminant in soil (mg/kg)
CCB	Continuing calibration blank
CDI	Chronic daily intake
CDI_8	Ingested dose (mg/kg-day)
CDI_w	Ingested/inhaled dose (mg/kg-day)
CEC	Cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
$Cf_{soil/child}$	Child soil dermal contact factor (mg/day)
$Cf_{soil/adult}$	Adult soil dermal contact factor (mg/day)
CG	Cleanup goal
CGL	Cleanup goal for leaching
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
cm/s	Centimeters per second
CNS	Central Nervous System
COC	Contaminants of concern

COPC	Chemicals of potential concern
cPAH	Carcinogen polycyclic aromatic hydrocarbon
CPSS	Chemicals present in site sample
CRQL	Contract required quantitation limit
CSAP	Comprehensive Sampling and Analysis Plan
CSS	Contaminant source survey
CT	Central tendency
C_w	Chemical concentration in groundwater
DCA	Dichloroethane
DCE	Dichloroethene
DDD	Dichlorodiphenyl dichloroethane
DI	De-ionized
DNAPL	Dense non-aqueous phase liquid
DOT	Department of Transportation (U.S.)
DRMO	Defense Reutilization and Marketing Office
DQO	Data quality objectives
E/A&H	EnSafe/Allen & Hoshall
ECAO	Environmental Criteria and Assessment Office
ECPC	Ecological chemicals of potential concern
ED	Exposure duration
Ed_{adult}	Adult exposure duration during ages 7-31 (yr)
$Ed_{dult\text{-}w}$	Adult worker exposure duration (yr)
Ed_{child}	Child exposure duration during ages 1-6 (yr)
EF	Exposure frequency
Ef_{res}	Residential exposure frequency (days/year)
Ef_w	Worker exposure frequency (days/year)
E&E	Ecology and Environment, Inc.
EPC	Exposure point concentration
F	Conversion factor (10^{-6} kg/mg)
FB	Field blank
FC	Fraction contacted from a contaminated source
FDEP	Florida Department of Environmental Protection
FDWS	Florida Drinking Water Standard
FFA	Federal Facilities Agreement
FGGC	Florida Groundwater Guidance Concentrations
FI	Fraction ingested from a contaminated source
f_{oc}	Organic carbon fraction
FPDWS	Florida Primary Drinking Water Standard
FS	Feasibility study
FSA	Full scan analysis
FSDWS	Florida Secondary Drinking Water Standard
ft/day	Feet per day
G&M	Geraghty & Miller, Inc.
GC/MS	Gas chromatograph/mass spectrometer

g/m^3	Gram per cubic meter
GPS	Global positioning system
GS	Grain size
H_2SO_4	Sulfuric acid
HCl	Hydrochloric acid
HEAST	Health Effects Assessment Summary Tables
HHRA	Human health risk assessment
HI	Hazard Index
HMW	High molecular weight
HNO_3	Nitric acid
HQ	Hazard Quotient
IAS	Initial Assessment Study
ICB	Initial calibration blank
ICP	Inductive coupled plasma
ICSA	Interference check sample analysis
ID	Inside diameter
IDL	Instrument detection limit
IFG	Inorganic Functional Guidelines
ILCR	Incremental lifetime cancer risk
$ILCR(chem_i)$	Incremental lifetime excess cancer risk for a specific chemical
IR	Ingestion rate (mg/day)
$Ir_{soil/adult}$	Adult soil intake rate (mg/day)
$Ir_{soil/child}$	Child soil intake rate (mg/day)
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IS	Internal standard
IT	International Technologies, Inc.
IWTP	Industrial Wastewater Treatment Plant
K	Hydraulic conductivity
K_d	Partition coefficient
K_{oc}	Carbon/water partitioning coefficient
LC_{50}	Lethal concentration for 50% of the population
LCS	Laboratory control sample
LCSA	Laboratory control sample analysis
LEL	Lower Explosive Limit
LMW	Low molecular weight
LNAPL	Light non-aqueous phase liquid
MCL	Maximum Contaminant Level
MEK	Methylethylketone
mEq/L	Milliequivalent per liter
mg/kg	Milligrams per kilogram
mR/hr	MilliRoentgens per hour
MS/MSD	Matrix spike/matrix spike duplicate
msl	Mean sea level

NADEP	Naval Aviation Depot
NaOH	Sodium hydroxide
NAS	Naval Air Station
NCEA	National Center for Environmental Assessment
NEESA	Naval Energy and Environmental Support Activity (now NFESC/Naval Environmental Engineering Support Agency)
NET	National Environmental Testing, Inc.
NFESC	Naval Facilities Engineering Service Center (formerly NEESA)
NOAEL	No-observed-adverse-effects level
NPL	National Priorities List
NTP	National Toxicology Program
OD	Outside diameter
OERR	Office of Emergency and Remedial Response
OFG	Organic Functional Guidelines
OSWER	Office of Solid Waste and Emergency Response
PAH	Polycyclic aromatic hydrocarbon
PBS	Soil preparation blank
PBW	Water preparation blank
PCB	Polychlorinated biphenyl
PCE	Perchloroethylene/Tetrachloroethene
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
PID	Photoionization detector
ppb	Parts per billion
PPE	Personal protective equipment
ppm	Parts per million
PPS	Physical parameters, soil
PPW	Physical parameters, water
PRG	Preliminary remediation goal
PVC	Polyvinyl chloride
PWC	Public Works Center
QA/QC	Quality assurance/quality control
Ra-226	Radium-226
RAGS	Risk Assessment Guidance for Superfund
RASO	Radiological Affairs Support Office
RBC	Risk-based concentration
RC	Reference concentration
RCRA	Resource Conservation and Recovery Act
REDOX	Oxidation/reduction
R_f	Retardation factor
RfD	Reference dose
RfDi	Inhalation reference dose
RfDo	Oral reference dose

RGO	Remedial Goal Option
RI	Remedial investigation
$Risk_p$	Total pathway risk of cancer incidence
RME	Reasonable maximum exposure
ROD	Record of decision
SAP	Sampling and Analysis Plan
SDG	Sample delivery group
SF	Cancer slope factor
Sf_i	Inhalation slope factor
SF_o	Oral slope factor
SMCL	Secondary Maximum Contaminant Levels
SMP	Site Management Plan
SOP/QAM	Standard Operating Procedures and Quality Assurance Manual
SOUTHNAVFACENGCOM	Southern Division Naval Facilities Engineering Command
SOW	Statement of work
SVOCs	Semivolatile organic compounds
TAL	Target Analyte List
TCA	Trichloroethane
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TCX	Tetrachloro-m-xylene
TEL	Threshold Effects Level
TEF	Toxicity equivalency factor
TIC	Tentatively identified compound
TOC	Total organic carbon
TRPH	Total recoverable petroleum hydrocarbon
TWA	Time-weighted average
UCL	Upper confidence limit
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground storage tank
VOA	Volatile organic analysis
VOC	Volatile organic compound
VTSR	Verified time of sample receipt

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EXECUTIVE SUMMARY

A remedial investigation was conducted for Operable Unit 2 (OU 2) — Sites 11 (North Chevalier Disposal Area), 12 (Scrap Bins), 25 (Radium Spill Area), 26 (Supply Department Outside Storage Area), 27 (Radium Dial Shop), and 30 (Building 649 Complex), at Naval Air Station (NAS) Pensacola. The investigation also included a portion of the former Industrial Waste Water Treatment Plant (IWTP) sewer line (Site 36) serving the OU 2 area. The assessments were conducted to evaluate the nature and extent of contamination at these industrial areas. To screen these large areas for suspected volatile organic contamination, a soil-gas survey was conducted. Radiation concerns at Sites 12, 25, and 27 required additional screening for radium-226 (Ra-226), used to illuminate aircraft instruments. These surveys provided information vital to efficient placement of borings and monitoring wells. The analytical results detected contaminants at all sites. A synopsis is provided for each site, along with the findings and recommendations.

Site 11

Known as the North Chevalier Field Disposal Area, Site 11 is a former landfill area where industrial and municipal wastes were disposed of and burned from the late 1930s to the mid 1940s. The site occupies approximately 20 acres adjacent to an arm of Bayou Grande north of the former Chevalier Field. In addition to soil borings and monitoring wells, the field investigation for Site 11 included trenching to provide insight as to the contents of the landfill.

The source of contamination was identified to be a former landfill, where trenching revealed evidence of a "seam" of blackened debris at the water table. This oily material contained finely corroded bits of metal and other debris.

The Baseline Risk Assessment (BRA) identified soil inorganic Chemicals Concern (COCs) at Site 11 to include aluminum, arsenic, cadmium, and chromium. Soil organic COCs include Aroclor-1260 and benzo(a)pyrene equivalents (BEQs). Groundwater inorganic COCs include aluminum, barium, cadmium, chromium, manganese, nickel, vanadium, arsenic and beryllium. Groundwater organic COCs include 1,2-dichloroethene (1,2-DCE), aldrin, chloroform,

1,2-dichloroethane (1,2-DCA), dieldrin, 1,1,2,2-tetrachloroethane, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride.

Site 12

Known as the Scrap Bins (officially, the Defense Reutilization and Marketing Office Recyclable Materials Center), Site 12 is a storage yard for scrap materials, to include metal of all types, aircraft, scrap tires, used furniture, and a large amount of electronics. This material is resold as used equipment, or for its scrap value. Site 12 soil exceedances mainly included primary/secondary metals, polychlorinated-biphenyls (PCBs), and semivolatile organic carbons (SVOCs). The storage of scrap metals contributes to metals contamination at this site. Though none were noted during the field investigation, past storage of old transformers pending their disposal are a possible contributor to the PCB contamination at Site 12. Residual fuels and oils from scrapped aircraft and vehicles stored at the site are possible sources of SVOCs at Site 12.

The BRA identified soil inorganic COCs at Site 12 to include aluminum, antimony, arsenic, cadmium, chromium, and copper. Soil organic COCs include Aroclor-1254, Aroclor-1260, and BEQs. In addition, soil samples contained radium in amounts equal to four times the standard in 40 CFR 192.12. COCs identified in groundwater included Aroclor-1260, chloroform, 1,1-DCE, dieldrin, heptachlor epoxide, and PCE.

Site 25

Known as the Radium Spill Area, Site 25 is a concrete-paved area about 50 feet by 50 feet. Site 25 is on the eastern portion of NAS Pensacola, immediately east of Murray Road and north of Farrer Road. The site is associated with former radium decontamination activities at Building 780, with emphasis on the concrete-paved area east of the building where the radium is reported to have spilled. No radium was found in this area. However, Building 780, which currently houses the Joint Oil Analysis Laboratory, is the source of contamination found at Site 25. This activity analyzes oil samples from vehicles and aircraft from military activities nationwide. Soil samples collected behind this building revealed a wide range of primary/secondary metals and SVOC contamination. Shallow wells next to the building contained

primary and secondary metals, and an adjacent intermediate depth well contained metals, as well as chlorinated solvents, benzene and xylene. Improper storage and disposal of materials at Building 780 are possible sources of soil and groundwater contamination. Another location of concern at Site 25 is the storage yard behind Building 225, used as a metal prefabricating shop by the NAS Pensacola PWC. This yard contains racks of metal sheeting, piping, etc. Shallow and intermediate wells located here contained numerous primary and secondary metals exceedances, as well as PCE and TCE. Activities in and around this building are a possible source for contamination in these wells.

The BRA identified soil inorganic COCs at Site 25 to include arsenic, beryllium, cadmium, chromium, and zinc. Soil organic COCs include Aroclor-1254, Aroclor-1260, and BEQs. The only inorganic COC is mercury. Groundwater organic COCs include reported groundwater concentrations of chlorinated VOCs (1,1-DCE, chloroform, PCE, TCE, and vinyl chloride).

Site 26

Known as the Supply Department Outside Storage Area, Site 26 is northwest of Chevalier Field, immediately south of Building 684. No significant contamination was detected at Site 26. No inorganics contributed to risk in Site 26 soil. BEQs in Site 26 soil samples elevate the risk close to the 1E-06 threshold. Groundwater inorganic COCs include arsenic and cadmium. Groundwater organic COCs include dieldrin, PCE and vinyl chloride.

Site 27

Known as the Radium Dial Shop, Site 27 is on the remaining concrete foundation of former Building 709, which is currently a parking lot. At Site 27, SVOC exceedances were noted from wells previously installed by ABB, Inc., in support of underground storage tank (UST) removals at this location. The former UST locations are possible contributors of contamination in these wells.

The BRA identified soil inorganic COCs at Site 27 to include arsenic and beryllium. Soil organic COCs included BEQs. In groundwater, chromium and manganese contributed to a cumulative

hazard index greater than 1. Groundwater organic COCs reported concentrations of chlorinated volatile organic carbons (VOCs), including 1,4-dichlorobenzene, 1,1-DCE, 1,2-DCA, dieldrin, chloroform, PCE, TCE, and vinyl chloride are associated with risk projections ranging from 1E-06 to 6E-04.

Site 30

The site includes a complex of industrial buildings (the Building 649 complex, and Buildings 3220, and 3450) housing plating, paint stripping, engine test cells, metal treating and paint shops. This industrial complex was part of the Dynamic Components Division of the Naval Aviation Depot (NADEP). At Site 30, numerous former ABB, Inc., wells which were associated with previous UST removals within the Building 649 complex revealed chlorinated solvents and benzene exceeding preliminary remediation goals (PRGs). E/A&H wells installed on the western side of this complex revealed SVOC and VOC exceedances. Above ground storage tanks at this complex, the former USTs, and associate buried piping are considered sources for this contamination. Several former ABB, Inc., wells in and around Building 3220 exhibited benzene, chlorinated solvents, and phenol exceeding PRGs. Also, former ABB, Inc., wells south of Building 3450 exhibited phenol above PRGs. All of these ABB, Inc., wells were associated with former UST removals. A shallow well (30GS154) installed on the north side of Building 3450 exhibited vinyl chloride and xylene above PRGs.

The BRA identified soil inorganic COCs at Site 30 to include arsenic, and beryllium. Soil organic COCs include BEQs. Groundwater inorganic COCs include arsenic, barium, cadmium, chromium, lead, and manganese. Groundwater organic COCs include benzene, chloroform, 1,1-DCE, 1,4-dichlorobenzene, PCE, 1,1,1-trichlorethane, vinyl chloride, and others. In addition to noting the risk associated in and around previous UST removals in the Site 30 area of investigation, the BRA noted that groundwater concentrations of vinyl chloride contribute significantly to elevated risk at locations represented by monitoring well 30GS154.

Site 30 also includes a portion of the IWTP sewer in Site 36. The intermediate well (30GI111) adjacent the southwest corner of Building 3189 exhibited chlorinated VOCs, benzene, iron,

manganese, and sodium above PRGs. Activities at the former hazardous materials accumulation area likely contributed to this contamination. Samples from well 30GS103 installed in a fenced storage yard directly north Building 3644 (a former NADEP building), contained primary/secondary metals contamination, as well as chlorobenzene. Nearby well 30GS101 contained xylene and benzene. The contamination in 30GS103 is likely attributable to NADEP activities at Building 3644. Well 30GS101 is adjacent the IWTP, and may be impacted from IWTP activities. Chlorobenzene and toxaphene were detected at well 30GS123, near a lift station for the IWTP sewer line. Past spills from this lift station are the suspected contributors of this contamination.

Current and potential receptors include the surficial zone of the Sand-and-Gravel Aquifer, the main producing zone of the Sand-and-Gravel Aquifer, NAS Pensacola Wetland 5A, NAS Pensacola Wetland 5B, the concrete-lined drainage ditch, also known as NAS Pensacola (Wetland 6), and the Yacht Basin. Potential ecological impacts on wetland areas adjacent OU 2 and Bayou Grande, will be addressed in separate upcoming RI/FSs for Bayou Grande (Site 40), and the NAS Pensacola Wetlands (Site 41).

No data gaps were noted that require additional fieldwork or analysis to complete this investigation and provide the basis for the feasibility study. The soil data offer sufficient analytical quantitation and distribution to assess the nature and extent. Soil exceedances due to metals, pesticides, PCBs, and SVOCs represent a risk that will need to be addressed by the feasibility study. Metals represent the largest proportion of the risk from soil. No VOCs detected comprise any risk due to a soil exceedance. SVOCs and pesticide/PCB compounds represent a minor part of the cumulative soil risk.

Phase I groundwater sampling data are inappropriate to evaluate nature and extent due to turbidity. However, Phase I data were used to focus Phase II sampling on the locations with the highest concentrations to verify their presence. Inorganics, SVOCs, and VOCs were confirmed by Phase II sampling to be addressed by the feasibility study.

The low-level radiological waste encountered at Sites 12 and 27 will be remediated by the Naval Sea Systems Command Radiological Affairs Support Office (RASO). RASO will be responsible for assessing, containing, packing, transporting, and disposal of any low-level radiological wastes. As a result, the FS will not be concerned with alternatives for low-level radiological wastes at these sites.

1.0 INTRODUCTION

Under the authority of the U.S. Navy Comprehensive Long Term Environmental Action Navy (CLEAN) program, a Remedial Investigation (RI) was recently completed at the following Operable Unit 2 (OU 2) sites at Naval Air Station (NAS) Pensacola.

- Site 11 — North Chevalier Field Disposal Area
- Site 12 — Scrap Bins
- Site 25 — Radium Spill Area
- Site 26 — Supply Department Outside Storage Area
- Site 27 — Radium Dial Shop Sewer
- Site 30 — Buildings 647, 648 (former Site 31), 649, 649B, 692, 755, 3815, 3220, 3450, and the Industrial Waste Treatment Plant (IWTP) Sewer (former Site 36)

These sites are listed in the Site Management Plan (SMP) of the Installation Restoration Program (IRP) for NAS Pensacola (Southern Division, Naval Facilities Engineering Command [SOUTHNAVFACENGCOM], 1996). OU 2 is on the northeast portion of the naval installation, and extends from the western edge of the golf course east to the Yacht Basin. The investigation was undertaken by EnSafe/Allen & Hoshall (E/A&H) to meet the requirements of the federal Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) program, which administers the investigation and cleanup of hazardous waste sites. The RI report summarizes the activities, results, and conclusions of the investigation, including a baseline risk assessment (BRA), and provides the basis for the feasibility study (FS). The RI objectives are to assess the nature and extent contamination and evaluate the risk to human health and the environment from onsite contaminated media.

1.1 Project Organization

The RI was executed in three parts. First, all available previous investigation reports in the administrative record were reviewed to develop a comprehensive understanding of the site history and background to develop the sampling and analysis plans (SAPs) for each OU 2 site (E/A&H, 1993a/b/c/d, 1994a, 1995, 1997). Next, a contaminant source survey (CSS) was performed to gain additional information concerning the history of OU 2, and past and present activities which may have contributed to contamination at these sites. Finally, soil borings were advanced and monitoring wells were installed to collect soil and groundwater samples.

1.2 Purpose of Report

This RI report summarizes the activities, results, and conclusions of the overall investigation, and provides the basis for an FS to be completed and, ultimately, a Record of Decision (ROD) for the site. The report also documents the data collection and analytical methods used during the investigation.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Area Description

OU 2, Sites 11, 12, 25, 26, 27, and 30 are on the northeast portion of NAS Pensacola as shown in Figure 2-1, Site Location Map, and Figure 2-2, Site Distribution Map. These sites were grouped as an operable unit because they are located near each other and within the same watershed. OU 2 extends from the western edge of the golf course east to the Yacht Basin.

Site 11 — North Chevalier Field Disposal Area

The North Chevalier Field Disposal Area, Site 11, is a former landfill where industrial and municipal wastes were disposed of and burned from the late 1930s to the mid 1940s. The area occupies approximately 20 acres next to an arm of Bayou Grande called the Yacht Basin north of former Chevalier Field. Surface elevations on the site are approximately 5 feet above mean sea level (msl) and topography slopes gently to the east toward Bayou Grande. Two prefabricated buildings, Buildings 3627 and 3628, are near the center of the site. Building 3445, at the site's southeastern corner, is used to store outdated office equipment. A fenced area north and south of Building 3445 is used for outside storage of boats, trucks, and heavy equipment. Pat Bellinger Road runs north-south through the site's center.

Site 12 — Scrap Bins

Site 12 is currently referred to as the Defense Reutilization and Marketing Office (DRMO) Recyclable Materials Center and used to store scrap metal. The site is approximately 800 feet northwest of former Chevalier Field and immediately west and upgradient of Site 26. Most of the site area is enclosed by a chain-link fence and covered with a large concrete pad where heavy equipment is kept. Surface elevations average 15 to 18 feet above msl and the terrain is relatively flat. The limited exposed surface soil is sandy and well drained. Buildings 455 and 3821 are in

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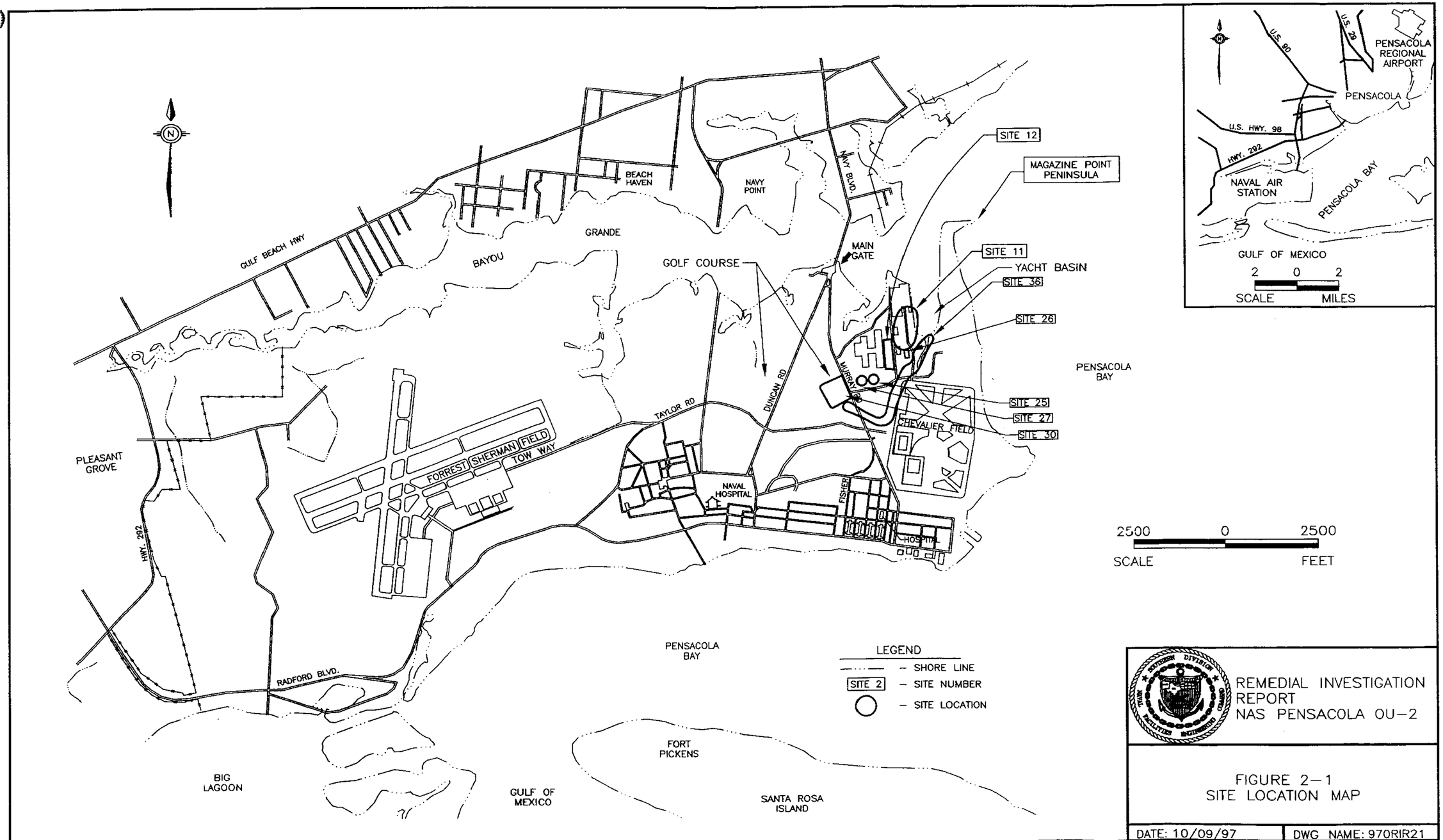
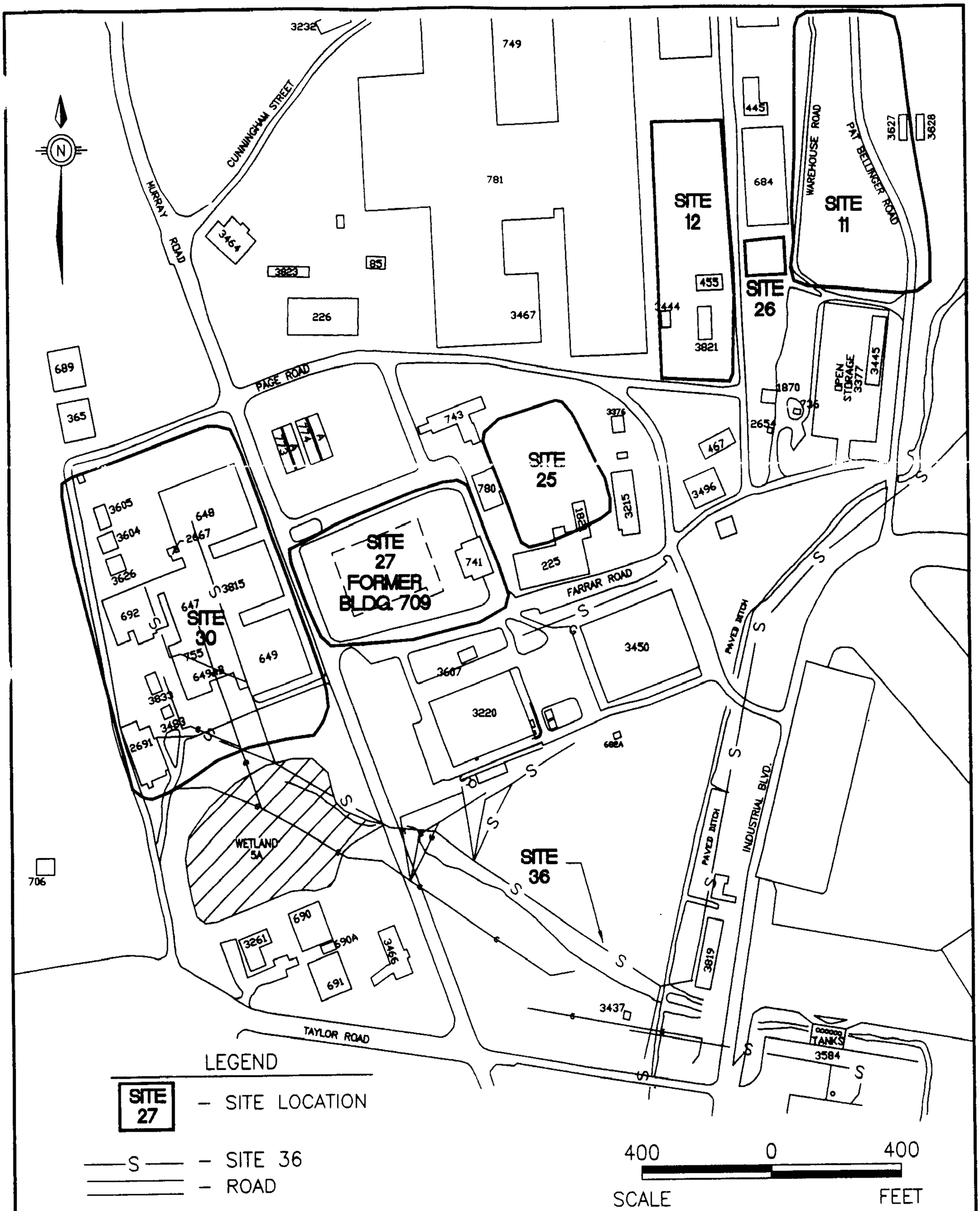

N
GULF BEACH HWY
BEACH HAVEN
NAVY POINT
NAVY BLVD
GRANDE
BAYOU
GOLF COURSE
MAIN GATE
SITE 12
MAGAZINE POINT PENINSULA
SITE 11
YACHT BASIN
SITE 36
SITE 26
PENSACOLA BAY
SITE 25
SITE 27
SITE 30
CHEVALIER FIELD
MILLCRAFT
DUNCAN RD
TAYLOR RD
FORREST SHERMAN FIELD
TOW WAY
NAVAL HOSPITAL
FISHER
HOSPITAL
PLEASANT GROVE
HWY. 292
RADFORD BLVD.
PENSACOLA BAY
FORT PICKENS
BIG LAGOON
GULF OF MEXICO
SANTA ROSA ISLAND
2500 0 2500
SCALE FEET
LEGEND
SHORE LINE
SITE 2 – SITE NUMBER
SITE LOCATION
U.S. 90
U.S. 29
PENSACOLA REGIONAL AIRPORT
PENSACOLA
U.S. HWY. 98
HWY. 292
NAVAL AIR STATION
PENSACOLA BAY
GULF OF MEXICO
2 0 2
SCALE MILES
REMEDIAL INVESTIGATION REPORT
NAS PENSACOLA OU-2
FIGURE 2-1
SITE LOCATION MAP
DATE: 10/09/97
DWG NAME: 970RIR21



REMEDIAL INVESTIGATION REPORT
NAS PENSACOLA OU-2

FIGURE 2-2
SITE AREA MAP

DWG DATE: 09/04/97 | DWG NAME: 590U2SMP

the southern portion of the site. Building 455 houses an office, break area, and storage warehouse, while Building 3821 is a storage warehouse.

Site 25 — Radium Spill Area

This approximately 50 by 50-foot concrete-paved area is on the eastern portion of NAS Pensacola, immediately east of Murray Road and north of Farrar Road. The site includes an area east of the radium decontamination building (Building 780), where the radium spill is reported to have occurred. A former helicopter scrap yard approximately 25 feet east of Building 780 is currently used as a parking area for Navy Exchange semitrailers. The fenced yard is unpaved and covered with interlocking, perforated metal sheets. Building 780 currently houses the Joint Oil Analysis Laboratory, used for quality assurance analysis of oil from aircraft and vehicles. The site is flat with land surface elevations averaging approximately 22 to 25 feet above msl. Where exposed, site surface soil is sandy and well drained.

Site 26 — Supply Department Outside Storage Area

The Supply Department Outside Storage Area, Site 26, is northwest of former Chevalier Field and immediately south of Building 684. The approximately 150- by 200-foot area houses an open metal shed near a former chemical storage building. Currently DRMO uses this area to store paints, fuels, and solvents. An 8-foot chain-link fence surrounds the storage area limiting access. The concrete pavement inside the fence is bordered by sandy soil and mowed grass. Site 26 is bounded to the west by a paved road and to the east by a wooded area (Site 11). The site gently slopes to the east to a topographic break where elevations abruptly drop to approximately 5 feet above msl.

Site 27 — Radium Dial Shop Sewer

The Radium Dial Shop Sewer, extends through Building 709's remaining concrete foundation, which is currently a parking lot. The building foundation is 2 to 4 feet above the surrounding

area. Its easement is unpaved. The site is approximately 150 feet west of Building 780 (Site 25) and bounded by Farrar and Murray roads to the south and west, respectively. An adjacent parking lot north of the building foundation is asphalt-paved while a gravel and shell parking lot is next to the foundation's northeastern portion. All area roads are paved with either concrete or asphalt. Originally, this site consisted of a small radium dial shop in former Building 709 with a connection to the sanitary sewer. However, recent investigations have associated additional areas of contaminants with the site, expanding the area of investigation to approximately 6 acres.

Site 30 — Complex of Industrial Buildings and IWTP Sewer Line

This approximately 35-acre site houses a complex of industrial buildings — known as the Building 649 complex (interconnected Buildings 647, 648, 649, 692, 755, 3815, and several smaller separate, but associated buildings). Housing the Dynamic Component Division of the former Naval Aviation Depot (NADEP), several functions related to aircraft component repair were carried out here. Operations within this complex began in the 1940s and continued until NADEP closed. Also included in the Site 30 investigation were the areas surrounding Building's 3220 and 3450, former NADEP buildings where aircraft electronics were repaired. The Site 30 investigation also included a portion of the IWTP sewer line associate with Site 36 (the IRP site encompassing the whole IWTP sewer line). The portions of the sewer investigated with Site 30 include those associated with Sites 25, 27, and 30 and downstream segments. These include the segment extending from the Building 649 complex, the feeder line from Building 3220, and the main line running to the IWTP.

The boundaries and location of Site 30 have changed in recent years to include Site 31, but excludes the nearby wetlands being investigated under Site 41. Site 31 was a former petroleum site turned over to the IRP because of chlorinated solvents found during assessment. Site 41 is to investigate base wetland resources for contamination from IRP sites.

2.2 Site Histories and Previous Investigations

2.2.1 General History

Site 11 — According to the Initial Assessment Study (IAS) conducted by the Naval Facilities Engineering Service Center (NFESC) this landfill was used to burn refuse through the mid-1940s. During this time, it received combustibles such as fuels, solvents, and waste oil from aircraft engine overhauls. During landfill operation from the early 1930s to the 1940s, approximately 24 cubic yards of material were disposed of daily from several NAS Pensacola locations. During this time frame, an unknown number of 55-gallon drums of unknown contents were observed at this site. Until the 1950s, oil slicks were noted during heavy rains in the Yacht Basin a branch of Bayou Grande (NEESA, 1983).

Site 12 — From the early 1930s to the 1940s, garbage was stored at Site 12 in an area known as "Pig Sty Hill" near Building 455. Approximately 16 cubic yards (2 truckloads) per day of wet garbage were stored here before being hauled off for livestock feed. The site has since been used as a scrap metal storage area (NEESA, 1983).

Site 25 — Building 780 was constructed in 1951 to house the oxygen and carbon dioxide shops. In approximately 1975, a radium decontamination operation was added. Radium wastes from this operation were stored in a drum onsite before being disposed of. In 1978 a spill occurred in the storage area between Building 780 and the scrap yard. Approximately 25 gallons of low-level radium paint waste spilled from a ruptured, corroded drum onto the underlying concrete floor (NEESA, 1983). The waste was reported to have been cleaned up, placed in a secure container, and sent to a proper disposal site. The exact location of the spill, the details of the cleanup operation, and whether the waste reached unpaved soil have not been determined from the currently available records (Ecology and Environment [E&E], 1992a).

Site 26 — From 1956 until 1964, the supply department used Site 26 to store incoming paint strippers and acids. Containers of these materials placed outside on steel matting sometimes leaked, resulting in discharge of the materials onto the ground (Geraghty and Miller [G&M], 1984).

Site 27 — Building 709, constructed in 1941, has since been used for several operations such as carburetor repair, propeller repair, painting and maintenance shop and various instrument shops (including a radium paint room), and a plating shop (E& E, 1992b). In 1949, a small shop in Building 709 was used to rework luminous instrument dials. It was here that worn and damaged instruments were returned to be stripped and repainted. From 1941 to 1965, the stripping procedure required soaking the instruments in benzene, scraping them in a benzene or water bath, or dry scraping and painting them under a ventilation hood. After 1965, the procedure switched to scanning the instruments for radium, then stripping them with paint stripper, and a lye-nitric acid solution. Contaminated instrument cases were soaked in another acid solution called "Turco" then scrubbed with a wire brush (NEESA, 1983).

Building 709 also housed a large plating operation from 1941 to approximately 1970. The operation involved the use of 50 solution tanks ranging from 50 to 3,865 gallons in capacity (E&E, 1992b).

A routine disposal operation in Building 709 was to wash spent cleaning solutions and luminous paint down the drains and into the sanitary sewer. The wastes disposed of from this location were cleaning solutions containing benzene, white pigments, phosphors, radium, and small amounts of acidic or caustic solutions. The plating waste from Building 709, and shops in Buildings 604 and 649/755, were periodically dumped via drains into the sanitary sewer. Most buildings had drains connected to a single line draining to the sanitary sewer line. From 1941 to 1948, all wastes from Building 709 were discharged directly into Pensacola Bay. From 1941 to 1962, concentrated

cyanide wastes from Building 709 were periodically dumped into the sanitary sewer. After 1962, the cyanide was drummed and disposed of 15 miles offshore in the Gulf of Mexico, although small quantities of cyanide continued to be discharged into the sewer. Plating operations ceased in Building 709 in 1970 or 1973 (NEESA, 1983). Today, Building 709 has been removed and the old building floor is used as a parking lot.

Site 30 — Aircraft and parts were painted in booths in the Building 649 complex beginning in 1940. The paints used at NAS Pensacola were cellulose nitrate lacquer, zinc chromate, nitrate dope, acetate dope, "day glow," epoxy, and enamel. Thinners used were lacquer thinner, toluene, and M-T-6096 (NEESA, 1983).

A tin-cadmium plating shop operated within the Building 649 complex from the mid-1940s to the early 1960s. At this time, it was replaced by a magnesium treatment line which operated there until the early 1970s. Near Building 649, 15 tanks ranging in capacity from 200 to 500 gallons, contained solutions of tin, cadmium, and cyanide. Additionally, a 250-gallon tank stored trichloroethylene (NEESA, 1983), and a 500-gallon UST on Building 649's north end stored waste oil (F. Graham, 1993, personal communication). The contents were drained periodically into a "ditch" east of the buildings. This "ditch" was either Wetland 5A or a topographical low draining into it based on current topography and historical data. The tin cadmium operation was replaced by a magnesium treatment line in the early 1970s; the 15 tanks near Building 649 were then used to store acids, caustics, degreasers, chromate solutions, and potassium permanganate (NEESA, 1983).

In the summer of 1994 as part of an interim removal action, the Public Works Center (PWC) removed an aircraft engine shipping container from a wetland immediately southeast of Building 649. It had used as an oil-water separator. Since then, E/A&H sampled this wetland under the Site 41 investigation as Wetland 5A. A second plating shop in Building 755 was used

from the early 1960s until the early 1970s. Fifty tanks ranging in capacity from 50 to 200 gallons contained metal plating solutions, including nickel, chromium, silver, lead, and tin (NEESA, 1983).

Concentrated cyanide wastes generated in Buildings 649 and 755 were disposed of in the same manner as Building 709's cyanide waste. Disposal involved discharging the wastes down the sewer from 1941 to 1962 and discarding drummed waste in the Gulf after 1962. Overflow discharged into the sewer (NEESA, 1983).

An empty fiberglass UST mounted in concrete is still near Building 692's southeast corner. Installed in 1986, this tank stored JP-1/JP-5 (jet fuel) calibration fluid for use in Building 692. The fiberglass tank replaced an older steel tank also used to store calibration fluid. The older tank had at least one undocumented spill. A UST along the west side of Building 692 supplied Building 755 with methyl ethyl ketone (MEK) via underground pipes. Several other USTs were along the entire north side of Building 692; their exact contents are unknown. Some of the storage tanks may have contained chromium wastes (F. Graham, 1993, personal communication).

In 1973, minor painting operations started in Building 3450 (Figure 2-2) (NEESA, 1983). Several 1,000-gallon USTs along the south wall of Building 3450 are reported to have been used to store gasoline (ABB, 1993a).

Several tanks were near Building 3220: a diesel UST near the southeast corner, a waste oil UST on the south wall, and a series of USTs some 50-feet south of the waste oil tank (ABB, 1993b).

The IWTP, originally built in 1948, was replaced with a modern plant that could accept industrial wastes in 1971. Most facilities discharging to the IWTP sewer did so without any pretreatment or waste segregation. The waste stream has included paint strippers, heavy metals, pesticides,

radioactive wastes, fuels, cyanide waste, and waste oil (NEESA, 1983). Beginning in 1973, the Naval Air Rework Facility operations discharged to the sewer instead of to Pensacola Bay. The IWTP sewer consisted of vitreous clay and cast-iron piping installed both before and after 1971 (E/A&H, 1997).

Contaminant Source Survey

Among hazardous wastes generated, disposed of, or spilled near the study area were: metal plating wastes, chlorinated and other solvents, PCBs, metal solutions, degreasers, strippers, cyanide solutions, acids, kerosene, chromate solutions, radium paint solutions, and phenols. Processes at the Site 30 facilities included plating, radium paint stripping, magnesium treatment, oil testing, machining, and painting.

2.2.2 Chronology of Events and Previous Investigations

This section summarizes events and investigations relative to the OU 2 sites.

1976 — Radiation Survey/Removal

This investigation by the Radiological Affairs Support Office (RASO) focused on the radium contamination in the drain lines at Building 709 (Site 27). According to NEESA accounts, RASO personnel surveyed the demolished Building 709 area in 1976. The survey identified portions of the drain pipe, linoleum floor, walls, and wood flooring within the dial painting shop as radioactive. No contamination was detected in adjacent areas, surrounding grounds, or in ventilation ducts. RASO personnel are reported to have supervised removal of the contaminated materials for disposal. The contaminated drain pipe was excavated to a depth of 18 inches, and the remaining underground portion was capped and abandoned. The pipe's dose rate was noted to be 1.2 milliRoentgens per hour (mR/hr). Normal background is about 0.02 mR/hr. RASO recommended that the pipe's outfall be located and checked for radiation contamination, but there is no evidence this check was made (NEESA, 1983).

1983 — Initial Assessment Study (IAS) of Naval Air Station Pensacola

The IAS was conducted by the NFESC (formerly NEESA). The IAS involved review of historical documents, aerial photographs, personnel interviews, and site inspections. NFESC identified 29 sites of potential contamination; none was thought to represent an immediate threat to human health or the environment. During the IAS, sediment samples were collected beneath surface waters off Site 11 in Bayou Grande detecting metals above toxicity standards. The IAS recommended seven sites, including Sites 11 and 27, for a confirmation study of suspected contaminants (NEESA, 1983).

1984 — Verification Study

This follow-up to the NEESA report, which was conducted by G&M, involved installing several monitoring wells and piezometers throughout NAS Pensacola involving all the OU 2 sites except 12 and 25. At Site 11, volatile organic compounds (VOCs) were detected in samples from three wells, including one east of Site 26. Additional wells were recommended for the Site 11 area. Samples from one well drilled at Site 27 detected gross alpha below the Florida drinking water standards and chlorinated hydrocarbons in the parts per billion (ppb) range. To further study Site 27, G&M recommended drilling a deep well to characterize the vertical hydraulic gradient and three shallow monitoring wells southwest of the site to characterize presumed contaminant migration. A well drilled north of Building 648 and next to Site 30 at former Site 31 had low concentrations of VOCs. Sediment samples collected from the presumed "ditch" at Site 30 contained concentrations of cadmium, magnesium, and copper (G&M, 1984).

1986 — Characterization Study

Several sites were investigated by G&M in this study. Samples from wells southwest of former Chevalier Field detected VOC contamination. However, no VOC contaminants were detected in the deep well at Site 27. No further action at Site 30 or Site 27 was recommended. Lead,

mercury, and VOCs were detected at Site 11 two zones of contamination were indicated. Therefore, additional work was recommended for this site (G&M, 1986).

1991 — Site Investigation

Radian Corporation/ABB Environmental Services performed this preliminary work by evaluating VOCs and radioactive contamination in soil at Sites 25 and 27. All parameters were at or near background levels (ABB, 1991).

1991 — Contamination Assessment/Remedial Activities Investigations

As part of the Navy's IRP, E&E conducted Phase I contamination assessments for 22 sites at NAS Pensacola to identify principal areas and primary contaminants of concern and to recommend subsequent investigations. Fieldwork included site reconnaissance, surface emission surveys, particulate air screening, utilities surveys, soil and groundwater sampling, and hydrologic assessments. Phase I investigations were conducted for Sites 11, 12, 26, and 30 during 1991, while Phase Is for Sites 25, 27, and 36 were conducted in 1992. Laboratory screening analysis, were only intended to focus future investigations. These screening analyses were somewhat deficient in their lack of reproducibility. Groundwater samples, which were analyzed unfiltered, were characterized by high turbidity explaining the high metal results. The findings were reported in interim data reports for each site.

- **Site 11** — The Site 11 Phase I identified soil and groundwater contamination. Metals, total recoverable petroleum hydrocarbons (TRPHs), VOCs, polycyclic aromatic hydrocarbons (PAHs), and phenols were present in unsaturated soils over a large area of the site. The soil contamination was attributed to past waste disposal and burning activities at the site. Groundwater was contaminated with metals at concentrations exceeding primary drinking water standards. TRPHs, VOCs, PAHs and phenols were also present in groundwater.

Some wells contained floating petroleum product. Potential impacts to Bayou Grande from soil and groundwater contamination at Site 11 were noted (E&E, 1991a).

- **Site 12** — The Site 12 Phase I identified sediment, soil and groundwater contamination. Metals, TRPHs, VOCs, PAHs, phenols, and PCBs were the primary contaminants. A potential source of radiation was documented to be in the southeast area of the site. Further investigation was recommended (E&E, 1991b).

- **Site 26** — The Site 26 investigation conclusions stated that limited soil and groundwater contamination was present at the site. Metals (arsenic, cadmium, and chromium), TRPHs, VOCs, and PAHs were the primary contaminants. Further investigation was recommended (E&E, 1991c).

- **Site 30** — Surface water, groundwater, and soil contamination consisting of metals, TRPHs, PAHs, phenols, and VOCs were identified at the site. The most contaminated areas were near the Building 648 complex and next to Site 11. Further assessment work was recommended at Site 30 (E&E, 1991c). E&E's Phase I investigation for the IWTP sewer identified metals, TRPH, VOC, and PAH contamination. It was not determined if the IWTP sewer line was their source. The E&E data were suitable for screening only and used to identify possible structural deficiencies in the IWTP sewer line (E&E, 1992d).

- **Sites 25 and 27** — This E&E study was the first effort at identifying soil and groundwater contaminants at Sites 25 and 27. The investigation involved a screening surface radiation survey, a soil head-space survey, and soil and groundwater sampling. Soils were analyzed for VOCs, PAHs, phenols, pesticides/PCBs, TRPHs, metals, and Ra-226. At Site 25, analyses showed isolated areas of TRPH, PCB, metals, and Ra-226 contamination in soil, and metals and Ra-226 contamination in groundwater. All wells at Site 25 have

concentrations of Ra-226 near or above the U.S. Environmental Protection Agency (USEPA) and Florida Department of Environmental Protection (FDEP) drinking water standards (E&E, 1992a).

At Site 27, metals were observed in soil near the drain and sewer lines at the former Building 709 location. Metals and Ra-226 were also detected where the apparent surface spills occurred south of the building, while VOCs, PAHs, and phenols were observed on the north side of the building. Groundwater results showed metals and Ra-226 near the spill locations and Ra-226 contamination at the drain and sewer lines. Arsenic, lead, TRPHs, phenols, and xylene were detected in groundwater at the north side of the former building (E&E, 1992b).

1992 — Site Inspection Report

This ABB investigation involved surface soil analyses at Sites 25 and 27 for target analyte list (TAL) metals, Resource Conservation and Recovery Act (RCRA) toxicity characteristics leaching procedure (TCLP) metals, and limited semivolatile organic compounds (SVOCs). The investigation did not study sources at these two sites. Instead it characterized adjacent areas. No elevated TCLP or SVOC data were noted at concentrations exceeding background level. The report concluded that soil in the area sampled would be nonhazardous under RCRA if removed during construction of a cold storage facility proposed within the site area (ABB, 1991).

1992 — Naval Aviation Depot Installation Restoration Conference

At this conference, ABB presented results from 18 UST investigations at NAS Pensacola. Groundwater data were presented for one UST near Building 709, four within the Building 648/649 complex, and five USTs near Buildings 3220 and 3450. Most UST sites showed petroleum and solvent contamination. The study documented contaminants and presented isoconcentration-contoured plots for some parameters. This presentation was not formally

published. The presentation resulted in solvent contaminated UST sites being transferred to the IRP.

1992 — USEPA Field Investigation for Sites 1, 11 and 30

The USEPA sampled surface water, sediment, and four wells near Site 11, along with the wetlands associated with Site 30. Metals were in sediment at Bayou Grande next to Site 11 and in the wetlands south of the Building 648 complex. Further sampling in Bayou Grande, removal of a waste receiving structure in Wetland 5A, and follow-up sampling were recommended (USEPA, 1992a).

1993 — Contamination Assessment Report, South of Building 3450

This investigation was conducted by ABB at a former UST on the south side of Building 3450 within the Site 30 study area. The study identified TRPH contamination in soils and chlorinated contaminants in groundwater near the UST location (ABB, 1993a).

1995 — Base Realignment and Closure; Remodeling at Buildings 3450 and 3220

As part of the BRAC construction for the Naval Training Center, Buildings 3450 and 3220 were remodeled. Construction alteration to the site included repaving parking lots, new electrical corridors, and a radar tower. Construction work damaged a few monitoring wells. The construction was complete and available for student occupancy in spring of 1996.

2.3 Wetland 5A Removal Action

The Department of the Navy, contracted Navy Public Works Center (PWC) to excavate, clean, and dispose of a waste-receiving structure and its contents, located in Wetland 5A south of Buildings 649 and 755 (Site 30). This section documents the excavation, restoration activities, and analytical data.

The removal action was carried out following the guidelines set forth in the work plan (E/A&H, 1994a). The removal action's goal was to mitigate potential risk to human health and the environment by removing the waste-receiving structure and its contents and properly disposing of the waste.

Site Description

Wetland 5A is south of Site 30 on NAS Pensacola's eastern portion between Murray Road and the golf course. Figure 2-3 depicts the site area and sample locations for the Wetland 5A removal. Wetland 5A, fed by groundwater discharge and other surface sources, is the headwater of a small creek flowing southeast, crossing beneath Murray Road into Wetland 5B, and intersecting Wetland 6, a north-south oriented drainage ditch. Wetland 6 flows north past Chevalier Field towards Bayou Grande, where it discharges into the Yacht Basin.

Site Background and Previous Studies

Buildings 649 and 755 (Site 30) are north and upgradient of Wetland 5A and separated from it by a service road and a driveway/parking lot. Building 649 was used from the 1940s to the 1950s as a tin-cadmium plating operation. Fifteen aboveground tanks near Building 649, ranging in capacity from 200 to 500 gallons, contained solutions of tin, cadmium, and cyanide. Additionally, a 250-gallon tank stored 1,1,1-trichloroethane (1,1,1-TCA). The tank's contents reported to have been dumped monthly into a "ditch" east of the building. Based on current topography and historical data, this "ditch" either fed directly into the wetland or was the wetland itself. During the 1960s and 1970s, the 15 tanks stored phosphoric acid, caustics, potassium permanganate, degreasers, and chromate solutions, which were also periodically drained into the "ditch." According to historical data, the concentrated cyanide solutions were placed into a tank truck, transported to the Building 709 plating shop and disposed of in the sanitary sewer. Plating operations in Building 649 ceased in the 1970s (NEESA, 1983).

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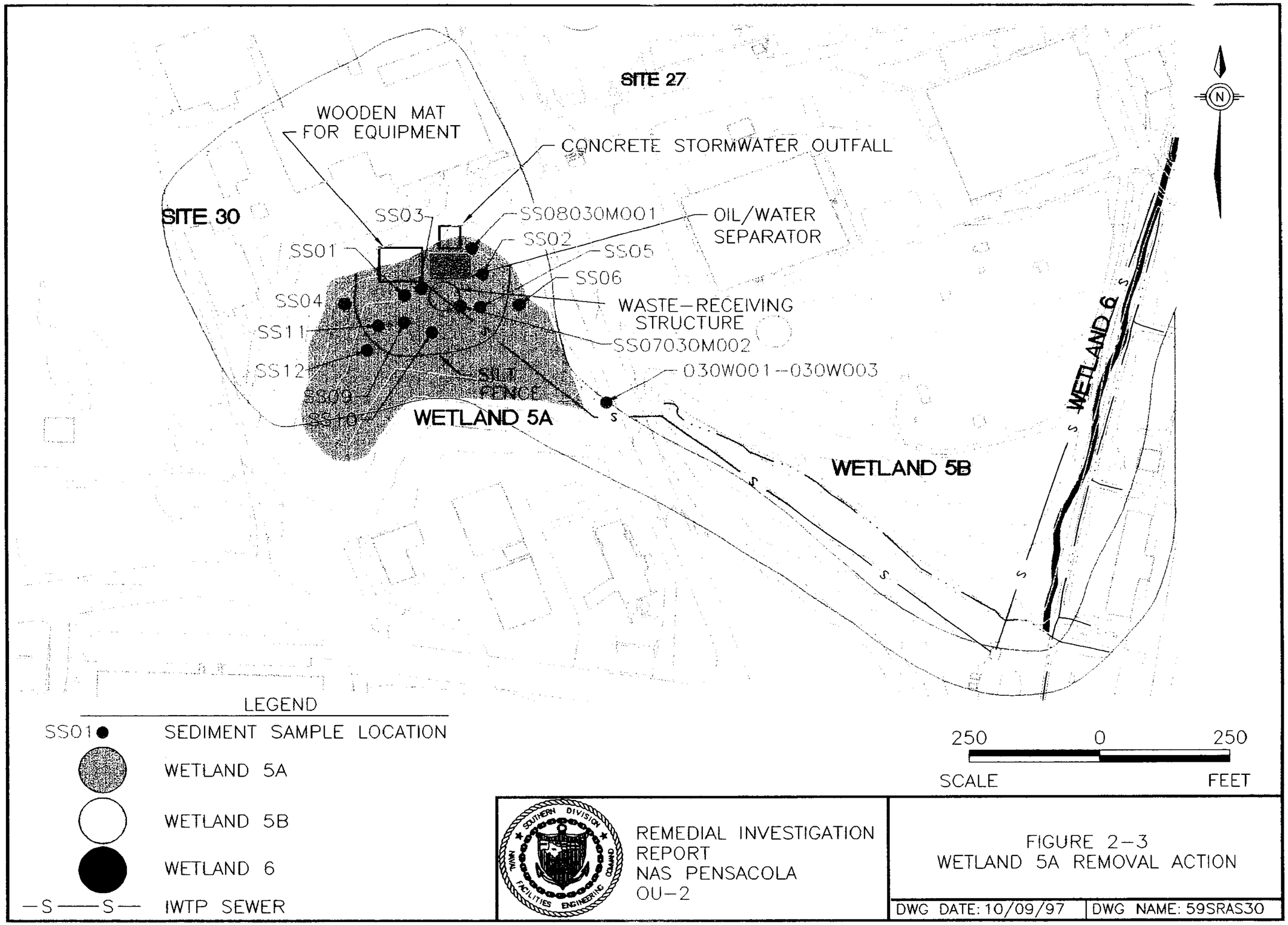
SITE 27
WOODEN MAT FOR EQUIPMENT
CONCRETE STORMWATER OUTFALL
SITE 30
SS03
SS08030M001
OIL/WATER SEPARATOR
SS01
SS02
SS05
SS06
SS04
WASTE-RECEIVING STRUCTURE
SS11
SS07030M002
SS12
030W001--030W003
SILT FENCE
SS09
SS10
WETLAND 5A
WETLAND 5B
WETLAND 6
N
LEGEND
SS01 SEDIMENT SAMPLE LOCATION
WETLAND 5A
WETLAND 5B
WETLAND 6
IWTP SEWER
250 0 250
SCALE FEET
REMEDIAL INVESTIGATION REPORT
NAS PENSACOLA
OU-2
FIGURE 2-3
WETLAND 5A REMOVAL ACTION
DWG DATE: 10/09/97
DWG NAME: 59SRAS30

Building 755 also operated as a plating shop during the 1960s and 1970s. It housed approximately 50 aboveground tanks, ranging in capacity from 50 to 200 gallons used to store plating solutions of nickel, silver, lead, tin, chromium, and other metals. These tanks were also reported to have been periodically drained into the "ditch" east of Building 649. Building 755 plating operations ceased in the 1970s (E/A&H, 1994a).

Aerial photographs from January 1951 through October 1989 indicate that the wetland appeared much as it does today. In 1951, Wetland 5A was covered with low-lying vegetation near several streams. Two of these streams discharged into the wetland from the southwest and thick vegetation was in and around the area. Surface drainage from the wetland seemed directed toward the east into a creek discharging to the drainage ditch along Chevalier Field. The creek looked wider in a March 1981 photograph than it had in earlier photographs. No other obvious changes in the wetland were noted. Past studies of Site 30 and Wetland 5A are summarized in the removal action work plan (E/A&H, 1994a).

Removal Activities

On August 1, 1994, PWC and E/A&H mobilized to the site and began pre-removal work at the site. From August 15-17, the waste-receiving structure, used as an oil-water separator, was excavated using a trackhoe. The contents were contained in 55-gallon drums and the structure was pressure washed and returned for salvage to the DRMO. The E/A&H engineer was onsite during excavation activities to monitor PWC progress.

Sediment Screening

On August 22, 1993, the sediment beneath and around the waste receiving structure was screened with a photoionization detector (PID) to identify areas of highest contamination. As anticipated, the highest readings were from locations near the waste-receiving structure. Sediment with PID

readings exceeding 10 parts per million (ppm) was excavated and disposed of until PID readings were below 10 ppm.

A PID was substituted for the organic vapor analyzer (OVA) required by the work plan because the high methane content of the sediment had exceeded the maximum OVA reading. The PID was used because it does not register methane but does register volatiles. Results from the PID screening are shown below. Screening sample locations are shown on Figure 2-3, and the results are depicted below:

Sample Location	Result (parts per million)
SS01	67
SS02	26
SS03	180
SS04	12
SS05	206
SS06	0
SS07	202
SS08	731
SS09	80
SS10	0
SS11	0
SS12	0

Sediment Confirmatory Sampling

On August 23, 1993, sediment samples for laboratory analysis were collected with a stainless-steel hand auger. Sample locations, selected by the E/A&H engineer, were directly below the waste receiving structure because they had the highest PID readings.

Because of constant mixing of the sand and sediment during excavation, the engineer decided to deviate from the work plan and collect composite sediment samples in lieu of discrete samples.

The samples were composited from the immediate areas surrounding both the waste-receiving structure and the oil-water separator (Figure 2-3). The samples were submitted to CompuChem Laboratory, Research Triangle Park, North Carolina.

Surface Water Confirmatory Sampling

Three surface water samples were collected during the project from the location shown on Figure 2-3. These samples were collected before, during, and after the removal to determine whether surface water was being impacted downgradient into Wetland 5B. This sampling location was chosen because it drains the entire wetland.

Waste Disposal

Fifty-two 55-gallon drums of solid waste were generated during this removal action. Based on TCLP analysis (Appendix A), the sludge was not considered hazardous and was instead transported as a special waste. Wash water and other waste was not considered hazardous based on the determination of the sludge. Of the 52 drums of solid waste generated, 19 drums of wastewater were generated, either through removing water from the top of the sludge, decontamination water from the waste receiving structure, or personal decontamination. This water was disposed in the IWTP located on base. Thirty-three drums of non-liquid waste was generated and included the following: 16 drums of sludge from the waste receiving structure; 11 drums of contaminated sediment from beneath the structure; and 6 drums of contaminated piping, plastic sheeting, and personnel protective equipment. The nonliquid waste was transported and disposed of by a PWC waste contractor.

Health and Safety

Site health and safety requirements were implemented in accordance with the requirements of the removal action health and safety plan (E/A&H, 1994b).

Confirmatory Analytical Results

CompuChem Analytical Laboratory performed the surface water and sediment analysis for the project, except for one TCLP analysis of the sludge from the structure, which was performed by PWC's laboratory. Analytical results from CompuChem are summarized in this section. Complete copies of the CompuChem analytical laboratory reports are provided in Appendix B.

Surface Water Analytical Results

The first surface water sample (030W0001) was collected on August 2, 1994, before the removal of the structure. The only exceedances of Florida Surface Water Standards were for lead and zinc, which were detected at 5.3 μg/L and 77.6 μg/L, respectively. The second surface water sample (030W0002) was collected on August 15, 1994, during the removal of the structure. The only exceedance of Florida Surface Water Standards was for lead, which was detected at 4.4 μg/L. The third surface water sample (030W0003) was collected on September 12, 1994 after the removal of the structure. No concentrations were detected which exceeded Florida Surface Water Standards.

Sediment Analytical Results

Two sediment samples were collected after the removal of the structure. One sample (030M001) was collected from the area below the waste receiving structure after its removal. The second sample (030M002) was collected from the area below the oil/water separator after its removal. Both sediment samples exceeded several Florida Sediment Quality Assessment Guidelines (SQAGs) for a variety of constituents. All SQAG exceedances are listed on Table 2-1.

Site Restoration

Following excavation, the wooden pads used to support the heavy equipment were removed from the site. The excavation area was filled by natural sand and sediment that flowed in after

Table 2-1
Site 30 Removal SQAG Exceedances
Naval Air Station Pensacola

Parameters	Florida SQAG	030M0001	030M0002
Inorganics (mg/kg)			
Antimony	11	19.4	15.5
Cadmium	0.676	101	131
Chromium	52.3	2,690	2,380
Copper	18.7	144	232
Lead	30.2	2,650	3,400
Mercury	0.13	1.5	1.6
Nickel	15.9	213	135
Silver	0.733	85.4	54.6
Zinc	124	252	605
Pesticide/PCBs (μg/kg)			
4,4'-DDD (p,p'-DDD)	1.22	27	22
4,4'-DDE (p,p'-DDE)	2.07	25	51
4,4'-DDT (p,p'-DDT)	1.19	9.4	2.4
Dieldrin	0.715	3.3	4.4
Endrin Aldehyde	3.3	20	14
gamma-BHC (Lindane)	0.32	ND	0.44
PCB-1260 (Aroclor 1260)	21.6	460	410
Semivolatile Organic Compounds (μg/kg)			
2-Methylnapthalene	20.2	16,000	6,800
Anthracene	46.9	ND	310
Benzo(a)anthracene	74.8	780	680
Benzo(a)pyrene	88.8	480	470
Chrysene	108	970	630
Fluoranthene	113	6,900	8,700
Naphthalene	34.6	3,200	ND
Phenanthrene	86.7	730	350
Pyrene	153	790	640

Table 2-1
Site 30 Removal SQAG Exceedances
Naval Air Station Pensacola

Parameters	Florida SQAG	030M0001	030M0002
Semivolatile Organic Compounds (μg/kg)			
bis(2-Ethylhexyl)phthalate (BEHP)	182	10,000	6,900

Note:
ND = Not detected.

excavation activities ceased. The sediment fence was left in place for three days to allow all sediment and water to settle before the fence was removed and disposed. Based on the lush vegetation in Wetland 5A, no re-vegetation was necessary. The area has since re-vegetated and appears much as it did before the structure was removed.

Conclusion

The waste-receiving structure and contents were removed and properly disposed of from within Wetland 5A, along with all sediment exceeding the 10 ppm PID reading and personnel protective equipment contaminated during the removal process. The waste receiving structure was sent to DRMO for recycling. The sludge and other contents were determined to be nonhazardous, based on TCLP analysis. All wastes generated were disposed as nonhazardous.

E/A&H collected three surface water samples from a downgradient location before, during, and after the removal to quantify any impacts to downgradient Wetland 5B. The highest concentrations of surface water contaminants exceeding SQAGs were found in the sample collected before the removal of the waste-receiving structure. This data suggests that there were no effects into downgradient Wetland 5B via surface water as a result of the removal of the waste-receiving structure. The silt fence constructed during the project and precautions taken during removal reduced any downgradient surface water impacts from the removal.

E/A&H collected two sediment samples from beneath the waste-receiving structure and the oil-water separator immediately after their removal. Based on these results, contaminated sediment, remains in Wetland 5A.

Risk from any remaining contamination in Wetland 5A from the waste-receiving structure and other industrial activities will be quantified during the Remedial Investigation for Site 41, NAS Pensacola Wetlands.

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3.0 ENVIRONMENTAL SETTING

3.1 Physiography

NAS Pensacola is in the Gulf Coast lowlands on a peninsula bounded by Pensacola Bay to the south and east and Bayou Grande to the north. The main topographic feature is a bluff paralleling the southern and eastern shorelines of the peninsula. Landward of the bluff is a gently rolling upland with elevations up to 40-feet above msl (U.S. Geological Survey [USGS], 1970a and 1970b). In the eastern part of the base, a low and nearly level marine terrace lies east of the bluff with elevations of approximately 5-feet or less above msl, constituting the areas of the former Chevalier Field and Magazine Point.

Sandy soils typify the NAS Pensacola area. Consequently, most rainfall infiltrates directly into the subsurface, resulting in few natural streams. Streams on base generally are man-made and channelized. Numerous natural wetlands occur in low-lying areas.

3.2 Stratigraphy and Hydrogeology

Stratigraphy beneath the Florida Panhandle generally consists of Quaternary marine terrace and fluvial deposits, underlain by a thick sequence of interlayered fine-grained clastic deposits and carbonate strata of Tertiary age (Southeastern Geological Society [SEGS], 1986). Three main regional hydrogeologic units have been described within this stratigraphic column (in descending order): the Surficial/Sand-and-Gravel Aquifer, the Intermediate System, and the Floridan Aquifer System. Figure 3-1 provides a generalized cross section of these hydrogeologic units in northwest Florida.

Surficial/Sand-and-Gravel Aquifer

The Surficial Aquifer, comprised primarily of unconsolidated siliciclastic sediments, is approximately 300 feet thick at NAS Pensacola. These sediments belong to undifferentiated Pleistocene-Holocene terrace deposits, the Pliocene Citronelle formation, and underlying Miocene

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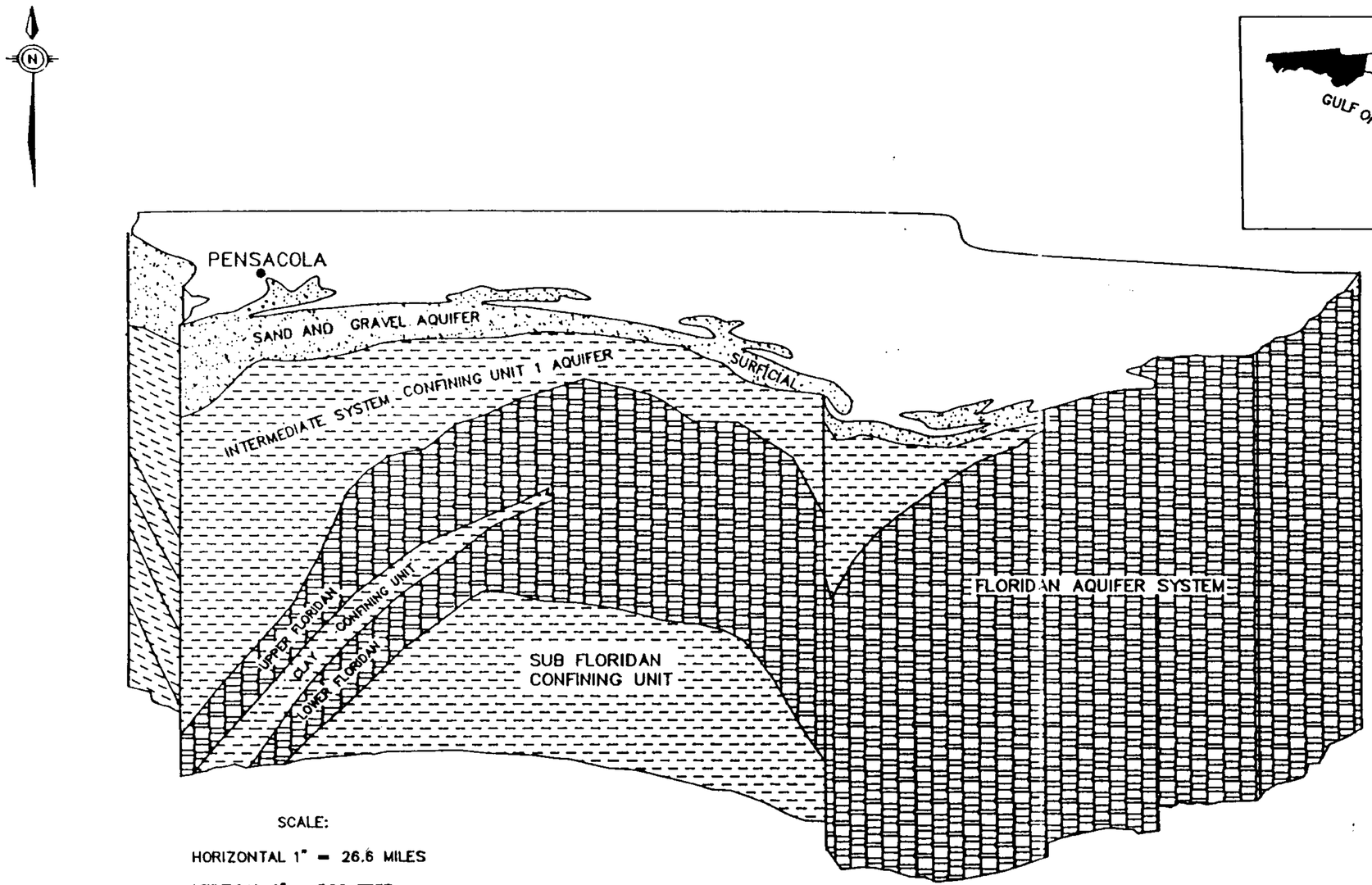

SCALE:

HORIZONTAL 1" = 26.6 MILES

VERTICAL 1" = 500 FEET

VERTICAL EXAGGERATION = 281

SOURCE: E&E 1992c.

REMEDIAL INVESTIGATION
REPORT
NAS PENSACOLA OU-2

FIGURE 3-1
GENERALIZED GEOLOGIC CROSS-SECTION OF
HYDROGEOLOGIC UNITS IN
NORTHWEST FLORIDA

DATE: 06/28/96 | DWG NAME: 580U2GCS

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coarse clastics (Wilkins et al., 1985). West of the Choctawhatchee River in northwest Florida, the Surficial Aquifer is referred to as the Sand-and-Gravel Aquifer, and is a major source of drinking water (SEGS, 1986). The FDEP classification of the surficial aquifer is G-1 with a USEPA classification of IIA. Because the Sand-and-Gravel Aquifer is the uppermost unit contiguous with land surface and receives recharge through direct infiltration, it is susceptible to contamination from surface activities. Near NAS Pensacola, the unit has been subdivided into three distinct zones based on hydrogeologic differences (in descending order): the surficial zone, the low permeability zone, and the main producing zone (Wilkins et al., 1985). This investigation focuses on the upper (shallow depth) and basal (intermediate depth) portions of the surficial zone. A generalized cross section of the Sand-and-Gravel Aquifer produced by G&M (1984), as shown in Figure 3-2, illustrates the stratigraphic relationship of these zones.

Surficial Zone

The surficial zone is contiguous with land surface and contains groundwater under water table or perched conditions. At NAS Pensacola, the surficial zone is approximately 40- to 60-feet thick and is generally composed of a poorly graded quartz sand (G&M, 1984 and 1986). Beneath the western side of the base, a substantial stratum of sand with abundant organic matter occurs within the zone and pinches out to the east. Depth to groundwater ranges from 0- to 20-feet depending on ground surface elevation. Aquifer tests have yielded high hydraulic conductivities, on the order of 10^{+1}- to 10^{+2}-feet/day (E&E, 1990). The lower contact with the low permeability zone is transitional, resulting in a fining downward sequence in the lower portion of the surficial zone proper. Generally, the low permeability zone is thicker to the west, and thins to the east. This increased clay content in the transition from surficial to the low permeability zone is responsible for lower hydraulic conductivities that have been measured in the base of the surficial zone. Shallow groundwater flow in the surficial zone is generally influenced by topography, usually flowing toward and discharging to the nearest surface water body.

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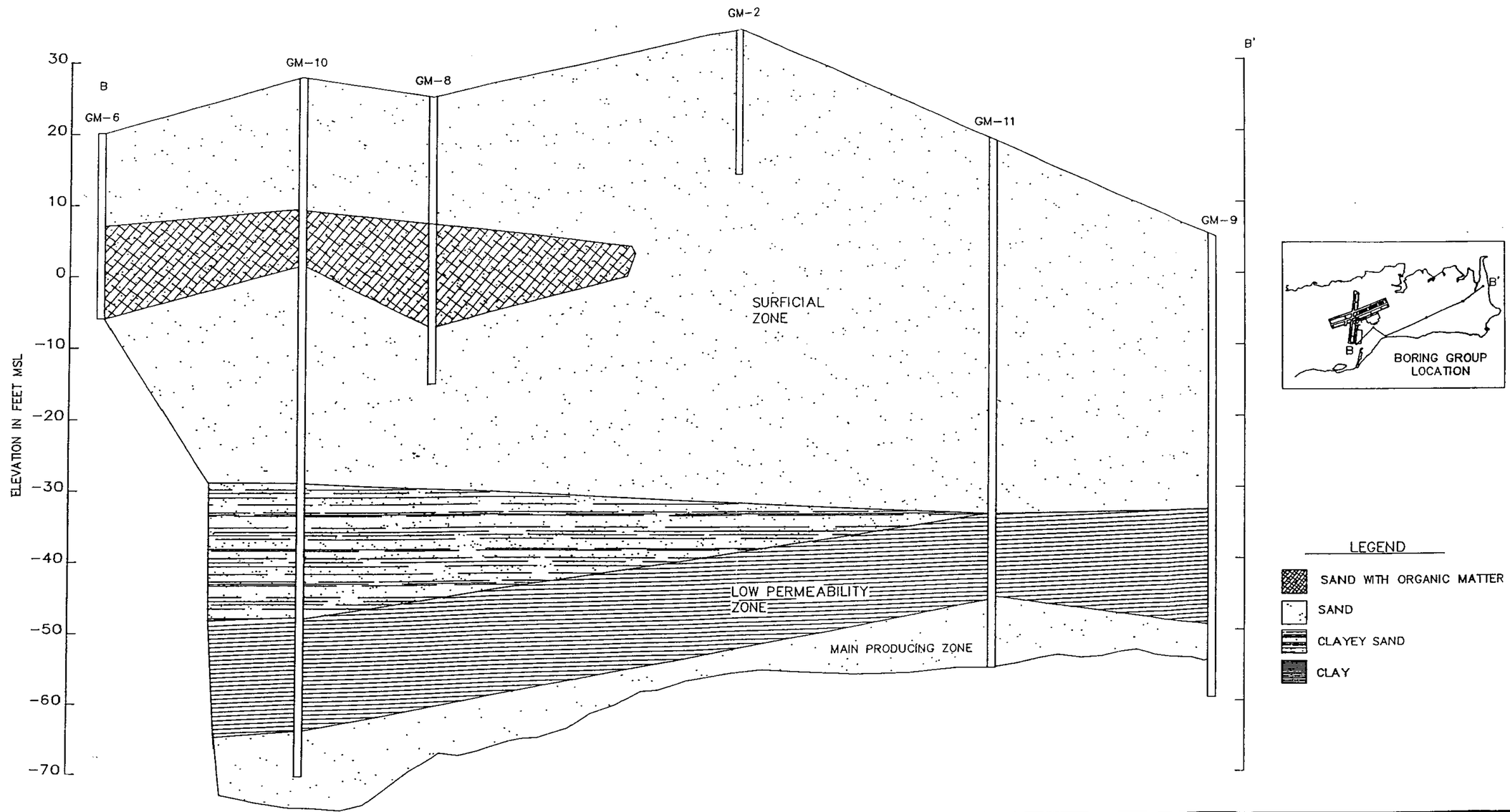

SOURCE: GERAGHTY & MILLER, 1986

REMEDIAL INVESTIGATION
REPORT
NAS PENSACOLA OU-2

FIGURE 3-2
GEOLOGICAL CROSS-SECTION
OF THE SURFICIAL AQUIFER
AT NAS PENSACOLA

DATE: 06/28/96 | DWG NAME: 580U2GC2

Low Permeability Zone

The low permeability zone underlies the surficial zone and is characterized by clay and silt-sized sediments. At NAS Pensacola, this zone comprises gray to blue-gray sandy and silty marine clay with some shell fragments and clayey sands, with total thickness ranging from 8 to 40 feet (G&M, 1984 and 1986). The upper contact is transitional with the overlying surficial zone; however, the top of the low permeability zone is marked by the first occurrence of a stiff blue-gray clay. Studies at NAS Pensacola indicate the low permeability zone is continuous beneath the air station. Hydraulic conductivities of the low permeability zone are much lower than the overlying surficial zone, ranging between the orders of 10^{-4} feet/day for clays and 10^{+0} feet/day for clayey sands (G&M, 1986). Hence, the low permeability zone acts as a confining or semiconfining layer to inhibit groundwater flow between the overlying surficial and underlying main producing zone.

Main Producing Zone

The main producing zone underlies the low permeability zone and constitutes the bottom portion of the Sand-and-Gravel Aquifer. Regionally, depth to the top of the zone ranges from 60-to 120-feet. The zone is composed of sand and gravel with thin beds of silt and clay, and is estimated to be approximately 300-feet thick at NAS Pensacola. Of the three zones in the Sand-and-Gravel Aquifer, this one is generally the most permeable and is the principal source of water supply for the Pensacola area (Wilkins et al., 1985). Groundwater in this zone is confined being recharged in northern Escambia County where it is present at the surface. In the vicinity of NAS Pensacola, the main producing zone is supplemented by leakage. Regional groundwater flows generally east toward Pensacola Bay and south toward the Gulf of Mexico. Three supply wells at NAS Pensacola produce water from this zone. However, the water has a high iron content and the wells are used only to supplement the base water supply irrigating the base golf course and for fire protection (G&M, 1984 and 1986). For potable water, NAS Pensacola depends on an offsite source provided from main producing zone wells at Corry Field, approximately three miles to the north.

Intermediate System

The Intermediate System, a regionally and vertically extensive, laterally persistent hydrologic unit, underlies the Surficial/Sand-and-Gravel Aquifer. The system comprises fine-grained clastic units of Miocene age (Pensacola Clay, Alum Bluff Group) that lie beneath coarse clastics of the overlying Sand-and-Gravel Aquifer. In the NAS Pensacola vicinity, depth to the top of the unit is approximately 300-feet, with a thickness of approximately 1,100 feet (Wilkins et al.,1985; SEGS, 1986). The system is regionally characterized by poor to non-water-bearing conditions. Permeabilities are much lower than those of the overlying Sand-and-Gravel Aquifer and the underlying Floridan Aquifer System, and consequently the system functions as a confining unit for the underlying Floridan Aquifer System (SEGS, 1986).

Floridan Aquifer System

The Floridan Aquifer System underlies the Intermediate System at an approximate depth of 1,400 feet in the NAS Pensacola area. The unit is predominantly limestone, but is separated into upper and lower units by a significant clay layer called the Bucatunna Clay (see Figure 3-1). Groundwater within the Floridan System is highly mineralized in the area of NAS Pensacola and is not used for water supply (Wagner et al., 1984). However, groundwater from the Upper Floridan Aquifer is used for water supply approximately 25 miles east of NAS Pensacola.

3.3 Ecological Setting

3.3.1 Regional Ecological Setting

According to Wolfe et al. (1988), the Florida Panhandle has a wide variety of surface waters and physiographic regions, leading to an ecological diversity found in few other areas of the United States. Watersheds of the panhandle support a diverse array of habitats and vegetative communities. Bottom land hardwoods predominate in river floodplains and pines, mixed with a variety of other shrubs, prevail in upland areas. Wetlands are prevalent along the coastal fringe

and river floodplains. Barrier islands support dune vegetation communities and salt marshes. Bays supporting seagrass meadows and oyster reefs are present in intertidal and subtidal areas.

Seven major rivers in the region discharge into seven bar-built estuaries formed at the mouths of the rivers. The Florida Panhandle is a crossroads where animals and plants from the Gulf Coastal Plain reach their eastward distributional limits, and where many northern species reach their southern limits. Many peninsular Florida species are also distributed there. Due to the wet temperate climate of the region, the panhandle area may support the highest diversity of species of any other similar-size territory in the U.S.

The high annual rainfall and low, gently sloping terrain create numerous wetlands in the region. Bogs, swamps, marshes, wet prairies, and wet flatwoods provide a diversity of wetland types supporting a wide variety of flora and fauna. Terrestrial vegetation includes open pine woods and hardwood forests; most are second-growth forests of pines and encroaching hardwoods.

The Florida Panhandle's estuaries and nearshore marine habitats are some of the greatest natural and economic assets of the region. Important commercial organisms (such as oysters and fish) abound in these areas and contribute to the region's economy. Coastal saltmarsh habitats provide critical nursery, feeding, and refuge for these important commercial species. Seagrass beds within estuaries also are vital to the seafood industry.

3.3.2 Ecological Setting at NAS Pensacola

NAS Pensacola, which occupies approximately 5,800-acres, is bounded by Bayou Grande to the north and Pensacola Bay to the east and south. To the west, the installation changes to less developed swampy lowlands. NAS Pensacola's eastern portion is largely developed, with military and industrial facilities and historical/cultural sites. Most of the installation's activities are on the

eastern side of the base. The less developed west side of the base has approximately 3,500 acres of natural or seminatural beach areas, forests, and wetlands.

NAS Pensacola is the setting for numerous aquatic and terrestrial habitats, from coastal strand and estuarine environments along the bay and bayou to inland pine flatwood communities. Wetland environments include a broad spectrum of both estuarine and palustrine wetlands, as well as various disturbed habitats, many in states of recovery as they undergo reforestation or return to their natural condition.

Vegetation Communities

NAS Pensacola natural vegetation communities fall into several broad categories: (1) coastal dune scrub communities, (2) pine flatwoods communities, (3) hardwood/pine communities, (4) sand pine scrub communities, (5) bay swamps, (6) freshwater marshes, and (7) estuarine coastal marshes. Coastal dune scrub communities are associated with shorelines subject to high-energy waves. The vegetation consists of salt-tolerant plants able to establish themselves in shifting sands. Pine flatwood communities in coastal lowlands are characterized by trees that can tolerate various soil moisture conditions. Tree species in flatwood communities are short, with a wide variety of small shrubs and herbaceous plants in the understory. Hardwood/pine communities are a highly diverse mixture of hardwood trees and pines. Sand pine scrub communities on well-drained sandy soil contain sand pines, oaks, and various shrubs. Bay swamps are wetlands with titi and cypress swamps known to contain permanent standing water and high accumulations of organic peat. Freshwater marshes occur as grass/ sedge/rush/herb communities in areas with high soil saturation or standing water. Estuarine coastal marshes, including salt marshes, occur along low-energy shorelines and in tidal bayous (U.S. Fish and Wildlife Service [USFWS], 1987).

Wildlife

NAS Pensacola habitats provide potential ranges for a wide variety of animal life such as deer, squirrel, opossum, raccoon, fox, beaver, and bobcat. The station's beaches serve as resting, feeding, and nesting areas for various shorebirds. Ospreys have been observed nesting along undeveloped shoreline areas of the Big Lagoon, southeast of the Forrest Sherman Airfield. Numerous small mammals, amphibians, and reptiles also inhabit the base. The coastal marsh, submerged grass bed, and shallow water habitats at NAS Pensacola help support fishery communities within the Pensacola Bay estuarine complex. Approximately 180 species of bony fishes form the basis of the Pensacola Bay fish community (USFWS, 1987).

Threatened and Endangered Species

Appendix A of the *Comprehensive Natural Resources Management Plan for NAS Pensacola and Outlying Field Bronson* (USFWS, 1987) lists the rare, threatened, and endangered species that may be found within NAS Pensacola boundaries. E/A&H investigations of different areas of NAS Pensacola have identified osprey, great blue heron (as well as other shorebirds), alligator snapping turtle, Godfrey's golden aster, Carolina lilaeopsis, white-top pitcher plant, and narrow-leaved sundew. All are considered rare or endangered for Escambia County, Florida, by the Florida Natural Areas Inventory (Florida Natural Areas Inventory, 1995).

3.4 Area Climate

The Pensacola area has a mild, subtropical climate with average annual temperature ranging from 55°F in the winter to 81°F in the summer. Daily temperatures can be more extreme, ranging from less than 7°F in the winter to more than 102°F in the summer. Thunderstorms, which occur on approximately half the summer days, can cause a precipitous drop in temperature of 10°F to 20°F in a matter of minutes (E&E, 1992a).

November is the driest month of the year, with an average rainfall of 3.2-inches, based on climatological data from 1962 to 1991. Rainfall averages approximately 60-inches a year, with the highest amounts in July and August when thunderstorms occur almost daily. Thunderstorms resulting in 3 to 4 inches of rain in an hour are common. Rainfall is lowest during spring and fall (4 inches average per month). In general, spring and fall rains are less intense, last longer, and produce less surface runoff, but higher rates of infiltration and net recharge (E&E, 1992d).

Winds, which prevail from the north during the winter and the south during the summer, are generally moderate in velocity, except during thunderstorms. A difference in the ocean-land temperature produces the sea-breeze effect, a daily clockwise rotation in the surface wind direction near the coast. Hurricanes and tornadoes can substantially damage the nearshore environment. Since 1980, 8 hurricanes have passed within 50-miles of Pensacola, the most recent being Hurricanes Erin and Opal in August and October 1995, respectively.

4.0 PRELIMINARY SURVEYS

4.1 Phase I Surveys

Preliminary surveys were performed for each OU 2 site during the 1991 Phase I investigations conducted by E&E. Section 2.2, Site History and Previous Investigations, summarizes the findings of these investigations. These E&E Phase I investigations are discussed in Interim Data Reports for each site.

4.2 Soil Gas Survey

A soil-gas screening survey was performed at Sites 11, 25, 27, and 30 to detect VOCs in soil. Most E/A&H sampling locations were based on the results of this study (see Appendix C).

4.3 Radiological Investigations

4.3.1 Sites 25 and 27

A radiological investigation was conducted to explore possible near-surface radiation at Sites 25 and 27. The investigation revealed a loading dock at Site 25 where a spill of radium-paint waste occurred. The contamination was confined to the concrete pavement and was cleaned up. E/A&H conducted a surface survey and found no evidence of the spill (see Appendix D).

At Site 27 radiation surveys revealed a small area south of former Building 709. From the size of the area, the contamination appeared to be a spill adjacent to an old stairway from Building 709. Outside this limited area, no significant soil radiological contamination was found anywhere on these sites (see Appendix D).

4.3.2 Sites 12 and 26

E/A&H performed a preliminary radiological screening survey at Sites 12 and 26. This survey involved scanning the site for Ra-226 using a radiation survey meter. The entire surface area of both sites was scanned, with measurements recorded at the soil surface (Figure 4-1). Additional

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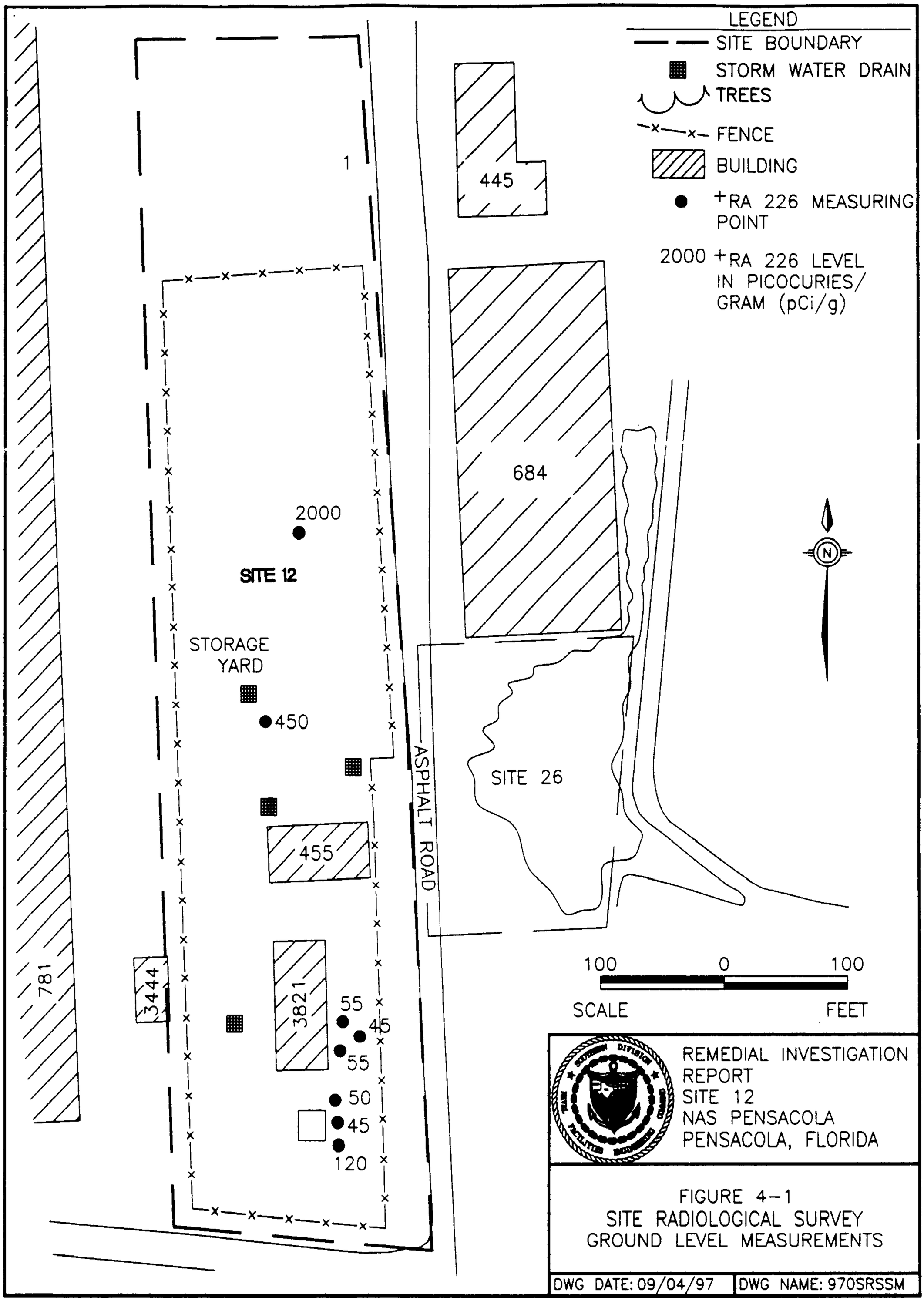
LEGEND
SITE BOUNDARY
STORM WATER DRAIN
TREES
FENCE
BUILDING
+RA 226 MEASURING POINT
2000 +RA 226 LEVEL IN PICOCURIES/ GRAM (pCi/g)
1
445
684
2000
SITE 12
STORAGE YARD
450
455
ASPHALT ROAD
SITE 26
781
3444
3821
55
45
55
50
45
120
N
100 0 100
SCALE FEET
REMEDIAL INVESTIGATION REPORT
SITE 12
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 4-1
SITE RADIOLOGICAL SURVEY
GROUND LEVEL MEASUREMENTS
DWG DATE: 09/04/97
DWG NAME: 970SRSSM

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measurements were obtained from contaminated locations at one meter above the ground (Figure 4-2). The investigation revealed radiological contamination in two locations in the north-central portion of Site 12, as well as a 15-foot by 50-foot area near the southeast corner of the site (Figures 4-1 and 4-2).

4.4 Contaminant Source Survey

A CSS was conducted before each site investigation. These surveys quantified information on past and present site activities or incidents that may have resulted in known or suspected releases of contamination to the environment. Previous investigation reports and site historical information, NAS Pensacola PWC drawings and utility maps, and aerial photographs were used to document the activities at OU 2. The results of this historical research has been detailed in Section 2.

4.5 Habitat and Biota Survey

Site 11

Site 11 is largely undeveloped, except for a warehouse complex (Buildings 3427/3428) situated along Pat Bellinger Road. The site can be classified as an early successional waste area containing disturbed habitat. Site 11 is known as the North Chevalier Disposal Area. It is bound on the north by the Sailing Facility; to the east by the Yacht Basin, and areas classified by Parsons and Pruitt (1991) as Wetlands 8 and 64; to the west by a wooded berm above which lies Site 26 with Building 684 of the Naval Supply Center complex; and to the south by a Naval Aviation Depot (NADEP) storage yard adjacent Building 3445, and former Chevalier Field. The site also includes the area immediately north of Building 3644, on the southwest portion of Magazine Point. Pat Bellinger Road traverses the eastern portion of the site from south to north. The site is also bordered on its west side by a dirt perimeter road at the base of the wooded berm.

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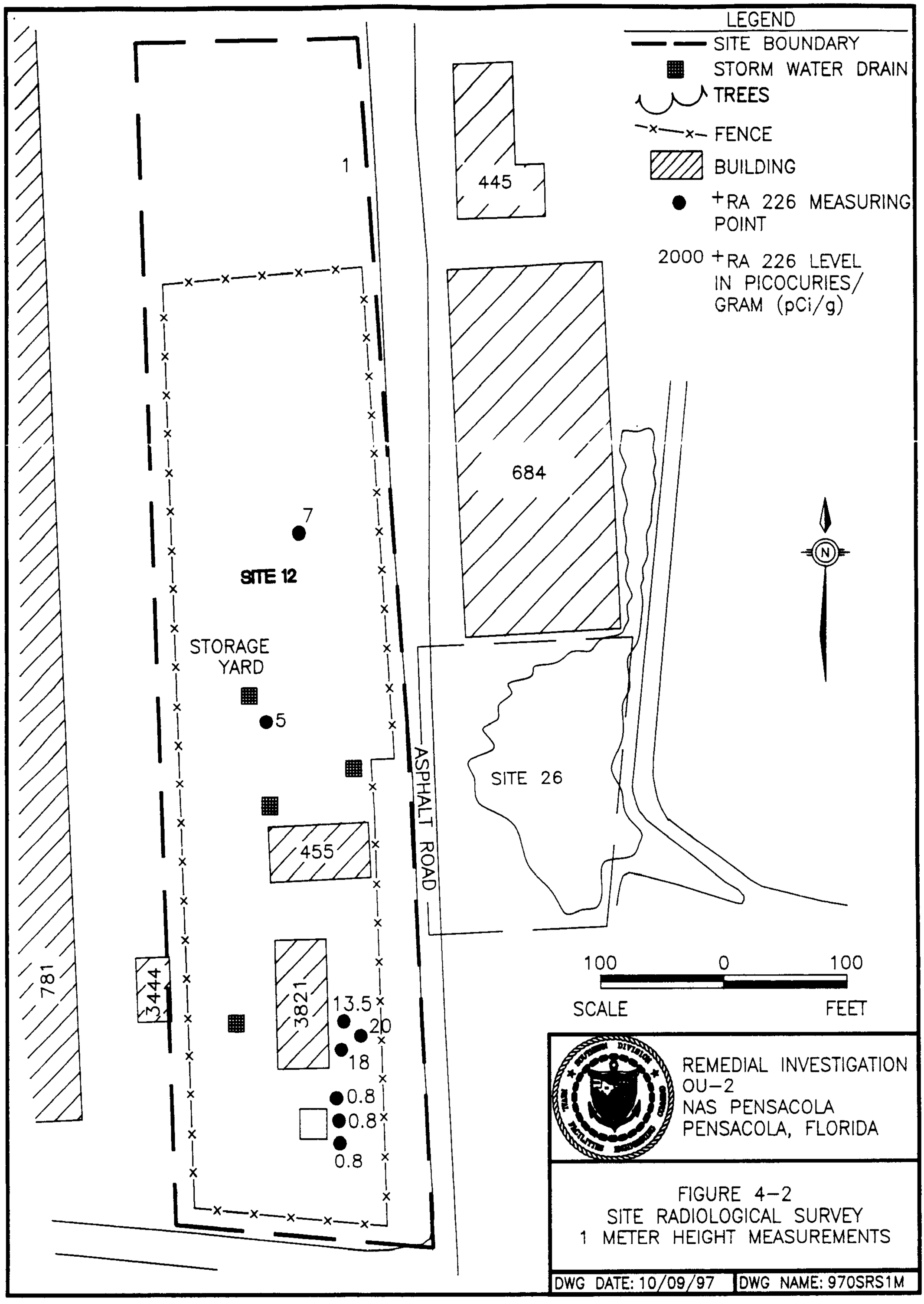

LEGEND
SITE BOUNDARY
STORM WATER DRAIN
TREES
FENCE
BUILDING
+RA 226 MEASURING POINT
2000 +RA 226 LEVEL IN PICOCURIES/ GRAM (pCi/g)
1
445
684
7
SITE 12
STORAGE YARD
5
ASPHALT ROAD
SITE 26
455
781
3444
3821
13.5
20
18
0.8
0.8
0.8
N
100 0 100
SCALE FEET
REMEDIAL INVESTIGATION
OU-2
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 4-2
SITE RADIOLOGICAL SURVEY
1 METER HEIGHT MEASUREMENTS
DWG DATE: 10/09/97
DWG NAME: 970SRS1M

The area along Wetland 6 from its crossing by Pat Bellinger Road to where it discharges into the Yacht Basin is a low, moist area densely overgrown with vegetation. This vegetation grows largely on heaped up fill material and concrete rubble disposed when the site was an active landfill. The floral distribution is typical of early successional waste areas, containing a distribution of native species mixed with opportunistic species and introduced species/escaped ornamental species. The vegetative cross section contains an unnatural arrangement of medium-sized trees intertwined with vines and shrubs, distinctly different from other secondary woods areas in less disturbed locations on the base. The overstory of this zone contains live oak *(Quercus virginiana)*, sand live oak *(Quercus geminata)*, laurel oak *(Quercus hemisphaerica)*, pecan *(Carya illinoiensis)*, slash pine *(Pinus elliotti)*, black willow *(Salix nigra)*, cabbage palm *(Sabal palmetto)*, white mulberry *(Morus alba)*, persimmon *(Diospyros virginiana)*, Atlantic white cedar *(Chamaecyparis thyoides)*, black locust *(Robina pseudoacacia)*, chinaberry *(Melia azedarach)*, and popcorn tree *(Sapium sebiferum)*. Midstory shrubs include yaupon *(Ilex vomitoria)*, carolina laurel cherry *(Prunus caroliniana)*, winged sumac *(Rhus copalina)*, sea myrtle *(Baccharis halmifolia)*, wax myrtle *(Myrica cerifera)*, and shrub verbena *(Latana camara)*. Understory plants include trumpet flower *(Campsis radicans)*, cat brier *(Smilax bona-nox)*, goldenrod *(Solidago fistulosa)*, peppervine *(Ampelopsis arborea)*, Virginia creeper *(Parthenocissus quinquefolia)*, dewberry *(Rubus trivialis)*, muscadine *(Vitis rotundifolia)*, rattlebox *(Sesbania drumondii)*, and partridge pea *(Cassia fasciculata)*.

North of Buildings 3627/3628, a wider wooded area exists which may be older than the band of vegetation along Wetland 6. It is distinctly dry along Pat Bellinger Road, but transitions to more of a wetland type habitat where the stream empties into the upper reaches of the Yacht Basin. The overstory contains a dense oak grove containing live oak, laurel oak, sand live oak, and diamond leaf oak *(Quercus laurifolia)*. Included also are slash pine, cabbage palm, persimmon, mimosa, and chinaberry. In wetter areas, southern magnolia *(Magnolia grandiflora)*, sweetbay magnolia *(Magnolia virginiana)*, popcorn tree, and black willow are found. Midstory shrubs include

carolina laurel cherry, yaupon, winged sumac, and wax myrtle. The understory includes trumpet flower, muscadine, minty rosemary *(Conradina canescens)*, beach rosemary *(Ceratiola ericoides)*, saw grass, *(Cladium jamaicense)*, and bush palmetto *(Sabal minor)*.

The center of the old landfill on Site 11, traversed by Pat Bellinger Road and enveloped by the site's dirt perimeter road, is largely an open area. This area contains hundreds of mounds of dirt fill that were dumped there when site was an active landfill. This area contains a mixed collection of isolated trees, shrubs, vines, and herbs, many of which are species that thrive in disturbed sites. Inside the landfill are isolated examples of trees, including china berry, black willow, live oak, laurel oak, sand live oak, persimmon, sand pine *(Pinus clausa)*, and long leaf pine *(Pinus palustris)*. Shrubs include wax myrtle, shrub verbena, minty rosemary, myrtle oak *(Quercus myrtefolia)*, goldenrod, and *Solanum capsicoides*. Understory herbs include partridge pea, morning glory *(Ipomea spp.)*, star grass *(Hypoxis spp.)*, and opportunistic weeds. The center of the landfill is thickly covered with vines, to include dewberry, and cat brier, with pepper vine and muscadine growing along the shrubby fringes of this area.

The west side of Site 11 is traversed by the dirt perimeter road, which abuts a thickly wooded berm below the Building 684 complex. This berm hosts a secondary woods area. The overstory contains live oak, sand live oak, laurel oak, chinaberry, southern magnolia, popcorn tree, sea myrtle, Atlantic white cedar, and bitternut hickory *(Carya cordiformis)*. Mid and understory plants include myrtle oak, wax myrtle, shrub verbena, yaupon, carolina laurel cherry, minty rosemary, goldenrod, trumpet flower, muscadine, dewberry, cat brier, saw palmetto *(Serenoa repens)*, red bay *(Persea borbonia)*, Saint Andrews cross *(Hypericum hypericoides)* kudzu *(Pueraria lobata)*, pennywort *(Hydrocotyle spp.)*, and green brier *(Smilax auriculata)*.

Sites 12 and 26

Site 12 is covered with concrete and packed shell hash pavement. No vegetation or habitat exists. Site 26 bounds the western edge of Site 11 offering at the edge of Site 26 shrubs and understory vegetation. The site itself is concrete surrounded by sandy soils and mowed grasses.

Site 25/27

Sites 25/27 encompasses an industrial area located predominantly east of the former NADEP Dynamic Components Division (Buildings 648/649), west of NADEP Buildings 743/780/741/225, north of the new Air Traffic Control School (Building 3220), and to the north by the cold storage warehouse. The center of the site contains the foundation of the former radium dial shop (Building 709). The typical habitats within the Sites 25/27 areas include grassy areas maintained by groundsmen with scattered native trees in the overstory. Also included are weeded lots which are not maintained. Plants include species which are able to thrive within human habitats. Trees growing within the area described include intermixed examples of live oak, sand live oak, laurel oak, and sand pine. These grow in the parking area adjacent Building 743, and along a grassy buffer between Farrar Road and Building 3220. In areas not maintained by groundsmen, chiefly along fence rows and parking lot margins, various shrubs and vines prevail, including peppervine, Virginia creeper, cat brier, green brier, and shrub verbena.

Site 30

Site 30 includes a number of areas: (1) the area within the former NADEP Dynamic Components Division, (2) the area immediately behind the new Air Traffic Control School, (3) the wooded area between the north bank of Wetland 5B and the water tower/collocated Gulf Power substation, and (4) the eastern bank of Wetland 6 from Building 3619, north to where the ditch is crossed by Farrar Road. At its northern end, the site overlaps somewhat with Site 11.

In areas adjacent to buildings, the habitat associated with Site 30 is identical to that described for Sites 25/27. The wooded zone between Wetland 5B and the Air Traffic Control School is a secondary woods area containing hardwoods in the overstory (mostly live oak, sand live oak, and laurel oak, with some interspersed hickories or magnolias). Sand pines dominate in the vicinity of Building 3220 and the water tower. These are medium sized trees to 30-feet tall which likely average 20 to 30 years in age, typical of woods areas which are disturbed every second to fourth decade for some sort of development or use. The understory in this area includes yaupon, cat brier, minty rosemary, saw palmetto, and persimmon. Along the Wetland 6 drainage ditch, the habitat is an early successional waste area containing small oak trees, an occasional pine, isolated shrubs and cat brier thickets.

Major faunal species associated with the habitats described for Sites 11, 12, 25, 26, 27, and 30 include small mammals, amphibians, and reptiles. In addition, shorebirds are expected to use the areas close to Bayou Grande/Pensacola Bay intermittently.

5.0 FIELD INVESTIGATION METHODS

The field investigation at OU 2 took place between July 1993 and December 1995. Work was performed in accordance with the work plans for the OU 2 sites (E&E, 1992e/f/g/h), the site specific SAPs for OU-2 (E/A&H, 1993a/b/c/d, 1995a/b, 1997), the Final Comprehensive Sampling and Analysis Plan (CSAP) for NAS Pensacola (E/A&H, 1994c), and the USEPA Region IV Standard Operating Procedures and Quality Assurance Manual (SOP/QAM) (USEPA, 1991a). Field methods followed guidelines set forth in these documents. Where warranted by field conditions, deviations from the approved procedures were carried out and appropriately documented. The investigation was conducted to identify any contaminants onsite, comparing identified constituents to previously established preliminary remediation goals (PRGs). Field change request forms were used to document any changes. The only change required was for sampling trenches at Site 11.

5.1 Analytical Parameters

Per the respective site-specific SAPs, the field investigation at OU 2 included soil, groundwater, and sediment sampling. All samples were analyzed for the full Target Analyte List/Target Compound List (TAL/TCL) in accordance with the Contract Laboratory Program (CLP). Physical parameters analyses included total organic carbon (TOC), and grain size (GS) analyses where dictated by the site-specific SAPs. Additional analyses included hexavalent chromium and Ra-226. Compuchem Laboratories, Inc., performed analyses for Sites 12, 25, 26, and 27. Soil and groundwater analyses for Sites 11 and 30 were conducted by National Environmental Testing (NET) Inc., and International Technologies (IT), Inc. Phase II groundwater samples were analyzed by Savannah Laboratories, Inc., Savannah, GA. Soil and groundwater physical parameters analyses were performed by Savannah Laboratories, Mobile, AL. Grain size analysis was conducted by Thompson Engineering and Testing, Inc. On a limited basis cation exchange capacity, total kjeldahl nitrogen, nitrate as nitrogen, and total phosphorus were analyzed.

5.2 Field Investigation

The field investigation for OU 2 was conducted in accordance with the site specific SAPs. The following sections detail exceptions not covered by the site specific SAPs.

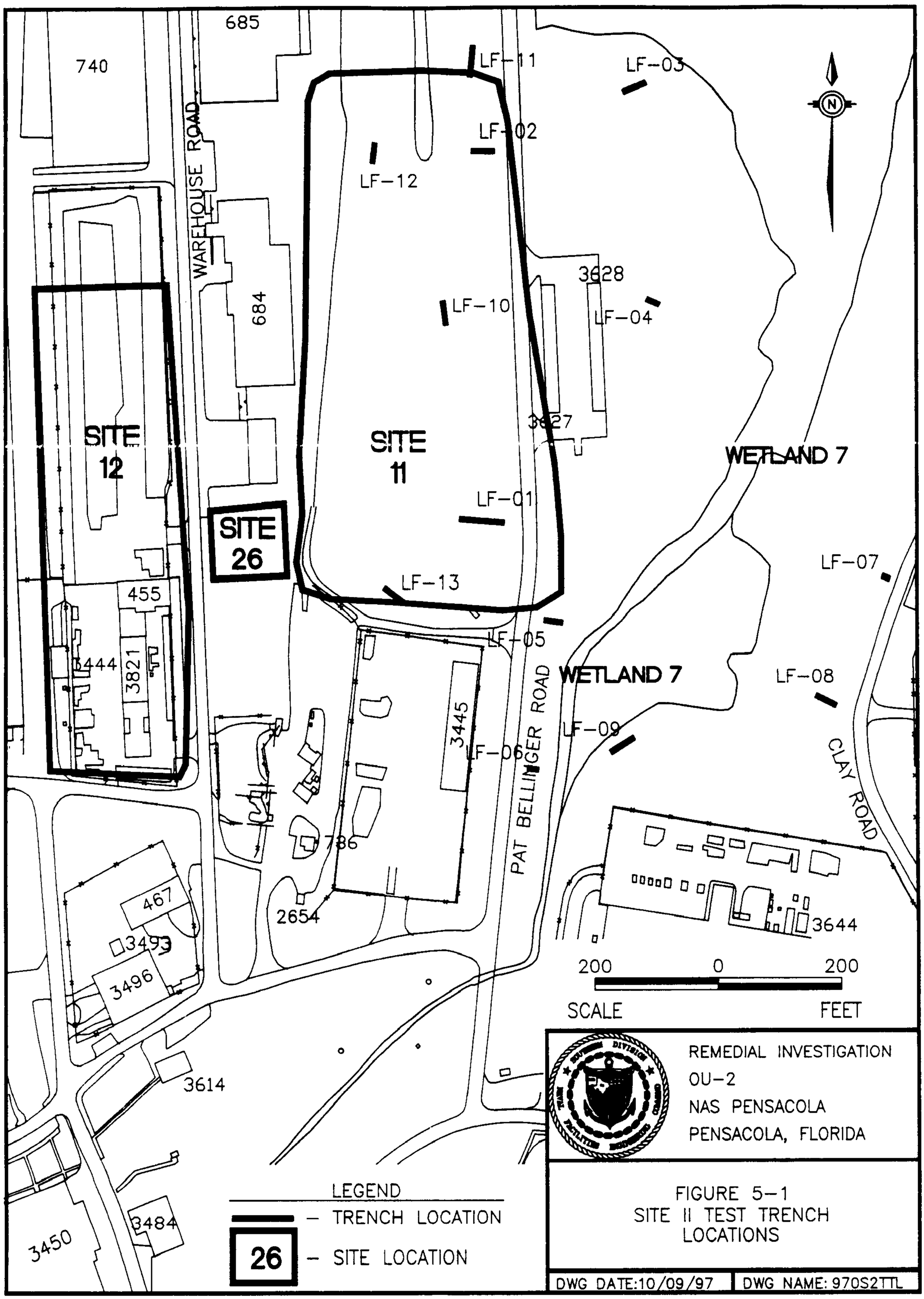
5.2.1 Trenching

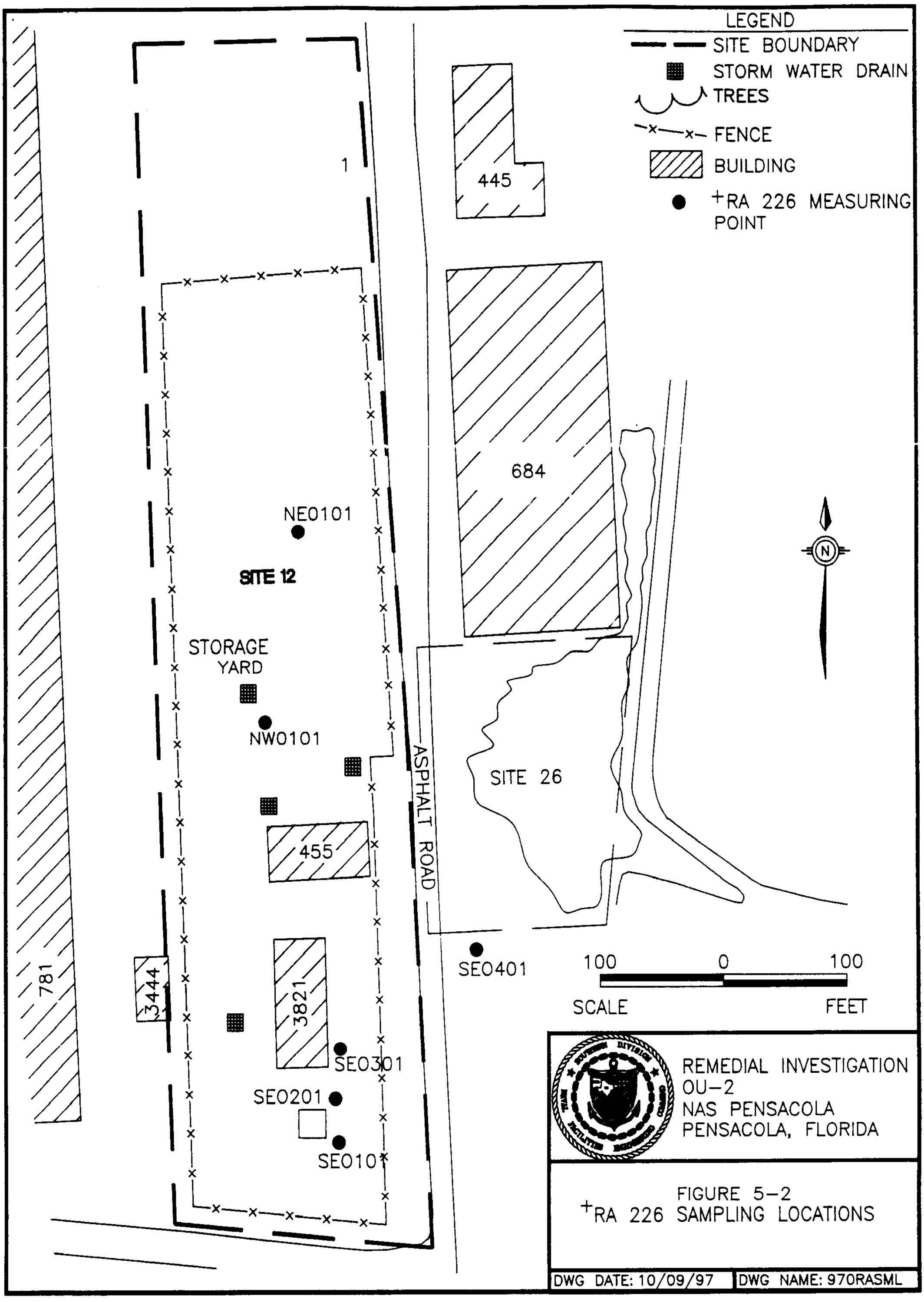
Due to the potential safety hazards associated with drilling in a landfill, Site 11 was trenched to evaluate the vertical extent of buried waste instead of soil borings. Figure 5-1 maps the trench locations at Site 11. Trenches were located to determine extent and content of the landfill. Waste material samples were collected at several test trenches when buried wastes were encountered. Trenching was conducted in accordance with Section 4.6.3 of the CSAP.

Since trenching was used to verify the type of waste at Site 11, sampling methods were field changed and documented on field change request forms. The soil samples were collected by using a stainless steel scoop or auger attached to an extension handle. Water samples were collected by inserting a stainless steel well screen into the muddy water at the bottom of the trench. Water samples were collected by lowering a bailer into the screen to collect the sample. This method did reduce some of the larger solids in the water. The analytical results of soil and water samples taken in the trenches are provided in Section 7.

5.2.2 Ra-226 Sampling

Based on the results of the preliminary radiological screening, five soil samples were collected at Site 12 (Figure 5-2). Soil samples for Ra-226 analysis were collected in accordance with Section 4.4 of the CSAP. Following the collection of soil samples, radiation levels were measured at the surface of each sampling location and inside each borehole. No soil contamination was found outside the southeast area of contamination. Radiation was detected prior to sampling at locations 012SNE0101 and 012SNW0101, but no radiation was observed after soil samples were


740
685
WAREHOUSE ROAD
684
SITE 12
SITE 26
SITE 11
LF-11
LF-03
LF-02
LF-12
3628
LF-10
LF-04
3627
WETLAND 7
LF-01
LF-07
LF-13
455
3444
3821
LF-05
WETLAND 7
LF-08
3445
LF-06
LF-09
PAT BELLINGER ROAD
CLAY ROAD
786
467
2654
3493
3496
3644
200 0 200
SCALE FEET
3614
3450
3484
LEGEND
TRENCH LOCATION
26 SITE LOCATION
REMEDIAL INVESTIGATION
OU-2
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-1
SITE II TEST TRENCH
LOCATIONS
DWG DATE:10/09/97
DWG NAME: 970S2TTL


LEGEND
SITE BOUNDARY
STORM WATER DRAIN
TREES
FENCE
BUILDING
+RA 226 MEASURING POINT
1
445
684
NE0101
SITE 12
STORAGE YARD
NW0101
ASPHALT ROAD
SITE 26
455
781
3444
3821
SE0401
SE0301
SE0201
SE0101
N
100 0 100
SCALE FEET
REMEDIAL INVESTIGATION
OU-2
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 5-2
+RA 226 SAMPLING LOCATIONS
DWG DATE: 10/09/97
DWG NAME: 970RASML

collected. Laboratory analyses identified Ra-226 in these samples. The radioactive sources at both 012SNE0101 and 012SNW0101 were removed when the soil samples were collected.

Additionally, various pieces of radioactive metal debris were recovered during soil sampling in the southeast section of Site 12, including a radium dial, at locations SE0101, SE0201, and SE0301.

5.2.3 Soil Boring and Sampling Methodology

Figures 1 and 2 in Appendix E show the OU 2 soil boring and monitoring well locations. Sampling patterns were biased based on soil gas survey results and historical evidence uncovered during the preliminary surveys. Appendix F contains soil boring and monitoring well construction logs for all OU 2 sites. Soil sample collection technique varied from 2-inch stainless steel sleeves inserted into split spoons to hand augers. Hand auger techniques were used as outlined in Section 4.4 of the CSAP. Samples were collected beginning with the natural soil underlying pavement. Shelby tubes were used to collect physical parameter samples. Hand augers were used exclusively at Sites 12 and 26 for sample collection.

Surface samples were collected from the 0- to 1-foot interval, and subsurface samples were collected from each 2-foot interval to the water table. The depth to the water table varied between sites, depending on each site's location within the investigation area. No soil intervals were sampled below the level of soil saturation.

5.2.4 Groundwater Monitoring

Monitoring Well Installation

Appendix F contains construction logs for the OU 2 monitoring wells. Monitoring wells were installed per each site-specific SAP. Permanent wells were installed in accordance with procedures outlined in Section 5.3 of the CSAP. Hollow stem auger procedures were used to

advance well borings to the desired depths. Two-inch polyvinyl chloride (PVC) well risers attached to ten-foot PVC well screens were utilized. Shallow monitoring wells were installed so the screened interval bracketed the water table to assess floating constituents. Intermediate depth monitoring wells were completed at the low permeability clay to detect the presence of any sinking solvents.

Monitoring Well Development

Monitoring wells were developed in accordance with procedures outlined in Section 5.4 of the CSAP, using a centrifugal pump. Wells were developed until water was visibly clear of sediment.

Groundwater Sampling

Groundwater sampling was conducted in accordance with Section 6 of the CSAP. Phase I sample locations were based on previous investigations and soil gas survey. Phase I samples on all OU 2 sites were collected with Grundfos submersible pumps. The "quiescent" vacuum/transfer groundwater sampling method (Section 6.3 of the CSAP) was used for Phase II groundwater sampling. Measured turbidities in samples were much lower during the later phase using the vacuum/transfer method. Table 5-1 depicts the wells sampled during Phase II.

Phase II sampling locations were determined by consensus at the January 1995 Tier I Partnering meeting. The objective of sampling was agreed to be verification of contamination.

5.2.5 Sediment and Surface Water Sampling

Limited sediment and surface water sampling was conducted during the field investigation for OU 2. Sediment and surface water sampling focused on specific aspects of the OU 2 sites that included such sampling in their respective field investigations. They were not designed to replace or supplement the comprehensive sediment and surface water sampling conducted during the Site 40 (Bayou Grande) and 41 (NAS Pensacola Wetlands) investigations. The Site 40 and 41

Table 5-1
Phase II Groundwater Sampling

			Parameter			
Site	Well Number	Date Sampled	Metals	VOCs	SVOCs	Pesticides/PCBs
1	01GI68	11/01/95	X			
	01GS17	10/30/95	X			
	01GS67	11/01/95	X			
	01GS69	10/30/95	X			
	11GM15	12/11/95	X			
	11GM47	11/02/95	X	X	X	
	11GM52	10/16/95		X		
	11GI02	10/24/95	X	X		
	11GI04	10/31/95	X			
	11GI12	10/16/95		X		
	11GI14	10/16/95		X		
	11GS01	1/23/95	X	X		
	11GS03	10/31/95	X	X		
	11GS05	10/31/95		X		
	11GS11	10/16/95		X		
	11GS13	10/16/95		X		
25	25GI01	12/12/95		X		
	25GI02	10/18/95		X		
	25GS01	10/24/95	X			
	25GS02	10/24/95	X	X		
	25GS03	10/26/95	X			
	25GS07	10/25/95	X			
	25GS08	10/30/95	X	X		
	25GS09	12/12/95	X	X		
27	27GS02	10/25/95		X		
	27GI01	10/26/95	X			
	27GI02	10/18/95		X		

Table 5-1
Phase II Groundwater Sampling

			Parameter			
Site	**Well Number**	**Date Sampled**	**Metals**	**VOCs**	**SVOCs**	**Pesticides/PCBs**
	27GS01	10/25/95	X			
	27GS02	10/18/95		X		
	27GS03	10/25/95	X			
	27GS04	10/26/95	X	X		
	27GS06	12/12/95	X			
	27GS07	10/27/95	X			
	27GS10	10/24/95	X	X		
	27GS11	10/18/95		X		
	27GS15	11/07/95	X		X	
	27GS18	11/07/95			X	
	27GS19	11/08/95		X	X	
	27GS20	11/08/96			X	
	27GS21	11/07/95		X	X	
30	30GI32	10/19/95		X		
	30GI60	10/27/95	X	X		
	30GI111	11/09/95		X	X	
	30GI126	11/06/95	X			
	30GI164	02/08/96				X
	30GS06	11/06/95	X	X	X	
	30GS12	11/13/95		X	X	
	30GS18	10/19/95		X		
	30GS20	10/19/95		X		
	30GS22	11/08/95	X	X	X	
	30GS26	10/18/95		X		
	30GS27	10/25/95	X	X		
	30GS28	10/25/95	X	X		
	30GS33	10/19/95		X		

Table 5-1
Phase II Groundwater Sampling

			Parameter			
Site	**Well Number**	**Date Sampled**	**Metals**	**VOCs**	**SVOCs**	**Pesticides/PCBs**
	30GS46	11/08/95		X	X	
	30GS48	10/26/95		X		
	30GS51	11/08/95			X	
	30GS59	10/27/95		X		
	30GS62	10/26/95	X			
	30GS103	12/11/95	X			
	30GS111	11/09/95	X	X	X	
	30GS123	11/03/95				X
	30GS126	11/06/95	X			
	30GS162	02/07/96		X		
	30GS166	02/08/96		X		
	30GS171	02/05/96	X	X	X	X
	30GS172	02/13/96	X	X	X	X
	30GS173	02/05/96	X	X	X	X

investigations were tailored to address impacts from all IRP sites of concern on the base. As such, the RI reports for Sites 40/41 will have detailed discussions on the potential impacts from OU 2 sites to adjacent wetlands and the bayou (i.e., impacts from the Building 649 complex to adjacent Wetland 5A and downstream areas, impacts from Site 11 to adjacent Wetlands 7, 8, and 64, and the Yacht Basin of Bayou Grande, etc.).

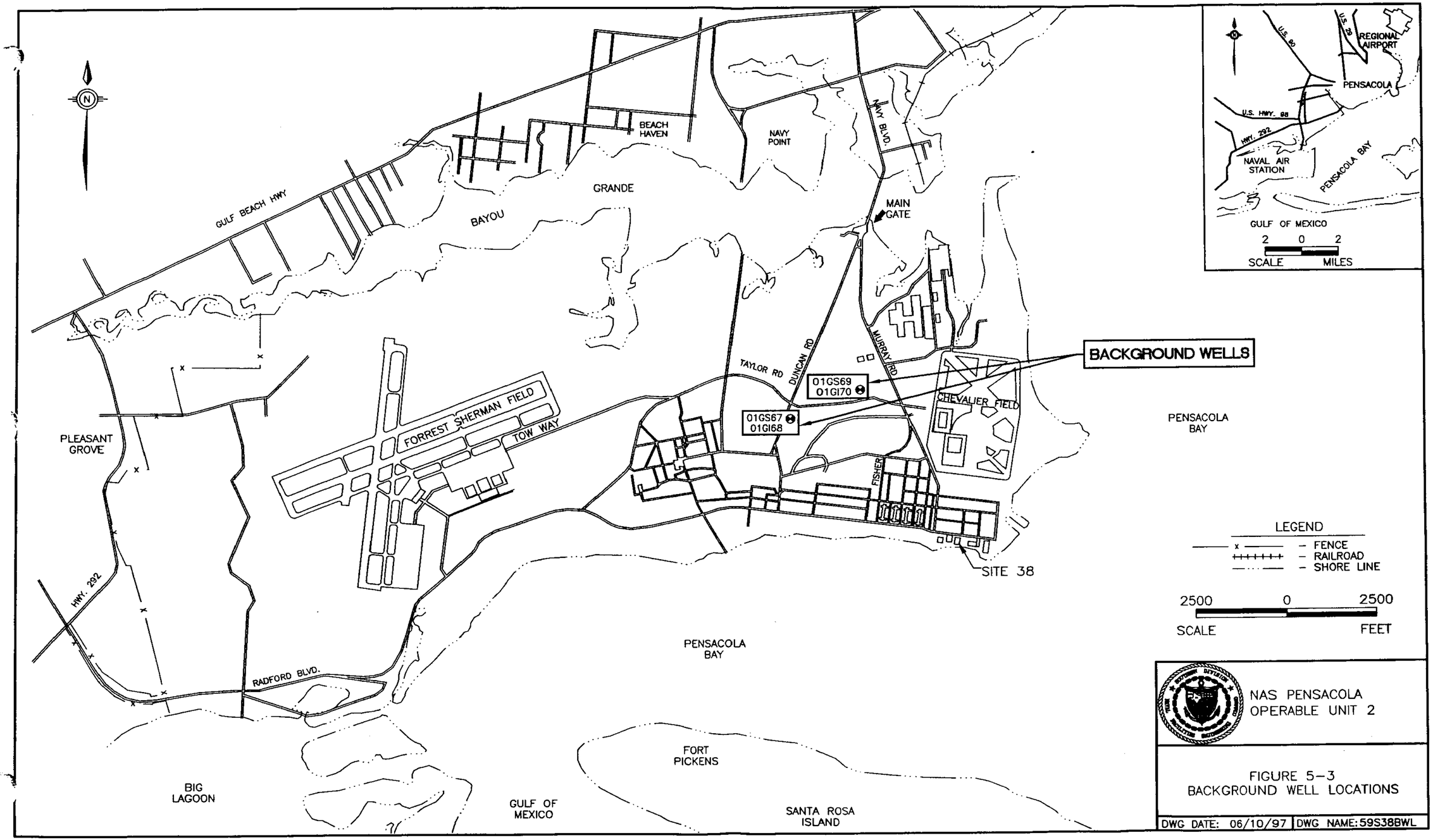
Sediment samples were collected at Wetland 5A (adjacent Site 30) in and around the waste receiving structure in 1993 to support development of the work plan (E/A&H, 1994a) for it's interim removal in 1994. Subsequently, post-removal confirmatory samples were collected, as discussed in Section 2.3 of this report.

Additional sediment samples were collected from storm sewer drains at Site 12. Six sediment samples were called for in the work plan for Site 12 (E/A&H, 1995a); however, because several storm drains were washed clean of sediments, only four samples were actually collected. The purpose of the sampling was to determine the overall impacts of contaminants to the storm sewer system at the site. It was noted, however, that sampling upstream and downstream segments of the storm sewer system near Site 12 would not be advantageous due to potential impacts by other sites (E/A&H, 1995a). A surface water sample was collected at Site 12 from pooled rain water. The purpose of this sample was to determine whether contaminants are being washed offsite with stormwater (E/A&H, 1995a).

Sediment and surface water samples were collected per Sections 7.2 and 7.3 of the CSAP (E/A&H, 1994c).

5.2.6 Background Sampling

To assess the range of naturally occurring metal concentrations in soil and groundwater four soil borings and monitoring wells were completed and sampled during the Site 1 investigation. These wells were resampled during Phase II using quiescent methods. As seen in Figure 5-3, these four monitoring wells were upgradient from all sites and industrial activities on base. Two of the wells, 01GS67 and 01GS69, were shallow depth wells. The other two wells, 01GI68 and 01GI70, were intermediate depth wells. Soil borings provided the background soil sampling down to the marine clay layer. This data is labeled and provided in Appendix G. The data provided is from the most recent sampling event utilizing quiescent sampling techniques.


N
GULF BEACH HWY
BAYOU
GRANDE
BEACH HAVEN
NAVY POINT
NAVY BLVD.
MAIN GATE
PLEASANT GROVE
FORREST SHERMAN FIELD
TOW WAY
TAYLOR RD
DUNCAN RD
MURRAY RD
FISHER
CHEVALIER FIELD
BACKGROUND WELLS
01GS69
01GI70
01GS67
01GI68
SITE 38
PENSACOLA BAY
HWY. 292
RADFORD BLVD.
BIG LAGOON
GULF OF MEXICO
FORT PICKENS
SANTA ROSA ISLAND
U.S. 90
U.S. 29
REGIONAL AIRPORT
PENSACOLA
U.S. HWY. 98
HWY. 292
NAVAL AIR STATION
PENSACOLA BAY
GULF OF MEXICO
2 0 2
SCALE MILES
LEGEND
FENCE
RAILROAD
SHORE LINE
2500 0 2500
SCALE FEET
NAS PENSACOLA
OPERABLE UNIT 2
FIGURE 5-3
BACKGROUND WELL LOCATIONS
DWG DATE: 06/10/97
DWG NAME: 59S38BWL

5.3 Fieldwork and Sampling Protocols

Sample Handling and Management

Soil and groundwater samples were collected in accordance with the appropriate section of the CSAP. Clean plastic sheeting was placed at each sampling location to minimize the potential for sample contamination. Clean latex gloves were donned each time a new sample was collected. Decontaminated sampling devices were kept wrapped until the samples were collected. Samples were managed in accordance with Chapter 12 of the CSAP. Labeling, preservation, packing, chain-of-custody, and shipping carefully followed procedures in that section.

Quality Assurance/Quality Control Samples

Quality Assurance/Quality Control (QA/QC) samples, including blanks, matrix spikes, and duplicates, were collected in accordance with Chapter 15 of the CSAP.

Sample Containers and Preservation

All laboratory-provided containers were precleaned and certified as specified in Chapter 12 of the CSAP.

Field Data

Auxiliary field data pertinent to the investigation were collected in accordance with Chapter 14 of the CSAP.

Decontamination

All exploration and sampling equipment used in the field investigation was decontaminated in accordance with Chapter 11 of the CSAP.

Investigation-Derived Wastes

Wastes derived from the field investigation were handled in accordance with Chapter 13 of the CSAP and the Investigation-Derived Waste Plan for NAS Pensacola (E/A&H, 1994d).

5.4 Site Area Land Survey

The site soil borings, and monitoring wells were surveyed by E/A&H personnel using Global Positioning System (GPS) surveying equipment, per Section 3.4 of the CSAP.

5.5 Site Area Hydrologic Investigation

A hydrologic investigation was conducted in accordance with Section 9.6 of the CSAP. Static water levels measured from each monitoring well were normalized to elevation data gathered during the GPS survey. These data were used to develop and analyze the potentiometric surface across the site.

6.0 GEOLOGICAL AND HYDROGEOLOGICAL RESULTS

This section provides the results of drilling, installation of monitoring wells, field observations, mapping studies, and physical measurements on soil, sediment, groundwater, and surface water at OU 2. These results will become the basis for the nature and extent (Section 7) and the fate and transport (Section 9) assessments. Based on the completeness of these data, soil characteristics and groundwater flow and direction have been assessed.

6.1 Site Geology

Site-specific geological and stratigraphic information developed while advancing soil borings was consistent with previous studies. All soil borings were confined to the surficial and the low permeability zones of the Sand-and-Gravel Aquifer. Twenty-one intermediate well/borings penetrated the full thickness of the surficial zone and 129 borings were confined to the upper surficial zone for shallow monitoring wells. Boring logs for this investigation are provided in Appendix C, and details of the generalized geologic section are listed in Table 6-1.

Table 6-1
Generalized Geologic Section

Site Number	Sample Interval (in feet)	Lithology
Sites 11, 12, 25, 26, 27, and 30	0-1.	Brown-to-tan, fine grained to silty quartz sand mixed with sandy loam, loamy soil, clayey silt, organics, brick, rock fragments, gravel, oyster shell, and some debris.
	1-3.	Tan-to-brown-to-black, red clayey, fine-grained quartz sand, mixed with gravel, few rock, and clay fragments.
	3-5.	White-to-tan-to-dark brown, fine- to medium-grained quartz sand.
	5-45.	Tan-to-white, silty, fine-grained quartz sand with intermittent lens of dark sandy clay and clayey sand near the bottom of the interval.
	45-60.	Sandy and medium stiff clay with occasional shell fragments. Color is light to medium gray occasionally green. This is the low permeability zone.

Surficial Zone

The surficial zone at OU 2 varies from 40 to 65 feet thick. The underlying clay, the low permeability zone, is relatively flat, making the surficial zone thickness dependent on the topographic elevation of the overlying strata. A layer of silty sand with occasional clay lenses is present over the area, varying in thickness from 0 to 5 feet, occurs just above the underlying clay. It is discontinuous laterally, frequently pinching out between adjacent borings, and appears to be a transitional zone between the clay and overlying surficial zone sands.

Low Permeability Zone

The low permeability zone of the Sand-and-Gravel Aquifer lies beneath the surficial zone and forms a semiconfining unit in this area. The low permeability zone consists of a plastic green to gray marine clay that is occasionally shelly at the top. The clay was encountered at the base of the surficial zone sands in all intermediate borings for this study, suggesting that it is continuous beneath the study area. The low permeability of this zone is described in the next section. The unit's thickness was not explored by E/A&H. According to G&M (1986), the thickness of this unit is reported at 30 feet in well GM-54. GM-54 is on Site 27 at the northeast corner of former Building 709.

6.2 Results of Physical Property Analysis

To aid in assessing potential remedial alternatives, representative samples from solid media encountered were collected and analyzed for grain-size analysis, permeability, and specific gravity. The results are presented below in Table 6-2.

6.2.1 Grain-Size Analysis

Typically, the surficial zone is made up of more than 90% sand-size particles with minor amounts of silt and clay-size particles. From Table 6-2, samples 27S1604 and 27S1612 are examples of

Table 6-2
Results of the Physical Property Analysis

Well No.	% Clay	% Silt	% Sand	% Gravel	SG	Vertical Permeability (cm/sec)
11GI08 (LPZ)	72.20	19.50	8.30	0	2.42	1.662E-08
11SI1044	12.40	2.20	85.40	0	2.64	0.00
11SI0649 (LPZ)	59.40	35.30	5.30	0	2.51	1.229E-08
27S1604	1.30	0.30	98.40	0	2.65	0.02
27S1612	1.60	0.80	97.60	0	2.68	0.04
27S1659	4.60	7.70	86.60	1.10	2.70	0.00
27S1704	13.60	5.50	77.00	3.90	2.66	0.00
27S1802	3.20	3.60	93.20	0	2.64	0.02
27S1812	4.20	3.70	92.10	0	2.64	0.02
27S1867 (LPZ)	65.70	25.30	8.80	0.20	2.67	1.217E-06
27S1962	20.10	1.70	76.90	1.30	2.64	0.00
30S0767	34.30	12.90	52.80	0	2.63	0.00
30S0973	10.60	0	88.80	0.60	2.65	0.01
30S11149 (LPZ)	53.60	13.10	33.30	0	2.61	1.288E-08
30S1952 (LPZ)	50.90	11.50	37.60	0	2.55	8.227E-09

Notes:
LPZ = The sample was collected from the low permeability zone.
cm/sec = Centimeters per second

clean sands. Samples collected from the transition zone contain 50% to 90% sand, 0% to 13% silt, and 10% to 34% clay-size particles. Samples from the low permeability zone were made up of 5% to 37% sand, 11% to 35% silt, and 51% to 72% clay-size particles. Some samples from all three zones contain small quantities of coarse sand particles.

6.2.2 Permeability

Table 6-2 also shows that the sand of the surficial zone has a median permeability of 1.8×10^{-2} centimeters per second (cm/sec). This sand is 92% to 98% sand with minor silt- and clay-size particles. More silty layers are discontinuous throughout the clay. Their permeability may be reduced by three orders of magnitude. The transition zone is highly variable in grain-size, varying from a slightly clayey sand to a slightly sandy clay, which results in a highly variable permeability, from 5.6×10^{-3} cm/sec to 3.3×10^{-5} cm/sec. Clay has a median permeability of 1.23×10^{-8} cm/sec, and varies by three orders of magnitude (1.217×10^{-6} cm/sec to 8.227×10^{-9} cm/sec). These permeability values provide a rough order of magnitude estimate in noncohesive deposits.

According to Fetter (1988), sediments with permeabilities of 10^{-5} cm/sec or less can be considered confining units. The lowest permeability in the clay layer suggests that the potential for groundwater movement through the clay is very low under ambient conditions.

6.2.3 Specific Gravity

The mean specific gravity of the clay, 2.55, is lower than that of the sand and the transition zone, 2.65. This change in specific gravity indicates that the mineralogy of the clay is different from that of the quartz sand. Field observations using hydrochloric acid effervescence further indicates the clay contains calcareous materials.

6.3 Hydrogeological Results

This section evaluates factors affecting groundwater flow. Vertical and horizontal flow characteristics will be discussed with the potential effects due to tides.

6.3.1 Horizontal Groundwater Flow Velocity

Groundwater elevation varies from 13 feet in the western portion of OU 2 (Site 27), to less than a foot along the Yacht Basin. This highest- to-lowest groundwater elevation drop occurs across an approximate 2,500-foot horizontal distance. Groundwater elevations indicate a general west-to-east flow verified by earlier studies, stating that horizontal movement of groundwater in the surficial zone generally mimics topography (G&M, 1984). Locally, groundwater flows toward Wetland 5A south of Site 30 and east-southeast toward the Wetland 5B stream and Wetland 6, which discharges to Bayou Grande. Figure 3 in Appendix E displays the shallow surficial potentiometric surface for Sites 11, 12, 25, 26, 27, and 30. The shallow zone is emphasized because of its higher permeability, closeness to suspected sources, and greatest potential for migration.

The horizontal hydraulic gradient varies from 0.001 to 0.006 across OU 2, with the gradient steepest near a wave-cut terrace. Three well pairs (30GS166/30GS123, 12GS05/11GS07, and 12GS15/11GS13) listed on Table 6-3 exhibit the hydraulic gradient across the prominent wave cut terrace across OU 2. This topographic feature separates the highest terrace elevations from coastal flats. The fourth pair (30GS43/25GS09) describes the hydraulic gradient in a easterly direction toward the Yacht Basin, while the fifth pair (30GS43/30GS06) exhibits the gradient in a southerly direction toward Wetland 5A. These topographic features affect the hydraulic gradient and therein contaminant transport.

6.3.2 Vertical Hydraulic Gradient

Vertical groundwater gradients indicate the direction of vertical flow. Table 6-4 provides the vertical flow around Site 11 representing a coastal flat and Table 6-5 compares groundwater levels in Site 25 and 27 representing an upland terrace. These shallow and intermediate well pairs offer a direct measurement of vertical flow at that location. The vertical gradient is calculated by

Table 6-3
Horizontal Hydraulic Gradients
Sites 11, 12, 25, 26, 27, and 30

Well Pair (see Appendix E: Figure 1)	Distance Between Wells (feet)	Difference Between Water Levels (feet)	Hydraulic Gradient	Groundwater Horizontal Velocity (feet/day)
12GS05 & 11GS07 (North terrace A-A')	830	1.1	0.001	0.89
12GS15 &11GS13 (East terrace B-B')	630	2.71	0.004	2.9
30GS166 & 30GS123 (South terrace C-C')	800	2.11	0.003	2.0
30GS43 & 25GS09 (East across OU 2: D-D')	1150	7.15	0.006	4.2
30GS43 & 30GS06 (South across OU 2: D-E')	500	1.9	0.004	2.6

Notes:
Hydraulic conductivity data were calculated for the shallow and intermediate portions of the surficial aquifer during the field investigation using specific capacity data. The geometric mean of the hydraulic conductivity was calculated at 167.7 feet/day (ft/day) for shallow wells from Table 6-6. Using this value, the average pore groundwater velocity for the upper level of the surficial zone beneath the site area was calculated using the following formula;

$V = Ki/n_e$.

Where:

V = horizontal groundwater velocity
K = hydraulic conductivity
I = horizontal hydraulic gradient
n_e = effective porosity

For reference, hydraulic conductivities were taken from Table 6-6. An effective porosity of 0.25 is estimated for unconsolidated sand from Heath (1989). Data obtained from Shelby tubes collected, show porosity for shallow wells was 0.369 and intermediate wells 0.403. Shelby tube measured porosity is not "effective" porosity by definition.

Table 6-4
Coastal Flats Measurements

Well ID	Depth	TOC EL	April 1, 1997 High Tide	Time	GW Elevation	Shallow - Inter.	High Tide Gradient	Low Tide	Time	GW Elevation	Shallow - Inter.	Low Tide Gradient	Total Change
30GS113	12	9.20	7.72	18:00:00	1.48			7.73	05:20:00	1.47			-0.01
30GI113	46	9.20	8.20	17:59:00	1.00	0.48	0.01	8.18	05:18:00	1.02	0.45	0.01	0.02
11GS005	12	10.34	7.66	18:30:00	2.68			7.69	04:55:00	2.65			-0.03
11GI006	46.6	10.34	8.41	18:31:00	1.93	0.75	0.02	8.61	04:57:00	1.73	0.92	0.03	-0.20
11GS003	12.5	11.21	8.89	18:34:00	2.32			8.89	05:02:00	2.32			0
11GI004	47	11.45	8.94	18:35:00	2.51	-0.19	-0.01	9.06	05:03:00	2.39	-0.07	0	-0.12
11GS001	12.5	9.89	7.53	18:45:00	2.36			7.54	05:13:00	2.35			-0.01
11GI002	45.8	10.31	8.16	18:44:00	2.15	0.21	0.01	8.20	05:11:00	2.11	0.24	0.01	-0.04
11GS13	11	5.48	4.01	17:38:00	1.47			4.07	03:57:00	1.41			-0.06
11GI14	44.5	5.46	3.79	17:39:00	1.67	-0.20	-0.01	3.81	03:58:00	1.65	-0.24	-0.01	-0.02
11GS009	10.5	5.01	3.37	18:04:00	1.64			3.40	04:26:00	1.61			-0.13
11GI010	45	5.01	3.47	18:03:00	1.54	0.10	0	3.59	04:25:00	1.42	0.19	0.01	-0.12
11GS007	11	6.28	4.68	18:16:00	1.60			4.72	04:38:00	1.56			-0.04
11GI008	44	7.05	5.81	18:17:00	1.24	0.36	0.01	6.08	04:40:00	0.96	0.59	0.02	-0.27

Table 6-5
Comparison of Groundwater Levels of the Upland Terrace Shallow/Intermediate Well Pairs

Well Pair ID	Depth	Groundwater Elevation	Shallow - Intermediate	Vertical Gradient
25GS08	22	5.69		
25GI02	50	4.46	1.23	0.04
27GS02	25	8.10		
27GI02	63	7.36	0.74	0.02
27GS11	24	7.89		
27GI06	57	7.25	0.64	0.02
27GS05	22.5	5.65		
27GI04	57	5.34	0.31	0.01
27GS04	22	6.22		
27GI01	54.5	5.73	0.49	0.02

dividing the difference in hydraulic head by the difference in completion depths. A positive gradient indicates a potential for downward flow, while a negative gradient indicates a potential upward flow. Measurements for gradient determinations were made at high and low tides to define potential gradient reversals. Of the wells measured on the upland terrace, most had groundwater levels lower in the intermediate well than in the corresponding shallow well. This implies that groundwater flows from shallow to intermediate depths, which is indicative of a recharge area. In the coastal flats, most wells had a slight downward flow, except for two well pairs, 11GS03/11GS04 and 11GS013/11GS014 which had a slight upward flow.

From Table 6-4, it can be seen that tides influences the vertical gradient in groundwater only in the coastal flats. No tidal influence was measurable in the wells of the upland terrace (Site 12, 25, 26, 27, and 30). The vertical gradient changed in only two well pairs with no reversal occurring. Since all the values for tidal change are less than zero, the effect is an overall increase in downward potential for flow (i.e. increased gradient). All the shallow wells, indicated by a "GS" in the well number, had less than 0.03 foot change. The greatest change in water levels due to tides was in the intermediate wells completed at the low permeability zone. These wells are shown on Figure 2 of Appendix E. In summary, there are generally positive gradients across OU 2 with no tide reversals.

6.4 Aquifer Characteristics

Specific capacity tests were conducted on many of the newly installed E/A&H wells to characterize the aquifer at these locations and depths. The specific capacity test results are presented in Table 6-6. Using Table 6-6 specific capacity data, the geometric mean of the hydraulic conductivities for the shallow wells (upper surficial zone) was 167.7 ft/day and 16.32 ft/day in intermediate wells just above the low permeability zone clay.

The conductivity is lower in the intermediate wells because of an increase in fine grain material as the surficial sands grade into the low permeability clay. It is not known if this trend is characteristic of the entire base.

6.5 Surface Water Hydrology

Due to the permeability of surface soil at NAS Pensacola, channelized stream flow is rare. Water in Wetland 5A pools due to two beaver dams supported by seeps and springs on the northwest slope. As a result, Wetland 5A discharges year-round to Wetlands 5B, 6, and 7, and empties to Bayou Grande. OU 2 storm water runoff is intercepted by a network of ditches and drains that control floods on roadways and parking areas. All storm water eventually discharges to the wetlands or the bayou.

Table 6-6
Specific Capacity Test Results

Well	Specific Capacity	Hydraulic Conductivity (ft/day)
11GI02	3	11
11GI04	1	4
11GI06	1	3
27GI02	2	28
27GI03	2	26
27GI04	1	16
27GI05	3	36
30GI09	2	28
30GI19	2	24
30GI32	2	22
30GI54	2	11
30GI60	1	13
30GI111	2	26
30GI113	1	11
30GI164	2	21
30GI170	3	36
11GS01	8	184
11GS03	28	647
11GS05	6	167
11GS13	5	99
11GS14	0	1
11GM47	1	33
11GM52	1	28
25GS04	9	170
25GS07	12	459
25GS08	9	213
27GS02	14	385
27GS05	13	429
27GS07	16	331
27GS08	12	401
27GS10	12	336
30GS05	11	221
30GS06	8	187

Table 6-6
Specific Capacity Test Results

Well	Specific Capacity	Hydraulic Conductivity (ft/day)
30GS07	2	32
30GS11	10	230
30GS15	13	261
30GS18	9	201
30GS20	7	152
30GS22	15	274
30GS24	16	291
30GS26	8	166
30GS27	15	300
30GS28	10	205
30GS29	9	190
30GS32A	4	82
30GS33	7	140
30GS37	13	238
30GS39	11	281
30GS43	13	262
30GS44	61	1,182
30GS46	15	296
30GS49	13	252
30GS50	13	241
30GS52	14	231
30GS59	11	223
30GS62	8	159
30GS101	8	142
30GS103	1	52
30GS105	6	89
30GS108	22	403
30GS118	4	63
30GS123	6	141
30GS126	5	102
30GS146	10	193
30GS154	10	223
30GS155	7	152

Table 6-6
Specific Capacity Test Results

Well	Specific Capacity	Hydraulic Conductivity (ft/day)
30GS157	8	168
30GS159	5	139
30GS160	7	147
30GS161	8	191
30GS162	9	151
30GS163	7	135
30GS164	5	125
30GS165	11	203
30GS166	10	182
30GS167	9	192
30GS168	8	137
30GS169	8	136
30GS170	7	124
30GS172	10	183

7.0 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination at OU 2 is discussed by contaminant type. The quantity of data collected required organizing the data for this section by contaminant type and not by site. The sampling density was such that only exceedances could be discussed and presented in this section. For reference the following appendices have been provided with an explanation of their contents.

Appendix G Analytical Data — Exhibits laboratory results

Appendix H Preliminary Remediation Goals — Provides a roster of PRGs used in this report

Appendix I Sample Values Exceeding PRGs — This is the results of a database search for all samples by site and matrix that exceeded a PRG

Appendix J Contaminant Statistics — This is the results of a database search providing detection statistics for each analyte detected.

Exceedances above regulatory standards are first discussed by contaminant type and then by site within OU 2. The sampling approach, methods, and sample locations for this investigation are discussed in Chapter 5 of this report. All figures for this section have been produced on small scale maps and placed in Appendix E. Soil, groundwater, and sediment analytical results were compared to established PRGs. Exceedances are compounds detected at a concentration above one or more of these PRGs for that specific compound. PRGs, listed below, are based upon the protection of human health and do not address the protection of ecological receptors.

Soil

- Risk-based concentrations (RBCs), soil ingestion scenario for residential soil (surface soil), and soil screening levels (SSLs), transfer scenario from soil to groundwater (subsurface soil) (USEPA, 1996a).

- Selected Cleanup Goals (CGs), residential scenario (surface soil) and leaching scenario (subsurface soil) (FDEP, 1995 and 1996).

- USEPA, Office of Solid Waste and Emergency Response draft revised Interim Soil Lead Guidance (USEPA, 1994a).

Groundwater

- USEPA Maximum Contaminant Levels (MCLs) (USEPA 1996b).
- Tap Water RBCs (USEPA, 1996a).
- Florida Primary Drinking Water Standards (FPDWS) (FDEP 1994a).
- USEPA Secondary Maximum Contaminant Levels (SMCLs) (USEPA 1996b).
- Florida Secondary Drinking Water Standards (FSDWS) (FDEP 1994a).
- Florida Groundwater Guidance Concentrations (FGGC) (FDEP 1994a).

Sediment

- Sediment Screening Values (SSVs) (USEPA, 1995a).
- Sediment Quality Assessment Guidelines (SQAGs), Threshold Effects Levels (TELs) (FDEP, 1994b).

Soil and groundwater inorganics were compared to NAS Pensacola-specific reference concentrations (RCs), developed by the Navy during the Site 1 investigation. These are equal to

two times the detected mean for any given parameter (E/A&H, 1996). The RCs can be found in Appendix H.

Soil RBCs and CGs were used for surface soil comparisons (0 to 1 foot depth interval). Subsurface interval soil samples were compared to subsurface leaching values (SSLs and CGs for leaching). Additionally, Figures 4 through 53 within Appendix E illustrate the distribution of inorganic and organic soil and groundwater contamination for each site within the area of investigation. For the soil contamination assessment, surface soil is defined as the 0- to 1-foot bls interval, while subsurface soil is the interval from 1 foot bls to the water table. Validated analytical data, including data used to calculate background reference concentrations, are tabulated in Appendix G. The PRGs for soil, groundwater, and sediment contaminants are listed in Appendix H. Sample values exceeding PRGs are listed in Appendix I. Contaminant statistics exhibiting the number of detections are found in Appendix J.

Due to the prevalence and frequency of primary metals identified in both the shallow and intermediate wells, the primary metals exceedances have been subdivided into shallow and intermediate. This emphasizes the differences between primary metals vs. secondary metals, shallow vs. intermediate wells, and Phase I vs. Phase II sampling. To aid the reader in evaluating these differences, points of interest are discussed at the end of each section.

7.1 Soil Contamination Assessment

OU 2 soil samples exhibited several compounds above their respective PRGs. VOCs, SVOCs, pesticides/PCBs, and inorganics were detected by laboratory analysis. Figure 1 (Appendix E) displays the surface and subsurface soil sampling locations and trenches. Figures 4 through 21 of Appendix E display exceedances for both surface and subsurface soil.

7.1.1 VOC Soil Contamination

7.1.1.1 Surface Soil

Detections of surface soil VOCs by site are as follows: Site 11 — six detections, Site 12 — two detections, Sites 25 and 27 — three detections, and Site 30 — 10 detections. However, no VOCs exceeded established PRGs in surface soil at OU 2. The lack of VOC exceedances in the surface soil is not surprising since it is exposed to the subtropical rain and temperature, encouraging volatization.

7.1.1.2 Subsurface Soil

The ratio of subsurface soil VOCs detected/exceeded PRGs by site are as follows: Site 11 — 12 detected/six exceeded, Site 12 — six detected/one exceeded, Sites 25 and 27 — seven detected one exceeded, and Site 30 — 19 detected/six exceeded. VOCs identified in the subsurface soil at OU 2 were compared to established leachability PRGs. The VOCs were detected in the subsurface soil ranging from 2- to 18-feet bls. Detected VOCs included acetone, benzene, chloroform, chloromethane, 1,1,2,2-tetrachloroethane, 1,2-dichloroethane (1,2-DCA), ethylbenzene, methylene chloride, toluene, tetrachloroethene (PCE), vinyl chloride, and xylene. Subsurface soil VOC exceedances are summarized in Appendix E, Figures 4 and 5.

Acetone exceeded the FDEP's cleanup goal for leaching of 1,400 μg/kg at borings 30GI09 at 2 feet bls and 30GS12 at 14 feet bls and 16 feet bls (Site 30) (Figure 4). Benzene exceeded the FDEP's CG for leaching of 3 μg/kg at trenches LF-01 at 9 feet bls and LF-08 at 6 feet bls (Site 11) and borings 30S16 at 18 feet bls, 30S106 at 5 feet and 7 feet bls, and 30S120 at 6 feet bls (Site 30) (Figure 5). Chloroform exceeded the FDEP's CG for leaching of 20 μg/kg at boring 27GS05 at 2 feet bls (Site 27) (Figure 4). Chloromethane exceeded the USEPA's SSL of 6.6 μg/kg at boring 30S114 at 5 feet bls and 7 feet bls (Site 30) (Figure 4). 1,2-DCA exceeded the FDEP's CG for leaching of 8 μg/kg at borings 30S124 at 3 feet bls, 30S125 at 3 feet and 5 feet bls, 30S127 at 3 feet and 5 feet bls, 30S137, 30S138, 30S142, and 30S148 at 6 feet bls, and

30S150 at 16 feet bls (Site 30) (Figure 4). Ethylbenzene exceeded the FDEP's CG for leaching of 200 μg/kg at trench LF-12 at 6 feet bls (Site 11) (Figure 5). Methylene chloride exceeded FDEP's CG for leaching of 10 μg/kg at borings 30S17 at 6 feet bls and 18 feet bls and 30GS53 at 2 feet, 4 feet, and 10 feet bls (Site 30) (Figure 4). Toluene exceeded the FDEP's CG for leaching of 200 μg/kg at three trenches: LF-01 at 9 feet bls, LF-06 at 4 feet bls, and LF-08 at 6 feet bls (Site 11) (Figure 5). PCE exceeded the FDEP's CG for leaching/USEPA's SSL of 30 μg/kg at boring 11GI06 at 6 feet bls (Site 11) (Figure 4). 1,1,2,2-tetrachloroethane exceeded FDEPs CG for leaching of 0.7 μg/kg in Site 12 boring 12GS06 at 15 feet bls (Site 12) (Figure 4). Vinyl chloride exceeded the FDEP's CG for leaching of 5 μg/kg at Site 11 trench LF-04 at 5 feet bls (Figure 4). Xylenes (total) were detected above the FDEP's CG for leaching of 100 μg/kg at trench LF-06 at 4 feet bls and LF-12 at 6 feet bls (Site 11) and boring 30S16 at 18 feet bls (Site 30) (Figure 5).

7.1.2 SVOC Soil Contamination

7.1.2.1 Surface Soil

The ratio of surface soil SVOCs detected/exceeded PRGs by site are as follows: Site 11 — 18 detected /five exceeded, Site 12 — 25 detected/five exceeded, Sites 25 and 27 — 24 detected/five exceeded, Site 26 — 12 detected/one exceeded, and Site 30 — 19 detected/six exceeded. SVOCs exceeding PRGs included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Surface soil SVOC exceedances are summarized in Appendix E, Figures 6 through 8.

Benzo(a)pyrene was the most frequently detected SVOC in the surface soil. It was detected at Several locations throughout OU 2 at concentrations above the USEPA's established RBC of 88 μg/kg (Figure 6). Specifically, benzo(a)pyrene was detected at trenches LF-07 and LF-08 and borings 11GS01 (Site 11), 12GS07, 12GS08, 12GS09, 12GS10, 12S11, 12GS12, 12GS13, 12GS15, and 12GS16 (Site 12), 25S15 through 25S18 (Site 25), 26S01, 26S05 (Site 26), 27GS06,

27S17, 27GI03, 27S40, 27S52, 27S53 (Site 27), 30S102, 30S104, 30S116, 30S137, and 30S140 (Site 30). Indeno(1,2,3-cd)pyrene exceeded the USEPA's established RBC of 880 μg/kg at trench LF-07 (Site 11) and borings 12GS09 (Site 12), 25S17 (Site 25), 30S137, and 30S140 (Site 30) (Figure 6). Benzo(a)anthracene exceeded the FDEP CG of 880 μg/kg at trench LF-07 and borings 12GS09, 12GS10 (Site 12), 25S15, 25S17, 25S18 (Site 25), 27S52 (Site 27), 30S137 and 30S140 (Site 30) (Figure 7). Dibenz(a,h)anthracene exceeded the USEPA's established RBC of 88 μg/kg at trenches LF-07 and LF-08 (Site 11) and borings 12GS10, 12GS16 (Site 12), 25S17 (Site 25), 27S40, 27S52 (Site 27), 30S137, and 30S140 (Site 30) (Figure 7). Benzo(b)fluoranthene exceeded the USEPA's RBC of 880 μg/kg at trenches LF-07 and LF-13 (Site 11) and borings 12GS08, 12GS09, 12GS10, 12GS16 (Site 12), 25S15 through 25S18 (Site 25), 27S52 (Site 27), 30S137, and 30S140 (Site 30) (Figure 8). Benzo(k)fluoranthene exceeded the USEPA's RBC of 8,800 μg/kg at boring 30S140 (Site 30) (Figure 8).

7.1.2.2 Subsurface Soil

The ratio of subsurface soil SVOCs detected/exceeded PRGs by site are as follows: Site 11 — 21 detected/seven exceeded, Site 12 — 16 detected/one exceeded, Sites 25 and 27 — 25 detected/ 11 exceeded, Site 26 — 2 detected/one exceeded, and Site 30 — 28 detected/seven exceeded. Subsurface SVOCs were detected in the subsurface soil ranging from 2 feet bls to 62 feet bls. Subsurface SVOCs included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, 3,3-dichlorobenzidine, 2,6-dinitrotoluene, hexachlorobutadiene, isophrone, naphthalene, nitrobenzene, phenanthrene, pentachlorophenol, and phenol. Subsurface soil SVOC exceedances are summarized in Appendix E, Figure 9.

Benzo(a)anthracene exceeded the USEPA's SSL of 700 μg/kg at trenches LF-01 at 9 feet bls, LF-03 at 3 feet bls, LF-05 at 3 feet bls, and LF-10 at 6 feet bls (Site 11) and borings 12GS14 at 5 feet bls (Site 12), 27GS04 and 27S52 at 2 feet bls (Site 27), and 30S102 at 2 feet bls (Site 30).

Differing from the surface soil SVOC exceedances, benzo(a)pyrene was detected at two locations within OU 2 at concentrations above FDEP's CG for leaching of 3,700 μg/kg. Benzo(a)pyrene was detected at trench LF-03 at 3 feet bls (Site 11) and boring 27GS04 at 2 feet bls (Site 27). Benzo(b)fluoranthene exceeded the USEPA's SSL of 4,000 μg/kg at trench LF-03 at 3 feet bls (Site 11) and boring 27GS04 at 2 feet bls (Site 27). Benzo(k)fluoranthene exceeded the USEPA's SSL of 4,000 μg/kg at boring 27GS04 at 2 feet bls (Site 27). Bis(2-ethylhexyl)phthalate exceeded the FDEP's CG for leaching of 11,000 μg/kg at boring 30GS12 at 20 feet bls (Site 30). Carbazole exceeded the FDEP's CG for leaching of 400 μg/kg at borings 27GS04 and 27S52, both at 2 feet bls (Site 27). Chrysene exceeded the USEPA's SSL of 1,000 μg/kg at trench LF-03 at 3 feet bls (Site 11) and borings 27GS04, 27S52 (Site 27), and 30S102 (Site 30) at 2 feet bls. 3,3-Dichlorobenzidine exceeded the USEPA's SSL of 10 μg/kg at boring 30S110 at 3 feet bls (Site 30). 2,6-Dinitrotoluene exceeded the FDEP's CG for leaching of 0.6 μg/kg at borings 11GS03 (Site 11) at 4 feet and 6 feet bls. Hexachlorobutadiene exceeded the USEPA's SSL of 100 μg/kg at boring 30GS06 at 8 feet bls (Site 30). Isophorone exceeded the USEPA's SSL of 200 μg/kg at boring 25GS05 at 14 feet bls (Site 25). Naphthalene exceeded the FDEP's CG for leaching of 100 μg/kg at trenches LF-04 at 5 feet bls and LF--12 at 6 feet bls (Site 11) and borings 27GS04 and 27S52 at 2 feet bls (Site 27), 30S06 at 8 feet bls (Site 30). Nitrobenzene exceeded the FDEP's CG for leaching of 40 μg/kg at boring 26GS05 at 5 feet bls (Site 26). Phenanthrene exceeded the FDEP's CG for leaching of 2,800 μg/kg at trenches LF-03 and LF-05 at 3 feet bls (Site 11) and borings 27S04 and 27S52 at 2 feet bls (Site 27). Pentachlorophenol exceeded the FDEP's CG for leaching of 10 μg/kg at borings 25GS08 at 14 feet bls (Site 25) and 27GI06 at 62 feet bls (Site 27). Phenol exceeded the FDEP's CG for leaching of 20 μg/kg at borings 27S17 at 6 feet bls (Site 27) and 30S122 at 3 feet bls (Site 30).

7.1.3 Pesticide and PCB Soil Contamination

7.1.3.1 Surface Soil

The ratio of surface soil Pesticides and PCBs detected/exceeded PRGs by site are as follows: Site 11 — 12 detected/one exceeded, Site 12 — 16 detected/one exceeded, Sites 25 and 27 — 22 detected/three exceeded, Site 26 — 14 detected/none exceeded, and Site 30—12 detected/three exceeded. PCBs exceeding PRGs included Aroclors-1242, -1254, and -1260. The only pesticide detected with a concentration above established PRGs was dieldrin. Surface soil pesticide and PCB exceedances are detailed in Appendix E, Figure 10.

Aroclor-1242 exceeded the USEPA's RBC of 320 μg/kg at boring 30S138 (Site 30). Aroclor-1254 exceeded the USEPA's RBC of 320 μg/kg at borings 25S17 and 25S18 (Site 25) and 30S138 (Site 30). Aroclor-1260 was the most frequently detected PCB in the surface soil, detected at concentrations above the USEPA's established RBC of 83 μg/kg at several locations within Sites 11, 12, 25, and 30. Specifically, Aroclor-1260 was detected at trenches LF-05 and LF-06 (Site 11), borings 12GS02 through 12GS10, 12S13, and 12GS15 (Site 12); and 25S15 through 25S18 (Site 25), 30S137, and 30S138 (Site 30). Dieldrin was the only pesticide detected with a concentration above established PRGs. Dieldrin exceeded the USEPA's RBC of 40 μg/kg at borings 25S16 (Site 25), 27GS01, 27GS06, and 27S52 (Site 27).

7.1.3.2 Subsurface Soil

The ration of subsurface soil Pesticides and PCBs detected/exceeded PRGs by site are as follows: Site 11 — 14 detected/five exceeded, Site 12 — 17 detected/two exceeded, Sites 25 and 27 — 22 detected/three exceeded, Site 26 — 10 detected/no exceeded, and Site 30 — 12 detected/one exceeded. No PCBs were identified in the subsurface soil at OU 2 with concentrations above established PRGs. Pesticides exceeded PRGs in the subsurface soil at depths ranging from 2 to 20 feet bls. Specifically, 4,4'-DDD, 4-4'-DDE, 4-4'-DDT, dieldrin, alpha-BHC, and

gamma-BHC (lindane) were identified. Subsurface soil pesticide and PCB exceedances are shown in Appendix E, Figure 11.

4,4'-DDD was detected exceeding the FDEP CG for leaching of 200 μg/kg in soil boring 12GS08 at 14 feet bls (Site 12). Both 4-4'-DDE and 4-4'-DDT were detected in the subsurface soil at trench LF-07 at 7 feet bls (Site 11) with concentrations above the FDEP's CG for leaching of 200 μg/kg and 500 μg/kg, respectively. Alpha-BHC was detected in the subsurface soil at trench LF-03 at 8 feet bls (Site 11) with concentrations above the USEPA's SSLs of 0.4 μg/kg. Gamma-BHC (lindane) was also detected at 8 feet bls at trench LF-03 (Site 11) with a concentration above the FDEP's CG for leaching/USEPA's SSL of 6 μg/kg. Dieldrin was the most frequently detected pesticide in the subsurface soil, detected at several locations throughout OU 2 at concentrations above the USEPA's established SSL of 1 μg/kg. Dieldrin was detected at trench LF-03 at 8 feet bls (Site 11); borings 12SG02, 12GS03, 12S04, 12S07, 12GS09 at 5 feet bls, and 12GS03 at 15 feet bls (Site 12); 25S16 at 2 feet bls, 12S19 at 2 feet and 4 feet bls (Site 25); borings 27GS02, 27GS04, 27S17, 27S24, 27S41, 27S44, 27S45, 27S49, and 27S52 at 2 feet bls, 27S13, 27S17, and 27S52 at 4 feet bls, 27GS01 and 27S17 at 6 feet bls, and 27S33 at 20 feet bls (Site 27); borings 30S05 and 30GS154 at 2 feet bls, 30S122, 30S125, and 30S127 at 3 feet bls, 30GS103, 30S117, and 30S123 at 4 feet bls, 30S127 at 5 feet bls, 30S126 and 30GS154 at 6 feet bls, and 30S153 at 11 feet bls (Site 30).

7.1.4 Soil Inorganics Contamination

The ratio of surface soil inorganics detected/exceeded PRGs by site are as follows: Site 11 — 19 detected/six exceeded, Site 12 — 21 detected/eight exceeded, Sites 25 and 27 — 22 detected/ 11 exceeded, Site 26 — 15 detected/no exceeded, and Site 30 — 23 detected/six exceeded. Detections of subsurface soil inorganics/exceedances by site included: Site 11 — 22 detected/six exceedances, Site 12 — 21 detections/four exceedances, Sites 25 and 27 — 23 detections/two exceeded, Site 26 — 16 detected/no exceeded, and Site 30 — 21 detected/four exceeded.

The soil inorganics (metals) have been subdivided into two categories identified as primary metals and secondary metals. Primary metals in soil are: antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, sodium, thallium, and vanadium. Secondary metals in soil are: aluminum, copper, iron, manganese, silver, and zinc.

7.1.4.1 Surface Soil Primary Metals

Six primary metals were identified in OU 2 surface coil at concentrations above established PRGs and RCs. The primary metals detected were antimony, arsenic, beryllium, cadmium, lead, and mercury. Exceedances are summarized in Appendix E, Figures 12 through 15.

Primary metals identified in surface soil were first compared to their respective NAS Pensacola RCs. This comparison was significant for arsenic and beryllium, where the RC exceeds the PRG. The surface soil PRG for arsenic (USEPA's RBC) is 0.43 mg/kg, while the NAS Pensacola RC is 1.56 mg/kg. The PRG for beryllium (USEPA's RBC) is 0.15 mg/kg, while the NAS Pensacola RC is 0.41 mg/kg. Of five surface soil arsenic exceedances at Site 11, four were above both the PRG and RC. Four of five surface soil arsenic exceedances at Site 12 also above the PRG and RC. Of 25 surface soil arsenic exceedances at Sites 25 and 27, 16 were above both the PRG and RC. At Site 30, only four of 15 surface soil arsenic exceedances were above both the PRG and RC. For beryllium, five concentration at Site 11 were above the PRG, but below the RC. At Site 12, one beryllium concentration exceeded both the PRG and RC. At Sites 25 and 27, and at Site 30, two beryllium concentrations exceeded the PRG and RC, respectively. All other surface soil primary metals concentrations above PRGs also exceeded their respective NAS Pensacola RCs.

Arsenic was the most frequently detected primary metal in the surface soil, exceeding both its RBC and RC at 28 locations within Sites 11, 12, 25, 27, and 30 (Figure 12). Arsenic exceeded the RBC/RC at trench LF-01 and borings 11S01, 11S03, 11GS11 and 11S013 (Site 11), borings

12S07, 12GS09, 12GS10, and 12GS14 (Site 12), borings 25S09, 25S15, 25S16, and 25S17, (Site 25), borings 27GS01, 27GS05, 27GS06, 27S08, 27S09, 27GI03, 27GS08, 27GS09, 27GS10, 27S52, and 27S53 (Site 27), and borings 30GS103, 30S137, 30S147, and 30S151 (Site 30). Cadmium exceeded the USEPA's RBC of 3.9 mg/kg of 1 mg/kg at several locations (Figure 13): trench locations LF-05, LF-06, LF-08, and LF-13 and borings 12GS03, 12S04, 12GS06, 12S07, 12GS08, 12GS09, 12GS10, 12GS13, 12GS15 (Site 12), 25GS06, 25S15, 25S16, 25S17 (Site 25), 27GS04, 27GI03, 27GS08, 27S52, 27S53 (Site 27), 30S102, 30S104, 30S123, 30S125, 30S137, 30S139, and 30S140 (Site 30). Lead exceeded the USEPA's interim soil lead guidance 400 mg/kg 7.32 mg/kg at trenches LF-05, LF-08, LF-12, and LF-13 (Site 11) and borings 25S15, 25S16, 25S17, 27GS08 (Site 25), and 27S53 (Site 27) (Figure 14). Antimony exceeded the USEPA's RBC of 3.1 mg at borings 12S02 12S07, 12GS10 (Site 12), and 27GS01 (Site 27) (Figure 15). Beryllium exceeded the RBC/RC at 12S15 (Site 12), 25S17 (Site 25), 27S07 (Site 27), 30GS103, and 30S137 (Site 30) (Figure 15). Mercury exceeded the USEPA's SSL of 2.3 mg/kg at borings 25S17 (Site 25), 27GI03, and 27S53 (Site 27) (Figure 15).

7.1.4.2 Subsurface Soil Primary Metals

Six primary metals were identified in the subsurface soil within OU 2 with concentrations above established PRGs and RCs. The primary metals were detected in the subsurface soil ranging from 2 to 57 feet bls. The primary metals detected above PRGs and RCs were arsenic, barium, cadmium, total chromium, mercury, nickel, and selenium. Exceedances are summarized in Appendix E, Figures 16 through 19.

As with surface soils, primary metals were first compared to their respective NAS Pensacola RCs. This comparison was significant only for subsurface soil thallium concentrations at Site 30. The subsurface soil PRG for thallium (USEPA's SSL) is 0.40 mg/kg, while the NAS Pensacola RC is 0.82 mg/kg. Fifteen thallium concentrations at Site 30 exceeded the PRG. However, all were

below the NAS Pensacola RC for thallium. All other subsurface metals concentrations above PRGs also exceeded their respective NAS Pensacola RCs.

Barium exceeded the USEPA's SSL of 32 mg/kg at boring 11GS11 at 6 feet bls, trenches LF-01 at 9 feet bls, LF-03 at 3 feet bls, LF-04 at 5 feet bls, LF-05 at 3 feet bls, LF-06 at 4 feet bls, LF-11 at 6 feet bls, and LF-13 at 5 feet bls (Site 11) and borings 12GS14 at 5 feet bls and 12GS15 at 5 feet bls (Site 12), 30SG20 at 6 feet bls, 30GS103 at 4 feet bls, and 30S104 at 5 feet bls (Site 30) (Figure 16). Cadmium exceeded the USEPA's SSL of 6 mg/kg at trenches LF-03 at 3 feet bls, LF-04 at 5 feet bls, LF-10 at 6 feet bls, LF-12 at 6 feet bls, and LF-13 at 5 feet bls and borings 11GI15 at 6 feet bls, 12S07, 12GS08, 12GS09, 12GS10, and 12GS13 at 5 feet bls, 12GS10 and 12GS16 at 10 feet bls, 12GS10 at 12 feet bls (Site 12), 25S16 and 25S19 at 2 feet bls (Site 25), 27GS04, 27S17, 27S45, and 27S52 at 2 feet bls and 27S17 at 6 feet bls (Site 27), 30S102 at 2 feet bls and 30GS103 at 4 feet bls (Site 30) (Figure 17). Lead exceeded the USEPA's interim soil lead guidance of 400 mg/kg at trenches LF-03 at 3 feet bls, LF-04 at 5 feet bls, LF-05 at 3 feet bls, LF-12 at 6 feet bls, and LF-13 at 5 feet bls (Site 11), and boring 12GS16 at 10 feet bls (Site 12) (Figure 18). Arsenic was detected at only one location in the subsurface soil, trench LF-01 at 9 feet bls, with a concentration above the USEPA's SSL of 0.15 mg/kg/NAS Pensacola RC of 1.56 mg/kg (Site 11) (Figure 19). Mercury exceeded the USEPA's SSL of 3 mg/kg at two borings, 27S44 and 27S53 at 2 feet bls (Figure 19). Nickel exceeded the USEPA's SSL of 21 mg/kg at trench LF-04 at 5 feet bls (Site 11) and borings 12GS16 (Site 12) and 30GS53 (Site 30) at 10 feet bls (Figure 19). Selenium exceeded the USEPA's SSL of 3 mg/kg at trench LF-01 at 9 feet bls (Site 11) (Figure 19).

7.1.4.3 Surface Soil Secondary Metals

Six secondary metals were identified in OU 2 surface coil at concentrations above established PRGs and RCs. The secondary metals detected were aluminum, copper, iron, manganese, silver, and zinc. Exceedances are summarized in Appendix E, Figure 20.

A reference concentration comparison for secondary metals in surface soils was only significant for iron, where the NAS Pensacola RC (2,745 mg/kg) exceeds the USEPA's RBC of 2,300 mg/kg. Only a small distribution of surface soil iron concentrations exceeding the RBC (five total) were below the RC. Most iron exceedances at the OU 2 sites were above both the PRG and RC.

Aluminum exceeded the USEPA's RBC of 7,800 mg/kg at borings 11GS01, 11GS11, 11GS13 (Site 11), 12GS10, 12GS14, and 12GS15 (Site 12), 25S09 and 25S15 (Site 25), 27S07, 27S08, 27S09, and 27S52 (Site 27), and 30S102, 30GS103, 30S137, 30S140, and 30S151 (Site 30). Copper exceeded the USEPA's RBC of 310 mg/kg at borings 12GS09 and 12GS10. Iron was the most frequently detected secondary metal, detected above the USEPA's RBC of 2,300 mg/kg/NAS Pensacola RC of 2,745 mg/kg at 36 locations within Sites 11, 12, 25, 27, and 30. Specifically, iron exceeded its PRG and RC at trenches LF-05, LF-06, LF-08, and LF-13 and borings 11GS01, 11GS03, 11GS11, 11GS13 (Site 11), 12GS03, 12S07, 12GS08, 12GS09, 12GS10, 12GS12, 12GS13, 12GS14, 12GS15 (Site 12), 25S09, 25S15, 25S16, 25S17 (Site 25), 27GS01, 27S07, 27S08, 27S09, 27S17, 27GS08, 27GS10, 27S52, and 27S53 (Site 27), 30S102, 30GS103, 30S137, 30S138, 30S140, and 30S151 (Site 30). Five iron concentrations between these sites exceeded the iron PRG, but were below the NAS Pensacola RC. Manganese exceeded the USEPA's RBC of 180 mg at borings 12GS09, 12GS10, 12GS14 (Site 12), 25S15, 25S17 (Site 25), 27S08, 27S53 (Site 27), and 30S137 (Site 30). Silver exceeded the USEPA's RBC of 39 mg/kg at boring 25S15. Zinc exceeded the USEPA's RBC of 2,300 mg at boring 25S17.

7.1.4.4 Subsurface Soil Secondary Metals

No secondary metals were identified in the subsurface soil at OU 2 with concentrations above established PRGs/RCs.

7.1.5 Soil Radiation

Radiological sampling conducted within OU 2 is discussed below. Sections 4 and 5 and Appendix D contain more detailed discussions of procedures, results, and analysis of the preliminary radiological screening and subsequent analytical results from OU 2. Figure 21, in Appendix E, identifies the locations where Ra-226 concentrations were detected in OU 2 surface soil samples.

7.1.5.1 Surface Soil

A preliminary radiological screening measured surface gamma radiation anomalies at the six sites within OU 2. During the field investigation, surface soil samples were collected for both standard laboratory and radiological analyses. Radiological sampling was focused in areas where gamma anomalies were detected in the preliminary sampling. Based on the results of the preliminary radiological screening and the laboratory analysis, Site 12 and 27 were identified as having radiological impact to surface soil above background. Laboratory analysis identified Ra-226 in five surface (0 to 1 foot bls) soil samples collected in Site 12 (Figure 21). Various pieces of contaminated metal debris were recovered during Site 12 soil sampling.

The only significant radioactivity found at Site 27 was from a single boring south of former Building 704. This boring is discussed in depth in Appendix D.

7.1.5.2 Subsurface Soil

A radiological survey was completed for the field investigation. Laboratory results from samples collected correlate well with the preliminary radiological screening. Where gamma anomalies were identified in the preliminary screening, results were higher than background values. Site 12 was the only site to have several results higher than background values. For other sites, soil contamination was not detected.

7.2 Groundwater Contamination Assessment

To assess the impact of historic and ongoing activities within Sites 11, 12, 25, 26, 27, and 30 (OU 2) on groundwater quality, unfiltered groundwater samples were collected from 137 shallow wells and 28 intermediate wells. Figure 2 displays the location of all monitoring wells. Not all wells shown were sampled for chemical analysis. Figure 3 displays the potentiometric surface and gradients as of April 2, 1996. No physical separation between the shallow and intermediate depth intervals is apparent, other than relative vertical position. Thus these two intervals should be considered part of the same hydrologic system — the surficial aquifer. However, as discussed in Section 6, differences generally were observed in the hydraulic properties (i.e., hydraulic conductivities) within the surficial aquifer (i.e., the surficial aquifer is slightly stratified with sand layers of varying permeabilities). Screened intervals in the shallow wells were placed at the appropriate elevations in order to establish a representative distribution of groundwater samples. Consideration was also given to (1) obtaining representative groundwater elevation measurements, (2) investigating specific sites or reported contamination, (3) monitoring the capillary fringe-saturated interval contact, and (4) evaluating the presence of any light non-aqueous-phase liquids (LNAPLs) or any related dissolved-phase constituents. For OU 2 intermediate wells, well screens were positioned to evaluate the presence of any dense non-aqueous-phase liquids (DNAPLS) or related dissolved-phase constituents. In addition to the E/A&H shallow and intermediate wells installed at OU 2, wells previously installed by G&M, Inc., were also sampled. These wells were installed in the mid-1980s and have 2.5 feet long screen lengths which were randomly positioned throughout the saturated interval. They therefore do not provide a true representation of either the shallow or intermediate zones. Additionally, several shallow wells previously installed by ABB, Inc. throughout the Site 30 area were also sampled. These wells were installed in conjunction with multiple UST removals performed by ABB, Inc. within the Building 649 complex, at the former Building 709, and near Buildings 3220 and 3450. Full CLP TAL/TCL were analyzed on all groundwater samples collected from each site during the first round of sampling in the fall of 1993. A second groundwater sampling round (Phase II) occurred in late

1995 and early 1996 with a more focused analytical scheme. Phase II sampling objectives were agreed upon by the Tier I Partnering Team in January 1995.

In the following sections, groundwater exceedances will be discussed by compound group and by depth corresponding to the shallow and intermediate intervals monitored onsite, followed by a discussion of possible contaminant migration pathways.

Samples collected from wells and temporary trenches as part of the initial groundwater sampling conducted in 1993 are designated as Phase I samples for this discussion. Wells sampled as part of the resampling effort in December 1995 and January 1996 are designated Phase II samples (see Table 2-1). Groundwater samples from the OU 2 area contain several dissolved phase organic and inorganic compounds. No radioactive constituents were detected in the groundwater samples collected from the Phase I sampling at any of the six sites within OU 2. Sampling methods from Phase I and Phase II differed greatly. Phase I sampling was conducted using an electric pump, resulting in higher turbidities and therein biasing the inorganic data high. During Phase II, wells were sampled using a peristaltic pump, which gently removed water from the well, with turbidity documented at less than 10 NTUs. The Phase II data appear to be more representative of current conditions within the aquifer. The Phase I data are provided for comparison.

7.2.1 VOC Exceedances

The ratio of groundwater VOCs detected/exceeded PRGs by site are as follows: Site 11 — 15 detected/eight exceeded, Site 12 — no detections/exceedances, Sites 25 and 27 — 16 detected/ 13 exceeded, Site 26 — 3 detected/none exceeded, and Site 30 — 24 detected/17 exceeded.

7.2.1.1 Phase I Shallow Groundwater Sampling

VOCs exceeding PRGs included 1,1-DCA, 1,2-DCA, 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethene (1,2-DCE) (total), benzene, chlorobenzene, chloroethane, chloroform,

ethylbenzene, methylene chloride, PCE, toluene, trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1,2,2-tetrachloroethane, vinyl chloride, and total xylenes. The distribution of these VOC exceedances within the shallow well samples is shown in Figures 22 and 23 in Appendix E. The most frequent Phase I shallow groundwater exceedances include 1,1-DCE, PCE, TCE, and total xylenes. Sites 12 and 26 had no VOC exceedances.

The sample from well 30GS22 (Site 30) exceeded the 1,1-DCA FGGC of 700 μg/L (Figure 22). The sample from well 30GS28 contained 1,2-DCA above its FPDWS of 3 μg/L (Figure 22). Samples from wells 27GS04, 27GS09, 27GS10, 27GS11, 27GS13, 27GS21 (Site 27), 30GS22, 30GS26, 30GS27, 30GS28, 30GS33, 30GS37, 30GS162, 30GS164, 30GS165, 30GS166, 30GS170, and 30GS172 exceeded the FPDWS/MCL of 7 μg/L for 1,1-DCE (Figure 22). 1,2-DCE (total) exceeded its MCL and FPDWS of 70 μg/L in wells 11GS52 (Site 11), 27GS19, 30GS28, and 30GS46 (Figure 22). Chlorobenzene exceeded its RBC for tap water of 3.9 μg/L in wells 30GS103, 30GS111, and 30GS123. Samples from wells 27GS13, 27GS16, 27GS21, and 30GS37 exceeded the FGGC concentration of 140 μg/L for chloroethane (Figure 22). One sample from well 30GS62 exceeded the FGGC concentration of 6 μg/L for chloroform (Figure 22). The FPDWS/MCL of 5 μg/L for methylene chloride was exceeded in one sample from well 30GS06 (Figure 22). PCE exceeded its FPDWS of 3 μg/L in samples from wells 25GS02, 25GS09 27GS11, 27GS18, 27GS19, 27GS21, 30GS22, 30GS26, 30GS27, 30GS28, and 30GS46 (Figure 22). Samples from trench LF-12 and wells 11GS05 and 11GM52, 25GS02, 27GS02, 27GS03, 27GS04, 27GS19, 30GS28, 30GS46, and 30GS50 exceeded the FPDWS of 3 μg/L for TCE (Figure 22). The FPDWS/MCL of 200 μg/L for 1,1,1-TCA was exceeded in samples from wells 27GS11, 30GS22, 30GS27, 30GS28, 30GS46, 30GS162, and 30GS164 (Figure 22). The RBC for tap water of 0.052 μg/L was exceeded for 1,1,2,2-terachloroethane in trench LF-13 and well 11GS28. Samples from wells 11GM28, 11GM47, 11GS52, 25GS04, and 30GS154 exceeded the FPDWS of 1 μg/L for vinyl chloride (Figure 22).

Benzene exceeded its FPDWS of 1 μg/L in trench grab sample LF-11 (Site 11), and in wells 30GS06, 30GS29, 30GS33, 30GS101, 30GS170, and 30GS171 (Figure 24). Samples from wells 11GS47, 27GS18, 27GS19, and 30GS03 exceed the FSDWS of 30 μg/L for ethylbenzene (Figure 23). The FSDWS of 40 μg/L for toluene was exceeded in samples 27GS19 and 30GS06 (Figure 23). The FSDWS limit of 20 μg/L for total xylenes was exceeded in samples from trench LF-12 and wells 11GM47, 27GS13, 27GS18, 27GS19, 27GS21, 30GS06, 30GS12, 30GS37, 30GS101, and 30GS154 (Figure 23). Floating petroleum product was observed in one well, 30GS12. No other wells exhibited any floating product. Bailing the petroleum product from the well revealed a poor recovery by the product. This suggests a limited distribution around 30GS12.

7.2.2 Phase I Intermediate Groundwater Sampling

VOCs exceeding PRGs included 1,2-DCA, 1,1-DCE, 1,2-DCE (total), benzene, bromodichloromethane, chlorobenzene, chloromethane, dibromochloromethane, methylene chloride, PCE, TCE, 1,1,1-TCA, vinyl chloride, and total xylenes. The distribution of these VOC exceedances within the intermediate well samples from OU 2 is shown in Figures 25 and 26 in Appendix E. The most frequent Phase I intermediate groundwater exceedances include 1,1-DCE, PCE, TCE, and total xylenes. Sites 12 and 26 had no VOC exceedances.

The sample from well 11GI10 (Site 11) contained 1,2-DCA above its FPDWS of 3 μg/L (Figure 24). Samples from wells 27GI04 (Site 27) and 30GI164 and 30GI32A (Site 30) exceeded the FPDWS/MCL of 7 μg/L for 1,1-DCE (Figure 24). 1,2-DCE (total) exceeded its MCL and FPDWS of 70 μg/L in wells 11GI12 and 11GI14 (Figure 24). Bromodichloromethane exceeded its FGGC concentration of 0.6 μg/L in well 30GS060 (Figure 24). The chloromethane FGGC concentration of 2.7 μg/L was exceeded in the sample from well 27GI05 (Figure 24). The RBC for tap water of 3.9 μg/L for chlorobenzene was exceeded in wells 27GI02, 30GI09, and 30GI111(Figure 24). The dibromochloromethane FGGC concentration of 1.0 μg/L was exceeded in the sample collected from well 30GI60 (Figure 24). The FPDWS of 5 μg/L for methylene

chloride was exceeded in the sample from well 30GI164 (Figure 24). PCE was above its FPDWS of 3 μg/L in samples from well 30GI170 (Figure 24). Samples from wells 11GI02, 11GI12, 25GI01, 25GI02, 30GI170, and 30GI19 (Figure 25) exceeded the FPDWS of 3 μg/L for TCE. The FPDWS/MCL of 200 μg/L for 1,1,1-TCA was exceeded in samples from wells 30GI164 and 30GI32A (Figure 24). Samples from wells 11GI14, 27GI02, and well 30GI111 exceeded the FPDWS of 1 μg/L for vinyl chloride (Figure 24).

Benzene exceeded its FPDWS of 1 μg/L in Site 27 well 27GI02 and Site 30 well 30GI111 (Figure 25). The FSDWS of 20 μg/L for total xylenes was exceeded in the well 27GI02 sample (Figure 25). No Phase I intermediate groundwater exceedances were noted for ethylbenzene or toluene.

7.2.2.1 Phase II Shallow Groundwater Sampling

Phase II shallow groundwater sampling results identified fewer exceedances. This reduction is attributable, in part, to the change in sampling techniques (see Section 5) and the natural dispersion of the contaminants within the aquifer. The previously discussed change in sampling technique reduced the turbidity of the samples and consequently the soil entrainment in the sample. Phase II shallow groundwater sample exceedances include 1,1-DCA, 1,2-DCA, 1,1-DCE, cis-1,2-DCE, benzene, chlorobenzene, chloroethane, ethylbenzene, PCE, 1,1,1-TCA, TCE, vinyl chloride, and total xylenes. Groundwater exceedances were identified at Sites 11, 27, and 30 in 18 monitoring wells. The distribution of these VOCs within the shallow well samples from OU 2 is shown in Figures 26 and 27 in Appendix E. The most frequent Phase II exceedances were for the compounds 1,1-dichloroethene, tetrachloroethene, trichloroethene, and vinyl chloride.

Samples from Site 30 wells 30GS22, 30GS26, 30GS27, and 30GS28 exceeded the FGGC for 1,1-DCA of 700 μg/L (Figure 26). The FPDWS of 3 μg/L for 1,2-DCA was exceeded in samples collected from wells 27GS10, 30GS27, and 30GS28 (Figure 26). The FPDWS/MCL of 7 μg/L

for 1,1-DCE was exceeded in samples from wells 11GM52 (Site 11), 27GS10 and 27GS11 (Site 27), and 30GS22, 30GS26, 30GS27, and 30GS28 (Site 30) (Figure 26). Samples from wells 11GM52, 30GS28, and 30GS46 had concentrations above the FPDWS/MCL of 70 μg/L for cis-1,2-DCE (Figure 26). Chlorobenzene exceeded its RBC in tap water of 3.9 μg/L in wells 11GS11 and 30GS111 (Figure 26). The FGGC concentration of 140 μg/L for chloroethane was exceeded in samples from wells 30GS26, 30GS27, and 30GS28 (Figure 26). PCE exceeded its FPDWS of 3 μg/L in samples from wells 11GS13, 11GM52, 27GS10, 27GS19, 30GS22, 30GS26, 30GS27, 30GS28, and 30GS46 (Figure 26). The FPDWS/MCL of 200 μg/L for 1,1,1-TCA was exceeded in samples from wells 27GS10, 30GS22, 30GS26, 30GS27, and 30GS28 (Figure 26). Samples from wells 11GS13, 11GM52, 27GS02, 27GS04, 27GS19, 30GS22, 30GS26, 30GS27, 30GS28, and 30GS46 exceeded the FPDWS of 3 μg/L for TCE (Figure 26). Samples from wells 11GS13, 11GGS47, 11GGS52, and 30GS26 exceeded the FPDWS of 1 μg/L for vinyl chloride (Figure 26).

Samples from wells 11GM47 and 30GS06 exceeded the FPDWS of 1 μg/L for benzene (Figure 27). The sample from well 11GGS47 exceeded the FSDWS of 30 μg/L for ethylbenzene (Figure 27). The FSDWS of 20 μg/L for total xylenes was exceeded in samples from wells 11GS05, 11GGS47, and 27GS19 (Figure 27).

7.2.2.2 Phase II Intermediate Groundwater Sampling

Phase II intermediate groundwater sampling results also identified fewer exceedances. This reduction is attributable, in part, to the items discussed in Section 7.2.2.3. Phase II intermediate groundwater sample exceedances include cis-1,2-DCA, benzene, TCE, and vinyl chloride. Groundwater exceedances were identified at Sites 11, 25, and 30 in seven monitoring wells. The distribution of these VOCs within the intermediate well samples from OU 2 is shown in Figures 28 and 29 in Appendix E. The most frequent Phase II intermediate groundwater exceedance was for TCE.

The FPDWS of 70 μg/L for cis-1,2-DCE was exceeded in the sample collected from Site 11 well 11GI14 (Figure 28). Samples from wells 11GI02 and 11GI12 (Site 11), 25GI01 and 25GI02 (Site 25) exceeded the FPDWS of 3 μg/L for TCE (Figure 28). Samples from wells 11GI14 and 30GI111 exceeded the FPDWS of 1 μg/L for vinyl chloride (Figure 28).

The sample from well 30GI111 exceeded the FPDWS of 1 μg/L for benzene (Figure 29).

7.2.2.3 Correlation of Phase I and Phase II Events

Shallow Groundwater VOCs

Specific wells and VOCs common to both shallow groundwater sampling events are discussed in this section. VOCs common to both Phase I and Phase II shallow groundwater sampling events include 1,1-DCA, 1,2-DCA, 1,1-DCE, benzene, chloroethane, ethylbenzene, PCE, 1,1,1-TCA, TCE, vinyl chloride, and total xylenes. Exceedances that were detected in a specific well during both events are discussed below. Well 30GS22 showed an exceedance for 1,1-DCA for both sampling events. Both Phase I and II samples from well 30GS28 showed an exceedance for 1,2-DCA. 1,1-DCE was exceeded in both events in wells 27GS10, 27GS11 (Site 27), 30GS22, 30GS26, 30GS27, 30GS28, and 30GS172 (Site 30). Ethylbenzene exceedances were detected in both samples collected from well 11GM47. Samples from wells 27GS19, 30GS22, 30GS26, 30GS27, 30GS28, and 30GS46 had exceedances for PCE in both sampling events. Exceedances for 1,1,1-TCA were identified in samples from wells 30GS22, 30GS27, and 30GS28. Samples from wells 11GM52, 27GS02, 27GS04, 27GS19, 30GS28, and 30GS46 showed an exceedance for TCE in both the Phase I and II events. Samples from wells 11GM47 and 11GM52 showed exceedances for vinyl chloride in both sampling events. Total xylenes exceeded the FSDWS in wells 11GM47 and 27GS19 in both events.

Intermediate Groundwater VOCs

Specific wells and VOCs common to both Phase I and Phase II intermediate groundwater sampling events are discussed in this section. VOCs common to both intermediate groundwater sampling events include benzene, 1, 2-DCE (total), TCE, and vinyl chloride. Exceedances that were detected in a specific well during both events are discussed below. Well 11GI14 (Site 11) showed an exceedance for 1, 2-DCE (total) during both events. TCE exceedances were detected in both samples collected from 11GI02, 11GI12 (Site 11), 25GI01, and 25GI02 (Site 25). Vinyl chloride exceedances were detected in both samples from 11GI14 and 30GI111.

7.2.3 SVOC Exceedances

The ratio of groundwater SVOCs detected/exceeded PRGs by site are as follows: Site 11 — nine detected/one exceeded, Site 12 — no detections/exceedances, Sites 25 and 27 — 13 detected/four exceeded, Site 26 — no detections/exceedances, and Site 30 — 19 detected/six exceeded.

7.2.3.1 Phase I Shallow Groundwater Sampling

SVOCs exceeding PRGs included 4-methylphenol, bis(2-ethylhexyl)phthalate (BEHP), carbazole, naphthalene, pentachlorophenol, and phenol. The distribution of Phase I shallow groundwater sample SVOC exceedances is shown in Figure 30 of Appendix E.

4-Methylphenol exceeded the FGGC concentration of 35 μg/L in the sample from well 27GS13 (Site 27). A sample from well 30GS12 (Site 30) exceeded the RBC for tap water of 4.8 μg/L for BEHP. Carbazole was identified exceeding the FGGC of 7.5 μg/L in the sample from well 30GS06 (Site 30). Samples from trench LF-12 and wells 11GM47, 27GS13, 27GS18, 27GS19, 30GS06, 30GS12, and 30GS22 (Site 30), exceeded the FGGC concentration of 20 μg/L for naphthalene. The FPDWS/MCL concentration of 1.0 μg/L for pentachlorophenol was exceeded in samples from wells 27GS13 and 27GS15. Phenol exceeded the FGGC of 10 μg/L in samples from wells 25GS09, 30GS11, 30GS16, 30GS156, 30GS160, and 30GS170.

7.2.3.2 Phase I Intermediate Groundwater Sampling

Groundwater semivolatiles exceeding regulatory standards were identified in two Phase I intermediate well samples from Sites 27 and 30. Sites 11, 12, 25, and 26 had no Phase I intermediate groundwater SVOC exceedances. SVOCs exceeding regulatory standards include 1,3-dichlorobenzene, 1,4-dichlorobenzene, and phenol. The distribution of Phase I intermediate groundwater sample SVOC exceedances is shown in Figure 31 of Appendix E.

The Phase I intermediate groundwater sample from Site 30 well 30GI111 exceeded the FGGC concentration for 1,3-dichlorobenzene of 10 μg/L and the FPDWS/MCL for 1,4-dichlorobenzene of 75 μg/L. Phenol exceeded the FGGC of 10 μg/L in the sample from Site 27 well 27GI06.

7.2.3.3 Phase II Sampling

Phase II groundwater semivolatile exceedances were identified in several Phase II shallow and intermediate well samples from Sites 11, 27, and 30. Sites 12, 25, and 26 had no Phase II SVOC exceedances. Specific SVOC exceedances include 1,3-dichlorobenzene, 1,4-dichlorobenzene, BEHP, naphthalene, and pentachlorophenol. The distribution of SVOCs in Phase II shallow and intermediate well samples is shown in Figure 32 of Appendix E.

The Phase II groundwater sample from Site 30 well 30GI111 exceeded the FGGC concentration for 1,3-dichlorobenzene of 10 μg/L and the FPDWS for 1,4-dichlorobenzene of 75 μg/L. BEHP exceeded its RBC for tap water of 4.8 μg/L in samples from wells 27GS19, 27GS20 (Site 27), 30GS22, 30GS46, and 30GS51 (Site 30). Samples from 11GM47 (Site 11), 27GS18 and 27GS19 (Site 27), and 30GS22 and 30GS51 (Site 30) exceeded the FGGC concentration of 20 μg/L for naphthalene. The FPDWS concentration of 1.0 μg/L for pentachlorophenol was exceeded in well samples 27GS19 and 30GS12.

7.2.3.4 Correlation of Phase I and Phase II Groundwater Events

Shallow groundwater SVOCs

Specific wells and SVOCs common to both sampling events are discussed in this section. SVOCs common to both the Phase I and Phase II sampling events include BEHP, naphthalene, and pentachlorophenol. Samples from well 11GM47 (Site 11), 27GS18, and 27GS19 (Site 27) showed exceedances for naphthalene in both events. Though common between the Phase I and Phase II sampling events, BEHP and pentachlorophenol were not observed in the same groundwater samples from these events.

Intermediate Groundwater SVOCs

Both Phase I and Phase II samples from well 30GI111 showed exceedances for 1,3-dichlorobenzene and 1,4-dichlorobenzene.

7.2.4 Pesticide/PCB Exceedances

The ratio of groundwater Pesticides and PCBs detected/exceeded PRGs by site are as follows: Site 11 — five detected/one exceeded, Site 12 — 16 detected/two exceeded, Sites 25 and 27 — 14 detected/none exceeded, Site 26 — four detected/none exceeded, and Site 30 — two detected/one exceeded.

7.2.4.1 Phase I Sampling

Pesticide/PCB exceedances were found in a trench sample from Site 11 and in three Phase I shallow and intermediate well samples from Sites 12 and 30. Samples from Sites 25, 26, and 27 did not exceed regulatory groundwater standards. Specific pesticides/PCBs exceeding regulatory standards include 4,4-dichlorodiphenyldichloroethane (4,4'-DDD), dieldrin, and toxaphene. The distribution of pesticides/PCBs in Phase I well samples is shown in Figure 33 of Appendix E.

Samples from trench LF-10 (Site 11) and from well 12GS08 (Site 12) exceeded the FGGC for 4,4,4-DDD of 0.1 μg/L. Dieldrin exceeded the FGGC concentration of 0.1 μg/L only in the sample from well 12GS03. Toxaphene exceeded its FPDWS/MCL of 3.0 μg/L in the sample from well 30GS123 (Site 30).

7.2.4.2 Phase II Sampling

No pesticide/PCB compounds were found above regulatory standards in the Phase II groundwater samples collected from wells in any of the six sites.

7.2.4.3 Correlation of Phase I and Phase II Events

No correlation could be shown between the Phase I and Phase II groundwater exceedances. No exceedances for pesticide/PCBs in the Phase II sampling were observed.

7.2.5 Groundwater Water Inorganics Contamination

The ratio of groundwater inorganics detected/exceeded PRGs by site are as follows: Site 11 — 23 detected/16 exceeded, Site 12 — 18 detected/three exceeded, Sites 25 and 27 — 22 detected/11 exceeded, Site 26 — 15 detected/three exceeded, and Site 30 — 21 detected/nine exceeded.

7.2.5.1 Phase I Shallow Groundwater Primary Metals

Phase I shallow groundwater primary metals concentrations were first compared to their respective NAS Pensacola RCs. This comparison was significant for antimony, where the RC exceeds the PRG. The PRG (FPDWS/MCL) for antimony is 6 μg/L, while the NAS Pensacola RC is 30.2 μg/L. One shallow groundwater antimony concentration on Site 11 was found to exceed both the PRG and RC. All 10 shallow groundwater antimony concentrations exceeding the PRG on Sites 25 and 27 also exceeded the RC. One shallow groundwater exceedance on Site 26 was above

the PRG, but below the RC. All other shallow groundwater primary metals concentrations above their PRGs also exceeded their respective RCs.

Primary standard exceedances were noted in all six sites. Ten primary drinking water metals exceeded their respective MCLs in several trench samples and Phase I shallow well samples, including antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, and vanadium. The distribution of these exceedances within shallow well samples from OU 2 is shown in Figures 33 through 40 of Appendix E. Cadmium, chromium, and lead were identified as the metals most frequently exceeding primary groundwater PRGs.

Antimony exceeded the FPDWS/MCL/RC in trench sample LF-10 (Site 11); wells 25GS02, 25GS03, 25GS04, 25GS09 (Site 25), 26GS03 (Site 26); and 27GS01, 27GS04, 27GS06, 27GS08, 27GS10, and 27GS20 (Site 27) (Figure 34). Samples from trenches LF-01, LF-10, LF-11, and LF-13, and well 25GS09 contained arsenic above its FPDWS of 50 μg/L (Figure 35). Cadmium was identified exceeding its FPDWS/MCL of 5 μg/L in samples from trenches LF-01, LF-10, LF-11, LF-12, and LF-13, and from well samples 11GS07, 11GM15 (Site 11), 12GS08 (Site 12), 25GS04, 25GS07, 25GS09 (Site 25), 26GS03 (Site 26), 27GS03, 27GS10, 27GS13, 27GS18 (Site 27), 30GS28, and 30GS157 (Site 30) (Figure 37). Samples from trenches LF-01, LF-10, LF-11, LF-13, and from wells 25GS04, 25GS09 (Site 25), 27GS04, 27GS10 (Site 27), 30GS27, and 30GS28 (Site 30) exceeded the chromium MCL and FPDWS of 100 μg/L (Figure 3&). Lead exceeded the FPDWS/MCL concentration of 15 μg/L in trench samples LF-01, LF-10, LF-11, LF-12, LF-13 and in wells 11GS05, 11GS13 (Site 11), 25GS03, 25GS04, 25GS05, 25GS06, 25GS08, 25GS09 (Site 25), 27GS02, 27GS03, 27GS04, 27GS06, 27GS10, 27GS11, 27GS13, 27GS18 (Site 27), 30GS06, 30GS22, 30GS24, 30GS57, and 30GS62 (Site 30) (Figure 38). The vanadium FGGC of 49 μg/L was exceeded in the samples from trenches LF-01, LF-10, LF-11, LF-12, and LF-13 (Site 11) and wells 25GS03, 25GS04, 25GS07, 25GS09 (Site 25), 27GS03, 27GS06, 27GS10, and 27GS11 (Site 27) (Figure 39). Samples from well 11GS13 and trenches

LF-10 and LF-13 (Site 11) contained barium above its FPDWS/MCL of 2,000 μg/L (Figure 40). Beryllium in samples from trenches LF-01, LF-10, and LF-11 (Site 11) exceeded the FPDWS/MCL of 4 μg/L (Figure 40). Samples from trench LF-10 (Site 11) and wells 25GS04 and 25GS09 (Site 25) exceeded the mercury FPDWS/MCL of 2 μg/L (Figure 40). Nickel exceeded its FPDWS/MCL of 100 μg/L in trench samples from LF-01, LF-10, and LF-13 (Site 11) and well 25GS09 (Site 25) (Figure 40).

7.2.5.2 Phase I Intermediate Groundwater Primary Metals

As with the Phase I shallow groundwater samples, Phase I intermediate groundwater primary metals concentrations were first compared to their respective NAS Pensacola RCs. Three intermediate groundwater antimony concentrations at Site 25 exceeded the FPDWS/MCL for antimony, as well as RC for this analyte.

Primary drinking water metals exceeded their respective MCLs in several intermediate Phase I groundwater samples collected in OU 2. Exceedances were noted at Sites 11, 25, 27, and 30. Sites 12 and 26 did not show any exceedances for primary standards. Intermediate primary metals exceedances include antimony, arsenic, beryllium, cadmium, chromium, lead, nickel, sodium, and vanadium. The distribution of these metals within the intermediate well samples from OU 2 is shown in Figures 41 through 47 in Appendix E. The most frequently identified constituents included chromium, lead, sodium, and vanadium.

Antimony exceeded the FPDWS/MCL/RC in samples from wells 25GI01 (Site 25) and 27GI01 and 27GI03 (Site 27) (Figure 41). Samples from wells 11GI15 (Site 11), 25GI01, 25GI02 (Site 25), and 27GI01 (Site 27) had exceedances of arsenic above the FPDWS/MCL of 50 μg/L (Figure 42). Samples from wells 11GI15 (Site 11), 25GI01, 25GI02 (Site 25), 27GI01, and 27GI06 (Site 27) exceeded the chromium FPDWS/MCL of 100 μg/L (Figure 43). Lead was identified above the FPDWS/MCL concentration of 15 μg/L in wells 11GI15 (Site 11), 25GI01,

25GI02 (Site 25), 27GI01, 27GI02, 27GI06 (Site 27), 30GI058, and 30GI164 (Site 30) (Figure 44). Sodium was detected exceeding its FPDWS of 160,000 μg/L in samples from Sites 11 and 30 in wells 11GI08, 11GI10, 11GI12, 11GI15, 11GI51, and 30GI111 (Figure 45). The FGGC concentration of 49 μg/L for vanadium was exceeded in the samples from wells 11GI15 (Site 11), 25GI01, 25GI02 (Site 25), 27GI01, 27GI02, 27GI04, 27GI06 (Site 27), and 30GI60 (Site 30) (Figure 46). Samples from well 11GI15 (Site 11) contained beryllium exceeded its FPDWS of 4 μg/L (Figure 47). Cadmium was identified exceeding the FPDWS/MCL of 5 μg/L in samples from wells 25GI01 (Site 25) and 30GI32A (Site 30) (Figure 47). The samples from wells 11GI15 (Site 30), 25GI01 (Site 25), and 27GI01 (Site 27) exceeded the FPDWS/MCL of 100 μg/L for nickel (Figure 47).

7.2.5.3 Phase II Groundwater Primary Metals

Phase II groundwater sample exceedances include antimony, cadmium, chromium, lead, mercury, and sodium. Exceedances were noted in eight well samples collected from Sites 11, 25, 27, and 30. The distribution of the OU 2 shallow and intermediate well primary metals exceedances is shown in Figures 48 and 49 of Appendix E. In general, both the number and frequency of FPDWS/MCL exceedances were significantly decreased from the Phase I results. Specifically, primary metals exceedances were detected at only two wells in Site 11, one well in Site 25, one well in Site 27, and four wells in Site 30. No samples from Sites 12 or 26 exceeded the FPDWS. The most frequent primary exceedances were for cadmium and lead. An antimony exceedance was above the PRG, but below the RC.

Phase II Shallow Groundwater Primary Metals

The FPDWS/MCL of 100 μg/L for chromium was exceeded in samples from wells 27GS10 and 30GS28 (Figure 48). One sample from well 25GS09 exceeded the FPDWS/MCL for mercury of 2 μg/L (Figure 49). Cadmium exceeded the FPDWS of 5 μg/L in samples from wells 11GS01,

30GS28, 30GS103, and 30GS126 (Figure 49). Samples from wells 30GS22, 30GS103, and 30GS126 exceeded the FPDWS of 15 μg/L for lead (Figure 49).

Phase II Intermediate Groundwater Primary Metals

Only one primary metal standard was exceeded in the OU 2 Phase II intermediate well samples. Sodium was identified in well 11GGS15 above its FPDWS of 160,000 μg/L (Figure 49).

7.2.5.4 Correlation of Phase I and Phase II Groundwater Primary Metals

Shallow Wells

Specific primary exceedances and wells in which they occur common to both sampling events are discussed in this section. Constituents common to both the Phase I and II sampling events include antimony, cadmium, chromium, lead, and mercury. As previously mentioned, the number and frequency of exceedances during Phase II were significantly reduced from those detected in the Phase I sampling event. This is partly attributable to the change in groundwater sampling methods (see Section 5). Specific wells in which a primary exceedance was detected in both sampling events include cadmium in well 30GS28, chromium in wells 27GS10 and 30GS28, lead in well 30GS22, and mercury in well 25GS09.

Intermediate Wells

No correlation could be shown between the Phase I and Phase II sampling exceedances. No primary groundwater standards were exceeded in the Phase II sampling.

7.2.5.5 Phase I Shallow Groundwater Secondary Metals

Secondary standards for aluminum, copper, iron, manganese, and zinc were exceeded at several OU 2 sites. The most common secondary exceedances were for aluminum, iron and manganese, at Sites 11, 25 and 27, and 30. Site 11 also had zinc and copper exceedances. Secondary metals in shallow groundwater were first compared to their respective NAS Pensacola RCs. This

comparison was significant for aluminum and iron, where the RC exceeds the PRG. The PRG (FSDWS/SMCL) for aluminum is 50 μg/L, while the NAS Pensacola RC is 3,882.8 μg/L. Likewise, the PRG (FSDWS/SMCL) for iron is 300 μg/L, while the RC is 1,707.8 μg/L. At Site 11, there were 12 shallow groundwater exceedances for aluminum. Of these, five were above both the PRG and RC, while seven exceedances were above the PRG, but below the RC for aluminum. At Site 12, 12 shallow groundwater aluminum exceedances were above the PRG, but below the RC. At Sites 25 and 27, of 29 aluminum exceedances, 25 were above both the PRG and RC, while four exceedances were above the PRG, but below the RC. At Site 26, two shallow groundwater aluminum exceedances were above the PRG, but below the RC. At site 30, there were 30 shallow groundwater exceedances, of which six were above both the PRG and RC, while 24 were above the PRG, but below the RC for aluminum. For shallow groundwater iron, at Site 11, there were 11 exceedances, of which 10 were above both the PRG and RC, while one iron concentration was above the PRG, but below the RC. At Sites 25 and 27, there were 29 shallow groundwater iron exceedances, of which 28 were above both the PRG and RC, while one concentration exceeded the PRG, but was below the RC. At Site 30, there were 35 shallow groundwater aluminum exceedances, of which 15 were above both the PRG and RC, while 20 aluminum concentrations were above the PRG, but below the RC. All other Phase I shallow groundwater secondary metals exceedances were above both their respective PRGs and RCs. Phase I shallow groundwater secondary metals exceedances are shown in Figure 50 of Appendix E.

All told, between Sites 11, 25 and 27, and 30, there were 36 shallow groundwater aluminum concentrations above both the PRG and RC, with most aluminum exceedances occurring at Site 25 and 27. The sample collected from trench LF-10 Site 11) was the only one exceeding the FSDWS/SMCL of 1,000 μg/L for copper. The FSDWS/SMCL of 300 μg/L/NAS Pensacola RC of 1,707.8 μg/L for iron was exceeded 53 shallow groundwater samples collected from Sites 11, 25 and 27, and 30. Manganese exceeded the FSDWS/SMCL of 50 μg/L in 45 shallow

groundwater samples at Sites 11, 25 and 27, and 30. Zinc exceeded the FSDWS concentration of 5,000 μg/L only in trench samples LF-10 and LF-13 at Site 11.

7.2.5.6 Phase I Intermediate Groundwater Secondary Metals

Aluminum, iron, and manganese were identified as exceeding their respective PRGs in the Phase I intermediate groundwater samples collected at OU 2. Secondary exceedances were noted at Sites 11, 25 and 27, and 30. The distribution of exceedances within the intermediate well samples from OU 2 is shown in Figure 51 of Appendix E.

As with shallow groundwater, intermediate groundwater secondary metals concentrations were first compared with their respective NAS Pensacola RCs. This comparison was significant for aluminum and iron for the intermediate groundwater samples. At Site 11, of eight aluminum exceedances, four were above both the PRG and RC, while four aluminum exceedances were above the PRG, but below the RC. At Sites 25 and 27, all eight aluminum exceedances were above both the PRG and RC. At Site 30, of eight aluminum exceedances, five were above both the PRG and RC, while three aluminum exceedances were above the PRG, but below the RC. For iron, at Site 11, four of eight exceedances were above both PRG/RC, while four iron exceedances were above the PRG, but below the RC. At Sites 25 and 27, and Site 30, 16 iron concentrations (eight per each respective site area) exceeded both the PRG and RC for iron. All other secondary metals in the intermediate groundwater samples exceeded both the PRG and RC.

Aluminum was the most prevalent secondary metal noted in the intermediate well samples collected in OU 2, exceeding its FSDWS/SMCL/RC in 17 intermediate groundwater samples. The FSDWS/SMCL/RC for iron was exceeded in all 20 intermediate groundwater samples. Manganese exceeded the FSDWS of 50 μg/L in 19 intermediate groundwater samples.

7.2.5.7 Phase II Groundwater Secondary Metals

Shallow Wells

A reference concentration comparison for Phase II shallow groundwater secondary metals reveals that of 14 shallow groundwater aluminum concentrations above the PRG, all were below the NAS Pensacola RC for aluminum. Of 19 shallow groundwater iron exceedances, eight were above both the PRG/RC, while 11 concentrations were above the PRG, but below the RC.

Phase II shallow groundwater secondary exceedances were noted at Sites 11, 25, 27, and 30 within OU 2. Constituents above standards were iron, and manganese. Iron concentrations exceeded the FSDWS/SMCL (300μg/L) and RC (1,707.8 μg/L) at 11GS01, 11GS05, 11GM15, 11GM47, (Site 11), 27GS01, (Site 27), 30GS27, 30GS38, 30GS103 (Site 30). Manganese had five exceedances above the FSDWS/SMCL of 50 μg/L (wells 11GS15, 27GS01, 27GS10, 30GS103, and 030GS171). Fewer exceedances occurred in fewer wells during the Phase II sampling, likely due in part to changes in sampling technique and natural dispersion of the contaminants within the aquifer. Phase II shallow groundwater secondary metals are presented in Figure 52 in Appendix E.

Intermediate Wells

Though there were three aluminum and six iron concentrations in the Phase II intermediate groundwater samples, all were below the NAS Pensacola RCs for aluminum and iron. There were no other intermediate groundwater secondary metals exceedances in the Phase II groundwater samples.

7.2.5.8 Correlation of Phase I and Phase II Groundwater Sample Exceedances

For shallow groundwater, secondary standards were exceeded during both Phase I and Phase II sampling events for iron, and manganese. Iron above the PRG/RC was detected in both Phase I and Phase II samples from wells 11GS05, 27GS01, and 30GS103. Phase I and II exceedances for

manganese occurred in the samples from 27GS10, 30GS103, and 30GS171. Since no secondary metals were exceeded in the Phase II intermediate groundwater samples, these samples cannot be correlated with the Phase I intermediate groundwater samples.

7.3 Correlation of Soil and Groundwater Exceedances

The correlation between surface soil, subsurface soil, and groundwater exceedances is discussed within this section. Specific compounds with exceedances were common between both soil (surface/subsurface) and groundwater. Any correlations between exceedances identified in both surface and subsurface soil, and/or surface/subsurface soil and groundwater are outlined.

7.3.1 VOC Exceedances

VOC exceedances could not be correlated between surface and subsurface soil. This is not surprising given the high volatility of VOCs and the high permeability of the sandy surface soil. Site specific discussions are included for Sites 11 and 30, where individual VOCs above PRGs were found in both soil and groundwater. At Site 11, benzene, vinyl chloride, and xylene were detected above PRGs in both subsurface soil and groundwater. At Site 30, 1,2-DCA, benzene, methylene chloride, and xylene were exceeded in both subsurface soil and groundwater. A comparison to the locations of these exceedances reveals that at both sites, none of these VOCs occurred at collocated or nearby soil/groundwater sampling locations, (upgradient, downgradient, etc.).

7.3.2 SVOC Exceedances

At Site 11, naphthalene exceeded PRGs in both soil and groundwater. Trench LF-12 had napthalene in both soil and groundwater samples. Naphthalene also appeared in the soil sample from trench LF-04 and the groundwater sample from 11GM47. Well 11GM47 is approximately 200 feet from both trench locations, but does not appear to be directly downgradient from either.

At Site 27, naphthalene, pentachlorophenol, and phenol exceeding PRGs occurred in both soil and groundwater samples. Naphthalene appeared in soil samples at borings 27GS04, and 27S52, in addition to groundwater samples from wells 27GS18 and 27GS19. Though located relatively near each other in the vicinity of the slab for the former Building 709, the wells appear to be upgradient from the borings, making it difficult to correlate soil to groundwater partitioning between these points. Also, 27GS18 and 27GS19 are former ABB, Inc. wells, where the naphthalene exceedances may be related to UST removals conducted near these locations. Pentachlorophenol appeared in soil samples from borings 27S12, and 27S52, in addition to groundwater samples from wells 27GS13 and 27GS15. Wells 27GS13 and 27GS15 are nearly collocated, and are approximately 50 feet south of boring 27S12. However, these wells appear to be across to slightly above gradient from boring 27S12. They are also former ABB, Inc. wells, related to previous UST removals. Boring 27S52 is downgradient from these wells. Phenol appeared in boring 27S17, and wells 27GS09 and 27GI06. Well 27GS09 is 200 feet down/slightly across gradient from 27S17. However, several monitoring wells are situated between these points, and there were only scattered phenol detections among these, with none exceeding PRGs. Well 27GI06 is not located in the direct vicinity of boring 27S17.

At Site 30, naphthalene and phenol were detected above PRGs in both soil and groundwater. Naphthalene exceeded PRGs at location 30GS06 (soil and groundwater), as well as at 30GS12 and 30GS22 (groundwater only). These locations are situated within the Building 649 complex. The exceedances are related to above ground storage tanks, former USTs, and associated delivery lines running through at these locations. Phenol exceeded PRGs at boring 30S122, in addition to numerous shallow groundwater monitoring wells (30GS11, 30GS16, 30GS156, 30GS160, and 30GS170). Boring 30GS122 is unrelated to any of these wells. However, wells 30GS156, 30GS160, and 30GS170 are former ABB, Inc., wells, associated with previous UST removals near Buildings 3220 and 3450. 30GS11 is located within the Building 649 complex, near the other wells related to UST removals, etc.

7.3.3 Pesticides/PCBs

Pesticides/PCBs exceeding both soil PRGs and groundwater regulatory standards include 4,4'-DDD and dieldrin (Site 12). No PCBs exceedances were detected in groundwater during either Phase I or II. Soil and groundwater PRGs for 4,4'-DDD were both exceeded at location 12GS08. Soil and groundwater PRGs for dieldrin were both exceeded at location 12GS03. At Sites 11 and 30, pesticide exceedances in soil cannot be correlated to similar exceedances in groundwater. At Sites 25 and 27, there were pesticide exceedances in soil, but none in groundwater. At site 26, there were no pesticide exceedances in either soil or groundwater.

7.3.4 Primary Drinking Water Metals

Exceedances of four primary metals — antimony, arsenic, barium, and cadmium — were detected in both soil and groundwater at the same location at three sites. At Site 11 arsenic exceeded PRGs in both soil and groundwater at trenches LF-01 and LF-13. Barium also exceeded PRGs for both media at trench LF-13. Cadmium exceeded PRGs for both media at trenches LF-10, LF-12, and LF-13. At Sites 25 and 27, antimony exceeded PRGs in both soil and groundwater at 27GS01. Lead exceeded PRGs in groundwater at wells 25GS08 and 25GI02, and at adjacent soil borings 25S15/25S16. At Site 30, cadmium exceeded PRGs in both media at location 30GS103.

7.3.5 Secondary Drinking Water Metals

Exceedances of aluminum, iron, and manganese are found within groundwater at OU 2. Aluminum exceeded PRGs in both soil and groundwater at locations 25GS04, 25GS08, and 25GI01 (Site 25). Iron exceeded PRGs in both media at 25GI01 (Site 25), 27GS01, 27GS08, 27GS10, 27GS13 (Site 27), and 30GS103. Manganese soil sample exceedances could not be correlated with any manganese groundwater exceedances.

7.3.6 Radioactivity

Based upon the information from the Phase I sampling and the subsequent resampling, radioactive constituents in concentrations exceeding soil PRGs have not impacted groundwater at OU 2.

7.4 Sediment and Surface Water Contamination Assessment

Limited sediment and surface water sampling was conducted during the field investigation for OU 2. This sampling was not designed to replace or supplement the comprehensive sediment and surface water sampling conducted during the Site 40 (Bayou Grande) and 41 (NAS Pensacola Wetlands) investigations. Sediment samples were collected at Wetland 5A (adjacent Site 30) in and around the waste receiving structure in 1993 to support development of the work plan (E/A&H, 1994a) for the interim removal performed there in 1994. Subsequently, post-removal confirmatory samples were collected, as discussed in Section 2.3 of this report.

Additional sediment samples were collected from storm sewer drains at Site 12. Six sediment samples were called for in the work plan for Site 12 (E/A&H, 1995a); however, because several storm drains were washed clean of sediments, only four samples were actually collected. The purpose of the sampling was to determine the overall impacts of contaminants to the storm sewer system at the site. It was noted, however, that sampling upstream and downstream segments of the storm sewer system near Site 12 would not be advantageous due to potential impacts by other sites (E/A&H, 1995a). A surface water sample was collected at Site 12 from pooled rain water. The purpose of this sample was to determine whether contaminants are being washed offsite with storm water (E/A&H, 1995a).

The storm sewer sediment samples at Site 12 contained several primary metals above PRGs. Notably, field samplers stated the sediments collected from these drains were heavily laden with small screws, washers, rivets, and metal debris. Pesticides, PAHs, and other SVOCs were also detected above PRGs in the storm sewer samples. The surface water sample collected from

Site 12 contained primary and secondary metals above PRGs, as well as Aroclor-1260, and dieldrin.

The storm sewer system beneath Site 12 drains via an outfall into Wetland 6, about 1,500 feet upstream from the Yacht Basin of Bayou Grande. The Site 40 and 41 investigations will address impacts to this wetland and the Yacht Basin from Site 12 and other adjacent sites in detail.

7.5 OU 2 Sources of Contamination

This section discusses sources of contamination by site, based on soil and groundwater sample exceedances, compared to current or past site activities.

At Site 11, primary/secondary metals, SVOCs, and VOCs were the main constituents exceeding PRGs in soil and groundwater. A former landfill, trenching at this site revealed in many places a "seam" of blackened soil/debris right at the water table. This oily material contained finely corroded bits of metal and other debris. The air around each trench was permeated with odors from volatile chemicals. This buried debris is a major contributor to the soil and groundwater contamination found at Site 11.

Site 12 is a storage yard for scrap materials, to include scrap metal of all types, scrapped aircraft, scrap tires, used furniture, and a large amount of scrap electronics. This material is resold as used equipment, or for its scrap value. Site 12 soil exceedances mainly included primary/secondary metals, PCBs, and SVOCs. The storage of scrap metals contributes to metals contamination at this site. Though none were noted during the field investigation, past storage of old transformers pending their disposal are a possible contributor to the PCB contamination found at Site 12. Residual fuels and oils from scrapped aircraft and vehicles stored at the site are possible sources of SVOCs at Site 12. There was little correlation between soil and groundwater contamination, with fewer metals noted in groundwater, and almost no organics. Most of Site 12 is covered with

concrete, which directs precipitation to storm drains, rather than allowing rain to leach through the soil.

At Site 25, Contamination was noted in soil and groundwater in and around the southeast corner of Building 780. This building houses the Joint Oil Analysis Laboratory, which analyzes oil samples from vehicles and aircraft from military activities nationwide. Soil samples collected behind this building (borings 25S04, 25S12, 25S14, 25S15, 25S16, 25S17, 25S18, 25S19) revealed a wide range of primary/secondary metals and SVOC contamination. Shallow wells next to the building (25GS03 and 25GS08) contained primary and secondary metals, and an adjacent intermediate depth (25GI02) well contained metals, as well as chlorinated solvents, benzene and xylene. Improper storage and disposal of materials at Building 780 are likely the sources of soil and groundwater contamination at this location. Another location of concern at Site 25 is the storage yard behind Building 225, used as a metal prefabricating shop by the NAS Pensacola PWC. This yard contains racks of metal sheeting, piping, etc. Shallow and intermediate wells (25GS09 and 25GI01) were located here, and groundwater samples from these wells contained numerous primary and secondary metals exceedances. 25GS09 contained PCE, while 25GI01 had TCE. Activities in and around this building are a likely source for contamination in these wells.

No significant contamination was detected at Site 26.

At Site 27, the focus of the investigation was located on the slab of the former Building 709. SVOC exceedances were noted from wells previously installed by ABB, Inc. in support of UST removals at this location. The former USTs are likely contributors of contamination in these wells.

At Site 30, numerous former ABB, Inc. wells which were associated with previous UST removals within the Building 649 complex revealed chlorinated solvents and benzene exceeding PRGs.

E/A&H wells installed on the western side of this complex revealed SVOC and VOC exceedances. Above ground storage tanks at this complex, the former USTs, and associate buried piping are considered sources for this contamination. Several former ABB, Inc. wells in and around Building 3220 exhibited benzene, chlorinated VOC, and phenol exceeding PRGs. Also, former ABB, Inc. wells south of Building 3450 exhibited phenol above PRGs. All of these ABB, Inc. wells were associated with former UST removals. An E/A&H shallow well (30GS154) located on the north side of Building 3450 exhibited vinyl chloride and xylene above PRGs.

For Site 36, several wells were installed along gravity-feed segments of the IWTP sewer line leading from the Building 649 complex and Buildings 3220/3450 to the main sewer line following Industrial Blvd., and along the main sewer line to the IWTP. A point of contamination was found adjacent the location of the former hazardous materials accumulation area at the former Building 3189. The intermediate well (30GI111) adjacent the southwest corner of this former building exhibited chlorinated VOCs, benzene, iron, manganese, and sodium above PRGs. Activities at the former hazardous materials accumulation area likely contributed to this contamination. Samples from well 30GS103, installed in a fenced storage yard directly north of Building 3644 (a former NADEP building), contained primary/secondary metals contamination, as well as chlorobenzene. Nearby well 30GS101 contained xylene and benzene. The contamination in 30GS103 is likely attributable to NADEP activities at Building 3644. Well 30GS101 is adjacent the IWTP, and may is likely impacted from IWTP activities. Chlorobenzene and toxaphene were detected at well 30GS123, near a lift station for the IWTP sewer line. Past spills from this lift station are the likely contributors of this contamination. Exceedances in well 30GI111 are likely associated with activities surrounding the former Building 3189.

7.6 Data Gaps

Data gaps represent data not collected or assessed during the investigation. These gaps occur because most projects cannot afford to sample every individual in a population and chose to

observe a few samples to represent the whole population. Below is a listing of the major data gaps affecting this report.

- Seasonal trends were not evaluated. This would have been accomplished by quarterly sampling for at least a year. To save money, the Partnering team determined the sampling regime and frequency during the January 1995 meeting. The Phase II sampling objective became to verify the presence of specific contaminants rather than determine seasonal trends. Based on the isolated nature of the contaminants detected, seasonal trends would not have aided the development of the feasibility study alternatives.

- Sediment and surface water data during storm events were not collected. This data would have provided the mechanism and the impact to adjacent water bodies from OU 2 due to surface water runoff. This objective has been transferred to the Site 40 (Bayou Grande) and Site 41 (NAS Pensacola Wetlands) remedial investigations.

- The scattered exceedances or "bulleyes" are not chemically or physically related making interpretation difficult. To solve this problem the sampling density could be increased offering a higher confidence in the data. However, the porous and well drained soils of OU 2 encourage rapid migration making isolated detections possible. The data suggests that increasing the sampling density would only define the "bullseyes" and not a plume. For the feasibility study, isolated exeedances in soil can be dealt with as a finite volume. However since groundwater contaminants are mobile, many chemicals are suspected to have dispersed or diluted beyond detection not allowing inference to be drawn between these exceedances. For the feasibility study, zones of contaminant exceedances based on "total" detections may offer where remediation needs to be implemented. A good example is provided in Figure 53 and 54 in Appendix E. The elongated zone of contamination is

not suspected to be a plume because it is perpendicular to the direction of groundwater flow. However, such figures do offer where to conduct remedial activity.

7.7 Current and Potential Receptors

The contaminants within OU 2 appear to be limited to the surface and subsurface soil, the surficial aquifer, groundwater-to-surface water discharge, and areas where point source or nonpoint source storm water discharges occur (e.g., wetlands). Potential receiving water bodies of contamination are as follows.

- The main producing zone of the Sand-and-Gravel Aquifer, which is used as a potable water source in Escambia County and underlies the surficial zone but is separated from it by a confining clay unit.

- NAS Pensacola Wetland 5A, which receives runoff from the southwestern portion of the OU 2 area (Sites 25, 27, and 30).

- NAS Pensacola Wetland 5B, which is a ditch draining the area from Wetlands 5A to 6.

- The concrete-lined drainage ditch, also known as NAS Pensacola Wetland 6.

- Yacht Basin, an arm of Bayou Grande, which receives runoff and groundwater flow from the areas of Sites 11, 12, 25, and 26.

The low-permeability clay layer between the surficial and main producing zones may inhibit any downward contaminant migration into the deeper groundwater below the clay. FDEP classifies the coastal waters of bordering NAS Pensacola as Class III water, indicating their use for recreation and maintenance of a well-balanced fish and wildlife population. Conservatively

estimating the rate of contaminant migration to equal groundwater velocity, the low concentrations of contaminants, and the amount of dilution they are likely to undergo before reaching Bayou Grande, minimizes their impact to nearby coastal waters. Potential ecological impacts on Bayou Grande will be addressed in separate RI/FSs for Bayou Grande (Site 40), and the NAS Pensacola Wetlands (Site 41).

8.0 DATA VALIDATION

The OU 2 investigation was divided into six sites (Sites 11, 12, 25, 26, 27, and 30), which were sampled in pairs to save on analytical costs. The sites paired together were 25/27, 11/30, and 12/26. OU 2 was investigated over a 2.5 year period, resulting in the use of three different laboratories and two different data validation firms to generate and validate the analytical data for the operable unit. The analytical work for site pairs 12/26 and 25/27 was conducted by CompuChem, Inc. Analytical work for site pair 11/30 were conducted by NET Inc., and IT Inc. Phase II groundwater samples from all sites were analyzed by Savannah Laboratories of Savannah, Georgia. E/A&H validated analytical data for site pairs 25/27 at NAS Pensacola, while Validata Chemical Services, Inc., performed validation for site pairs 11/30 and 12/26. Potential disadvantages were minimized by ensuring the paired sites were concurrently sampled, and that they followed the analytical process together.

The analytical protocols and data validation were performed in accordance with the following guidance documents:

- USEPA Contract Laboratory Program, *Statement of Work (SOW) for Organic Analyses, OLM01.0* (CLP Organic SOW) (USEPA, 1990a).

- USEPA Contract Laboratory Program, *Statement of Work for Inorganic Analyses, ILM03.0* (CLP Inorganic SOW) (USEPA, 1990b).

- USEPA Superfund Analytical Methods for *Low Concentration Water for Organics Analysis (10/92)* (USEPA, 1992b).

- NEESA Level D QA/QC guidelines as stated in: *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (NEESA 20.2-047B)* (NEESA, 1988).

- *USEPA Laboratory Data Validation Functional Guidelines For Evaluating Organics Analyses,* Revised November 1988 (USEPA, 1988).

- *USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses*, Revised February 1989 (USEPA, 1989a).

- *USEPA Contract Laboratory Program National Functional Guidelines For Inorganic Data Review,* February 1994 (EPA-540/R-94/013) (Inorganic Functional Guidelines) (USEPA, 1994b).

- *USEPA Contract Laboratory Program National Functional Guidelines For Organic Data Review,* Revised June 1991 (Organic Functional Guidelines) (USEPA, 1991b).

Site Pair 11/30

A total of 294 soil/sediment and 113 water/groundwater samples were collected from August 18 through December 1, 1993. Results were reported in 28 Sample Delivery Groups (SDGs) for organics, and 29 SDGs for inorganics.

Site Pair 12/26

A total of 90 soil/sediment and 17 water/groundwater samples were collected from April 18 through June 21, 1995. Results for organic and inorganic field samples were reported in 11 SDGs.

Site Pair 25/27

A total of 472 soil and 39 groundwater samples were collected on May 4 through August 17, 1993. Results for organic and inorganic field samples were reported in 27 SDGs.

All samples for OU 2 arrived at the respective receiving laboratory in good condition, with the proper custody documents and seals intact. The analytical data from each site pair were found to be acceptable for use in the remedial investigation.

8.1 Organic Analysis

8.1.1 Holding Times

All associated sample results were qualified in accordance with the Organic Functional Guidelines (OFGs). The technical and contractual holding times for each site pair were found to be within QC requirements with few exceptions:

- For site pair 11/30, one volatile and two semivolatile soil samples, along with select volatile and semivolatile dilutions and/or reanalyses, fell outside of these requirements. However, no holding times exceeded 30 days.

- For site pair 12/26, the pesticide fraction of samples 026S000201, 026S000210, and 026S000212 in SDG 00004 fell outside QC requirements. These samples had a holding time to extract of 30 days. Consequently, pesticide results were qualified as estimated (J) for positive results and unusable (UR) for non-detects. The semivolatile fraction for samples in SDG 00008 had holding times to extraction ranging from 19 - to 27- days. All positive and non-detected semivolatile results in this SDG were qualified as estimated or unusable (UJ).

- For site pair 25/27, select volatile and semivolatile dilutions and/or reanalyses fell outside of QC requirements.

8.1.2 Calibration

The purpose of the initial and continuing calibration is to ensure that the instrument is capable of acceptable and quantitative performance at the beginning and throughout each analytical run. The QC criteria for volatile and semivolatile gas chromatograph/mass spectrometer (GC/MS) tuning were met for all site pairs. There were QC deficiencies representing common laboratory practices, occurring at a rate consistent with instruments that are calibrated correctly. In some cases, QC deficiencies were for compounds considered common laboratory artifacts. Where calibration outliers occurred at rates higher than usual, they were still consistent with correctly calibrated instruments.

All site pairs had volatile, and semivolatile target compounds outside the QC criteria for percent relative standard deviation and/or percent difference. Site pair 11/30 and site pair 25/27 also had pesticide compounds outside percent relative standard deviation criteria. Site pair 12/26 had low concentration water volatile fractions outside the criteria for minimum relative response factors.

Sample results were qualified for calibration outliers per the OFGs.

8.1.3 Blanks

Blank results are used to determine the presence and magnitude of any contamination problems. Compounds considered to be common laboratory artifacts were qualified per the OFGs, with action levels based on the highest concentration per associated method blanks or QC samples. No laboratory artifact result was reported as positive unless it exceeded 10-times the amount found in any blank. For compounds not considered as common laboratory artifacts (such as pesticides),

action levels were set at 5-times the contaminate concentration for each SDG, with associated sample results qualified accordingly.

Acetone, methylene chloride, and several phthalate esters were detected in the blanks associated with all site pairs. For site pair 11/30, one pesticide SDG had some minor blank contamination. Site pair 12/26 had methoxychlor and/or heptachlor in the method blanks of 3 SDGs. This was likely due to the laboratory conditions at the time of sample analysis. No conclusions or recommendations for the site pair were based on laboratory artifacts. For site pair 25/27, there was blank contamination in the pesticide fraction of most SDGs. This is most likely due to CompuChem's unusual practice of reporting pesticide results below their method detection limits.

All frequencies and compliance requirements were found to be satisfactory, and sample results for each site pair were qualified accordingly.

8.1.4 Matrix Spikes

In each analytical method used to analyze environmental samples, there are variations in the reported results that may be due to the random differences in the handling and analysis of that matrix. These variations are referred to as the precision or the reproducibility of results. To demonstrate reproducibility, the CLP Organic SOW specifies the addition of known quantities of several compounds to two separate aliquots of each sample matrix type. The spiked aliquots are referred to as the matrix spike (MS) and the matrix spike duplicate (MSD). These samples can then be analyzed by applying the same preparation techniques and analytical methods used for all the samples of similar matrix types. This enables the MS and MSD to be used to detect matrix effects caused by contaminants during sample analysis that interfere with the compounds of interest that may also be present within the sample.

Several volatile, semivolatile, and pesticide SDGs for site pair 11/30 were outside MS/MSD QC criteria due to percent recoveries and/or high relative percent difference for spiked compounds. For site pair 12/26, all pesticide and volatile SDGs met MS/MSD QC criteria, though several semivolatile SDGs had detections outside these criteria due to percent recoveries/relative percent differences in spiked compounds. For site pair 25/27, all pesticide SDGs met MS/MSD QC criteria, with 1 pesticide SDG qualified for low MS/MSD recoveries. As with the other site pairs, 25/27 had several volatile and semivolatile SDGs with detections outside QC criteria resulting from the analyses of the spiked compounds.

Sample results were qualified as recommended in the OFGs.

8.1.5 Surrogates

Accuracy is the degree to which a given result agrees with the true value. To check the accuracy in a volatile, semivolatile, and pesticide analysis, the CLP Organic SOW requires the addition of known amounts of surrogate compounds or compounds which are not target compounds. If percent surrogate recoveries are close to the known concentrations as defined within the limits set by the CLP, the reported target compound concentrations are assumed to be accurate.

Several volatile, semivolatile, and pesticide SDGs for site pair 11/30 contained samples with results qualified due to surrogate recoveries. For site pair 12/26, SDG volatile fractions met all surrogate QC criteria. Two SDGs contained several pesticide samples qualified due to high surrogate recoveries, while four SDGs had semivolatile samples qualified from low surrogate recoveries. For site pair 25/27, the volatile fraction of all SDGs met all surrogate QC criteria, with several SDGs containing semivolatile and pesticide samples qualified from surrogate recoveries.

8.1.6 Internal Standards

During each analytical run, GC/MS internal standards (IS) are added to samples to check the stability of the instrument's sensitivity and response. IS area counts for samples and blanks must not vary by more than a factor of two (-50% to +100%) from the associated calibration standard. All site pair 11/30 volatile and semivolatile SDGs met internal standard retention time QC criteria, with two semivolatile and several volatile SDGs qualified for low internal standard recoveries. For site pair 12/26, all volatile and semivolatile SDGs met internal standard QC criteria. For site pair 25/27, all volatile and semivolatile SDGs met QC criteria, however, there were volatile and semivolatile samples qualified for low internal standard recoveries.

8.1.7 Field Duplicates

Representativeness describes: (1) the degree to which sample data accurately and precisely represent the characteristic of a population; (2) parameter variations at a sampling point; or (3) an environmental condition. Duplicate samples also provide an indication of overall field and laboratory precision. Due to the differences in matrix, a greater variance should be expected for the soil sample duplicates compared to those for water. The field duplicates associated with each site pair indicated acceptable precision. Any sample results that exceeded recommended QC limits were qualified as recommended by the OFGs.

8.2 Inorganic Analysis

8.2.1 Holding Times

All OU 2 samples were received by the laboratory in good condition with the proper custody documents and seals intact. From the date of collection to the date of sample analysis, sample holding times were within method and contractual requirements.

8.2.2 Calibration

Initial and continuing calibrations were performed for the analysis of inorganics within the criteria established by the EPA CLP Inorganics SOW. For site pair 11/30, two SDGs had cyanide outside the criteria for percent recovery. All associated sample results were qualified as recommended by the Inorganic Functional Guidelines (IFGs).

8.2.3 Blanks

According to IFGs, a sample result is not positive unless a concentration of a compound in the sample exceeds 5-times the amount in any associated blank. As to be expected, for each site pair there was contamination in the blanks of every inorganic SDG. Action levels were set for each affected element and sample results qualified per the IFGs.

8.2.4 Inductive Coupled Plasma Interference Check Sample Analyses

The inductive coupled plasma (ICP) interference check sample analysis investigates the laboratory's instrument and the background correction factors. The first three SDGs for the site pair 11/30 inorganic SDG summary had very low percent recoveries for magnesium. All magnesium results in these SDGs were rejected. ICP analyses for all other 11/30 SDGs revealed no indication of interferences. All ICP analyses for site pairs 12/26 and 25/27 disclosed no indication of interferences.

8.2.5 Inductive Coupled Plasma Serial Dilutions

ICP serial dilutions assess the presence or absence of matrix interferences. One sample from each set of similar matrix type is diluted by a factor of five. For an analyte concentration which is at least a factor of 100-times above the instrument detection limit, the measured concentrations of the undiluted sample and of the diluted sample should agree within 10%. ICP serial dilutions for site pair 11/30 were outside QC criteria in nine SDGs. Site pair 12/26 had ICP Serial Dilutions

outside QC criteria in several SDGs, while in site pair 25/27, ICP serial dilutions were outside these criteria in three SDGs. All OU 2 results were qualified per the IFGs.

8.2.6 Laboratory Control Sample Analyses

Laboratory control sample (LCS) analyses monitor the overall performance or accuracy of all steps in the analysis. For site pair 11/30, one SDG contained an LCS with silver recovery exceeding the QC requirements. The silver in this LCS and all positive silver results in this SDG were determined to be due to blank contamination, so no action was based on the LCS silver recovery. All other site pair 11/30 LCS results were within QC requirements. For site pairs 12/26 and 25/27, all SDGs had LCS results within QC requirements.

8.2.7 Laboratory Duplicates/Spikes

Laboratory duplicate samples determine the precision of analytical methods, and are designed to describe the sample matrix's effects on the digestion and measurement methodology. For all site pairs, several SDGs were qualified that did not meet the laboratory duplicate and/or spike QC criteria.

8.2.8 Field Duplicates

Field duplicates associated with all site pairs indicated acceptable precision. Any sample results that exceeded recommended QC limits were qualified as recommended by the IFGs.

8.3 Completeness

Completeness defines the percentage of measurements made which are judged to be valid. With the exception of results flagged "UR" or "R," all OU 2 samples were determined to be valid with some qualification. For site pair 11/30, of 58,659 total measurements, 271 were flagged "UR" or "R," demonstrating completeness greater than 99%. For site pair 12/26, of 3,164 total

measurements, 91 were flagged "UR" (97% completeness). For site pair 25/27, of 60,933 total measurements, 31 were flagged "UR" or "R" (99% completeness).

There were no positive results rejected. All data were considered to meet the 90% completeness goal.

8.4 Comparability

Comparability is a qualitative parameter expressing the confidence by which comparison can be made between data sets. Comparability is assured through using established field sampling and laboratory methods as specified by EPA protocols. All OU 2 samples were collected in accordance with established procedures and analyzed according to CLP SOW protocol.

8.5 Conclusion

The overall data quality of the analytical work done for OU 2 were considered to be satisfactory and usable for site remediation and risk assessment, except for the sample results qualified as unusable. Data validation reports will be provided upon request and will become a part of the NAS Pensacola OU 2 Final Report file.

9.0 FATE AND TRANSPORT

Contaminant fate is assessed by studying the physical and chemical processes affecting contaminants detected in the environment. Chemical processes that affect the residency of chemicals in the environment include solubility, volatility, and chemical or biological degradation. Physical processes that move contaminants through the environment include advection, diffusion, and erosion. Based on OU 2's physiography and geology, the primary transportation pathways considered in this discussion are from soil to groundwater, groundwater to surface water, surface soil to air, and surface soil to sediment. Each pathway will be addressed in a discussion of specific contaminant groups, i.e., VOCs, SVOCs, pesticide/PCBs, and inorganics.

A potential pathway is judged to be complete if a link can be demonstrated between a source and the receptor. Pathways without analytical data to support them are incomplete and may represent a data gap.

9.1 Contaminant Migration

VOCs

The chemical and physical properties with the greatest influence on the fate and transport of VOCs are solubility, temperature, and vapor pressure. VOCs are highly mobile in both soil, surface water, and groundwater because they have low molecular weights, high solubilities, and high vapor pressures. For this reason, they have a short residence in all media. Depending on substitution of the VOC molecule, densities may be more than that of water. For example, chlorinated or fluoridated compounds are heavier than water because of the halogen substitution. Densities become important when the solubility product has been exceeded, encouraging a dual phase of the VOC, specifically a dissolved phase and a non-aqueous-phase liquid. Degradation due to sunlight, biological activity, and oxidation reduction reactions will break down VOCs to intermediate compounds and eventually carbon dioxide and methane.

Soil-to-groundwater: This migration pathway was incomplete for surface soil, as no surface soil VOC exceedances were detected at OU 2. This data emphasizes the extreme volatility of these compounds and suggests that these compounds have migrated offsite or off gassed to the atmosphere.

Subsurface soils were found to contain VOCs. Comparing subsurface soil to groundwater VOC detections (Figure 4 to Figures 22, 24, 26, and 28, in Appendix E) indicates that the chlorinated VOCs and associated compounds observed in subsurface soil do not correspond to the contamination detected in groundwater analysis. The only area suggestive of VOC migration from soil to groundwater is around 11GI06, where PCE was detected in soil and only a suspected degradation product, vinyl chloride, was identified in downgradient wells. Of the chlorinated solvents detected in groundwater at OU 2, degradation products such as 1,2-DCE were identified, suggesting natural attenuation. The maximum concentration of any chlorinated solvent detected did not exceed 1% of its solubility product, supporting the observation that no dense non-aqueous phase liquids were present. To complicate the issue of degradation products, the areas under investigation did use products containing these "degradation" products.

For non-chlorinated VOCs such as fuel constituents, shallow wells were installed by screening across the water table. Intermediate wells were installed to investigate dense non-aqueous-phase liquids such as chlorinated solvents by terminating the well at the low-permeability zone clay. No free-phase liquids were observed in the bottom of any intermediate well, based on measurement with an interface probe. However, in shallow well 30GS12, free-phase floating liquids (fuels) were observed by interface probe and by bailer test. Additional wells and borings were installed to investigate the extent of floating product. No other wells exhibited floating product.

Based on Phase II data, most VOC groundwater exceedances are fuel constituents such as benzene, ethylbenzene, toluene, and xylene (compare Figure 5 to Figures 23, 25, 27, and 29). Of these,

benzene is the most soluble in water and rapidly biodegrades. As noted in Section 7, these contaminant are associated with a nearby UST.

Soil to air pathway: The surface/subsurface pathway was also incomplete. No indoor or outdoor air monitoring was conducted, except for personnel air monitoring. However, no soil VOC concentrations exceeded the USEPA SSL for transfer from soil to air, indicating that this pathway is not a concern at OU 2.

Surface soil-to-sediment: This pathway is incomplete. No volatiles were observed in sediment samples collected from Wetland 5A during the interim removal.

Groundwater-to-Surface Water

This pathway is incomplete as no volatiles were observed in surface water samples.

SVOCs

The chemical and physical properties with the influence on the fate and transport of SVOCs are solubility and the organic carbon/water partitioning coefficient. The partitioning coefficient ratio expresses the preference of an SVOC to ionize in water or to absorb to an organic carbon substrate. SVOCs have high molecular weights, high organic carbon partitioning coefficients, and moderate to low vapor pressures that do not encourage the volatilization of many SVOCs. The high partitioning coefficients suggest that SVOCs tend to bond to carbon substrates preferentially over ionization in water. Typical pathways for SVOCs are soil to groundwater, groundwater to surface water, and surface soil to sediment. Surface soil to air is not a viable pathway because these contaminants are not volatile. Some SVOCs can be classified by their ability to ionize in water, producing an acid or base. For this reason, SVOCs are often described as base, neutral, and acid-extractable organics. These organics often exhibit characteristics similar to bases and acids, and are more mobile as they ionize in water. Overall, neutral SVOCs are relatively

immobile in soil and diffuse rarely in water because the ionic bond with a soil particle is greater than the ionization potential in water.

Soil to Groundwater

When the SVOC analytical results in Figures 6, 7, 8, 9 for surface and subsurface soil are compared to the results for groundwater in Figures 30, 31, and 32, no correlation can be made between soil and groundwater contamination.

Groundwater to Surface Water

In order for this transport pathway to be viable, the SVOCs need to be water soluble. Naphthalene, phenol, 1,3-DCB, 1,4-DCB, and pentachlorophenol (Figure 30, 31, and 32) are slightly water soluble SVOCs found in groundwater of which none were found in surface water. This pathway is not complete for these contaminants.

Surface soil-to-sediment: This pathway lacks analytical data from a source. The roof runoff from buildings coated with asphalt compounds, roadway runoff, and parking lot runoff are a possible source for PAH compounds in Wetland 5A. Wetland 5A received wastes from an oil-water separator, thought to be the primary source of the SVOCs in Wetlands 5A and 5B adjacent to OU 2. This oil-water separator, which was described in Section 2 as a waste-receiving structure, was removed.

Pesticides/PCBs

The chemical and physical properties with the greatest influence on the fate and transport of pesticides/PCBs are solubility and organic carbon partitioning coefficient. Pesticides are designed to kill animals. To get inside the body of an animal, a pesticide must be miscible in water or soluble in a solvent (e.g., alcohol) that is water-soluble. For this reason, pesticides are generally more mobile than most large cyclic hydrocarbons. PCBs, multiple phenyl groups substituted with

chlorine, are very stable compounds known for their resistance to thermal and chemical degradation. Typical pathways include soil to groundwater, groundwater to surface water, and surface soil to sediment. Surface soil to air is not a viable pathway based on the low volatility of pesticides and PCBs. Pesticides/PCBs have moderate to high molecular weights and organic carbon partitioning coefficients, and generally low vapor pressures. Pesticides/PCBs tend to adsorb to soil particles. PCBs tend to be hydrophobic, that is, they avoid water, suggesting they are immobile in the environment.

Soil-to-groundwater and groundwater-to-surface water pathways

Because no pesticide or PCB exceedances were observed in Phase II groundwater data, the soil-to-groundwater and groundwater-to-surface water pathways are incomplete.

Surface soil-to sediment pathway

The only remaining pathway to consider for SVOCs is surface soil to sediment. From Figure 10, the only pesticide of concern is dieldrin, which was present around and under building foundations where it was applied. Figure 10 also shows that the PCBs were present around abandoned transformer pads. Neither area is subject to erosion and subsequent sediment transport. The Site 41 investigation will report pesticide/PCB impacts to wetlands adjacent OU 2 in detail.

Inorganics

Aqueous solubility has the greatest influence on the fate and transport of the inorganics tested for, TAL metals and cyanide. Cyanide, which easily degrades in the presence of an oxidizer or sunlight, was not detected at OU 2.

The chemical and physical properties with the greatest influence on the fate and transport of metals are pH, Eh, and solubility. Metals tend to adsorb to soil particles, ionize in water, and precipitate as a function of the pH and element-specific solubility product. Depending on the

electronegativity, large cations in phyllosilicates can be replaced by mobile metals. Metals are not degradable or volatile and tend to have moderate to low mobility. In environments where pH is less than 5 (i.e., acidic conditions), they can become mobile. Amphoteric metals such as zinc, tin, and aluminum are mobile at low pH, (<5.5) and at higher pHs (>8.3). Metals also move as colloidal suspensions, based on the electrical properties of the surrounding media, which media tend to dictate the fate and transport mechanisms. For example, metals bound to clay matrices or sequioxides of iron or manganese may be very difficult to mobilize. These matrices, which are extremely stable, require a lot of chemical energy to be released into an aqueous solution. Typical pathways for metals include soil to groundwater, groundwater to surface water, and surface soil to sediment. Surface soil to surface water is possible due to stormwater runoff from OU 2. Stormwater runoff was not sampled as part of this investigation.

Soil-to-groundwater

The soil to groundwater pathway contains numerous common metals. Figures 12 through 15 show the occurrence of surface soil metal exceedances while Figures 16 through 19 show the subsurface metal exceedances. Similar metals were found in groundwater during Phase I and II sampling events. Since Phase I sampling is thought to be biased by the sampling method affecting metals, Phase II results seen in Figures 48, 49 and 52 verify that this is an active pathway for metals transport. The metals present in adjacent receiving wetlands will be assessed under the Site 41 investigation.

Groundwater-to-surface water

Metals detected in groundwater were found in surface water. This pathway is suggested to be complete and active for several metals. The Site 41 RI is to assess the impact of these metals on these wetland resources.

Surface soil-to-sediment

Several metals observed in surface soil were found in sediments. This may be due to surface soil being transported to sediment or may be chemical precipitates or absorption from groundwater transport to sediment. In either case the complete assessment of the sediment contamination is the function of the Site 41 RI.

9.2 Other Properties Affecting Fate and Transport

The other environmental media properties used to evaluate fate and transport are TOC, bulk density, cation exchange capacity (CEC), porosity, and soil pH. The following briefly discusses these properties.

Table 9-1 summarizes the chemical and physical parameters of OU 2 soil used to evaluate fate and transport. The average CEC for OU 2 surface and near-surface soil (including subsurface soil 20 feet or less below land surface) is 3.16 milliequivalent per liter (mEq/L); for deeper soil (below 50 feet) it is 10.3 mEq/L. CEC ranges from 0.21 to 18 mEq/L for surface and near-surface soil and from 1 to 15 mEq/L for soil deeper than 50 feet. These values for CEC represent low part per million ion exchange storage for soil. Since the soils are fine-to medium-grained quartz sand, the mineral quartz is electrically stable, offering no binding sites. In a marine environment, sodium out competes most other elements for binding sites because it is so electropositive. These facts suggest a low capacity for OU 2 soils to bind any contaminants.

The average value for pH in OU 2 shallow groundwater samples is 6.36 standard units. pH values range from 4.43 to 7.40, indicating neutral to slightly acidic conditions. Overall, these soil conditions suggest limited mobility for metals by advection, diffusion, and dispersion, although mobilization of metals in groundwater is encouraged in areas where pH values are lower.

Table 9-1
Soil Parameters Used to Evaluate Fate and Transport
Surficial Zone: Shallow Depth/Intermediate Depth

Parameter	OU 2 Minimum Value	OU 2 Maximum Value	OU 2 Average Value	Units
Cation Exchange Capacity	0.21/1	18/15	3.16/10.3	mEq/L
Total Organic Carbon	80/480	5400/1700	1528/1103	mg/kg
pH[a]	4.34	7.4	6.36	--
Total Porosity[b]	0.349/0.372	0.387/0.431	0.369/0.403	--
Bulk Density[b]	1.643/1.503	1.720/1.665	1.674/1.581	g/cm3

Notes:
a = pH values compiled from groundwater samples.
b = Total porosity and bulk density values are based on OU 2 Shelby tube data.

The average TOC concentration for OU 2 surface and near-surface soil samples is 1,528 mg/kg, an amount that decreases with depth because soils deeper than 50 feet had an average of 1,103 mg/kg. These TOC measurements indicate low organic content providing few binding sites. Shelby tubes used to collect four vadose sand samples had an average porosity of 36.9% in permeable sands of the surficial zone aquifer. Porosity was measured in the laboratory. Similar analysis of four sand samples yielded an average porosity of 40.3% for permeable sands in the basal portion of the surficial zone aquifer. Because the deep samples had an average of 15.2% clay (clay content of shallow samples was 2.6%), a reduced figure of 35% was used as an effective porosity of the deeper samples for calculating mean groundwater velocity.

Assuming contaminants such as metals are mobile in groundwater, Table 9-2 lists the approximate travel time to a surface water receptor. These travel times depend on flow direction, local groundwater gradient, local hydraulic conductivity, and assumed mean effective porosity of the aquifer sand. The travel times represent a rough order of magnitude for bulk groundwater movement and transport due to advection only. Because dissolved constituents generally travel more slowly through an aquifer than groundwater does, this attenuation is estimated by using a common divisor of 20 (USEPA, 1996c), that is, a solute would travel within groundwater at about 1/20th the speed of its solvent.

Table 9-2
Travel Time Analysis
(Advective Transport Only)

Source Location		Hydraulic Conductivity (feet/day)[a]	Horizontal Gradient (—)	Effective Porosity (—)[b]	Horizontal Velocity (feet/day)	Horizontal Distance (feet)[c]	Travel Time (days)
Site 11	(011GS003, GS005)	282	0.00354	0.369	2.71	600	221
Site 12	(012GS03)	316	0.00415	0.369	3.55	1,120	315
	(012GS06)	282	0.00289	0.369	2.21	800	362
	(012GS14)	142	0.00513	0.369	1.97	550	279
Site 25	(025GS01)	232	0.00532	0.369	3.34	850	254
Site 26	(026GS04)	415	0.00347	0.369	3.90	550	141
Site 27	(027GS02)	342	0.00566	0.369	5.25	1,400	267
	(027GS04)	244	0.00699	0.369	4.62	800	173
Site 30	(030GS27)	307	0.00630	0.369	5.24	400	76
	(030GS154)	230	0.00712	0.369	4.44	150	34
	(030GS15)	243	0.00755	0.369	4.97	1,000	201

Notes:
a = Based on specific capacity test data from adjacent and downgradient monitoring wells.
b = Effective porosity is based on the mean of four Shelby tube samples collected in the vadose sand.
c = Horizontal distance is based on the potentiometric path of groundwater flow (Figure 3 of Appendix E).

9.3 Summary

Direct evidence of contaminant transport is considered if both the source and receptor media contain the same chemical contaminant. To be protective of groundwater, a CGL or SSL exceedance suggests a future pathway to a receptor media. Contaminants transported from soil to groundwater, groundwater to surface water, surface soil to air, and surface soil-to-sediment have been considered. The soil-to-groundwater pathway represents the most direct evidence by subsurface soil samples in which contaminants exceed a CGL or SSL. Metals, VOCs, SVOCs, and pesticides are at concentrations suggesting a threat to groundwater quality. No PCBs exceeded a leachability goal. Groundwater exceedances during Phase II directly support metals, SVOCs, and VOCs in groundwater.

The surface soil-to-air pathway applies to fugitive dusts or volatile compounds. Fugitive dusts were not monitored and apply only to surface soil results. VOCs apply only to surface soil since they are the only soil media exposed to the atmosphere. Other media such as subsurface soil and groundwater could degas, but not directly to the atmosphere. Both subsurface soil and groundwater would obviously degas to surface soil first. Since no RBCs for surface soil were exceeded, this pathway is not a concern. The NAS Pensacola subtropical temperatures and rainfall help to minimize this pathway.

The groundwater-to-surface water, surface soil to sediment, and surface soil to surface water pathways from the OU 2 sites to adjacent wetlands and Bayou Grande will be investigated in detail in the RI/FSs for Sites 40 (Bayou Grande) and 41 (NAS Pensacola Wetlands). Specifically, the Site 41 investigation will investigate the impacts of contaminant transport from Site 30 to adjacent Wetlands 5A and 5B, along with associated impacts from Sites 25 and 27. It will also cover the impacts of contaminant transport from Site 11 to adjacent wetlands that are upstream from the Yacht Basin in Bayou Grande. The Sites 40 and 41 RI/FSs will assess the nature and extent of contamination affecting the wetlands and Bayou Grande, ecological impacts to these bodies, and associated human health risks. These preliminary results are used to justify and scope the Site 40 and 41 investigations.

10.0 BASELINE RISK ASSESSMENT

10.1 Introduction

A baseline risk assessment analyzes the potential adverse effects on actual or hypothetical human and ecological receptors that could arise from exposures to hazardous substances released from a site if no remedial actions are taken to reduce the extent of environmental contamination. This BRA is divided into two sections; one addresses the human health risk and the second assesses ecological risk. Section 10.2 discusses health risk assessments (HHRA) methods used for every OU 2 site. This general discussion is applicable to all sites and has been provided in a separate section to avoid redundancy. Site-specific human HHRA provided in Section 10.3 are broken into subsections. Supporting tables have been provided at the end of each subsection for easy reference.

- Section 10.3.1 — Site 11 HHRA
- Section 10.3.2 — Site 12 HHRA
- Section 10.3.3 — Site 25 HHRA
- Section 10.3.4 — Site 26 HHRA
- Section 10.3.5 — Site 27 HHRA
- Section 10.3.6 — Site 30 HHRA

Section 10.4 briefly discusses toxicological properties for each COPC identified for OU 2. Section 10.5 presents the methods and results of the ecological risk assessment.

The HHRAs for OU 2 were prepared in accordance with the guidelines set forth in:

- *Risk Assessment Guidance for Superfund (RAGS), Volume I — Human Health Evaluation Manual (Part A)*, (USEPA, 1989b).

- *RAGS, Volume I — Human Health Evaluation Manual (Part B, Development of Risk-Based PRGs)*, (USEPA, 1991c).

- *Dermal Exposure Assessment: Principles and Applications — Interim Report,* ORD, EPA/600/8-91/011B, January 1992 (USEPA, 1992c).

- Supplemental Guidance to RAGS: Region IV Bulletin, *Human Health Risk Assessment — Interim*, (USEPA Region IV, 1995b).

- Supplemental Guidance to RAGS: Region IV Bulletin, *Development of Health-Based Preliminary Remediation Goals, Remedial Goal Options (RGOs) and Remediation Levels* (Supplemental RGO Guidance) (USEPA, 1995c).

- Supplemental Guidance to RAGS: Region IV Bulletin, *Provisional Guidance of Quantitative Risk Assessment of PAHs* (PAH Guidance) (USEPA, 1993a).

- *Exposure Factors Handbook* (USEPA, 1989c).

- USEPA Region III *Risk-Based Concentration Table.* USEPA Region III, Office of RCRA, Philadelphia, Pennsylvania (USEPA, 1996a).

- *Groundwater Guidance Concentrations.* FDEP Division of Water Facilities, Bureau of Drinking Water and Groundwater Resources, Tallahassee, Florida (FDEP, 1994b).

- *Memorandum-Soil Cleanup Goals for Florida.* FDEP Division of Waste Management, Tallahassee, Florida (FDEP, 1995).

- *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering*, (USEPA, 1991e).

These references are identified fully in Section 12.

HHRA Objectives

The objectives of the HHRA are to:

- Characterize the source media and determine the chemicals of potential concern (COPCs) for affected environmental media.

- Identify potential receptors and quantify potential exposures for those receptors under current and future conditions for all affected environmental media.

- Qualitatively and quantitatively evaluate the adverse effects associated with site-specific COPCs in each medium.

- Characterize the potential baseline carcinogenic risk and noncarcinogenic hazards associated with exposure to impacted environmental media at OU 2 under current and future conditions.

- Evaluate the uncertainties related to exposure predictions, toxicological data, and resultant carcinogenic risk and noncarcinogenic hazard predictions.

- Establish remedial goal options (RGOs) to facilitate risk management decision-making for chemicals of concern (COCs) in each environmental medium based on risk/hazard.

Organization

A HHRA, as defined by *RAGS Part A,* includes the following steps:

- *Site Characterization:* Evaluation of data regarding site geography, geology, hydrogeology, climate, and demographics.

- *Data Collection:* Analysis of environmental media samples, including background/reference samples.

- *Data Evaluation:* Statistical analysis of analytical data to identify the nature and extent of contamination and to establish a preliminary list of COPCs based on risk-based and background screening. This list will subsequently be refined to identify COCs.

- *Exposure Assessment:* Identification of potential receptors under current and predicted conditions, visualization of potential exposure pathways, calculation of exposure point concentrations (EPCs), and quantification of chemical intakes.

- *Toxicity Assessment:* Qualitative evaluation of the adverse effects of the COPCs, and quantitative estimate of the relationship between exposure and severity or probability of effect.

- *Risk Characterization:* A combination of the outputs of the exposure assessment and the toxicity assessment to quantify the total noncancer and cancer risk to hypothetical receptors.

- *Uncertainty:* Discussion and evaluation of the areas of recognized uncertainty in HHRAs in addition to medium- and exposure pathway-specific influences.

- *Risk/Hazard Summary:* Presentation and discussion of the quantification of exposure results (risk and hazard) for potential receptors and their exposure pathways, identified under current and future conditions.

- *Remedial Goal Options:* Computation of exposure concentrations corresponding to risk projections within the USEPA target risk range of 10^{-6} to 10^{-4} for carcinogenic COCs and Hazard Quotient (HQ) goals of 0.1, 1, and 3 for noncarcinogenic COCs.

This general process was followed in preparing the HHRA for each site at OU 2.

10.2 OU 2 Human Health Risk Assessment Methods

10.2.1 Site Characterization

The focus of each site is detailed in the "Site Background and Investigative Approach" section. Comprehensive tables list identification numbers and analytical methods used for each sample. At most sites, sampling consisted of collecting surface and subsurface soil samples, in addition to groundwater samples from monitoring wells installed in the shallow and intermediate zones of the aquifer underlying the sites. Analytical results from surface soils, subsurface soils, and shallow and intermediate groundwater were used to assess possible human exposure to environmental contaminants. Subsurface soil results were also evaluated in Section 9, Fate and Transport, with respect to contaminant migration from soil to groundwater.

10.2.2 Data Sources

As part of each investigation, soil, groundwater, surface water, sediment, and/or other samples of applicable environmental media samples were collected and analyzed to delineate the sources, nature, and extent of any contamination associated with current or past site operations. The data used in the HHRA for each site were obtained from the RI sample results.

Environmental samples were collected for the OU 2 RI from June to December 1993 (excluding later supplemental groundwater sampling). Several laboratories provided analytical services for RI samples including CompuChem Inc., NET Inc., IT Inc., and Savannah Inc. Samples were analyzed according to USEPA DQO Level IV. The analytical methods and DQO laboratory deliverables are summarized in Section 8.

10.2.3 Data Validation

Data validation is an after-the-fact, independent, systematic process of evaluating data and comparing them to established criteria to confirm they are of the technical quality necessary to support RI/FS decisions. Parameters specific to the data are reviewed to determine whether they meet the stipulated DQOs. The quality objectives address five principal parameters: precision, accuracy, completeness, comparability, and representativeness. To verify that these objectives are met, field measurements, sampling and handling procedures, laboratory analysis and reporting, and nonconformances and discrepancies in the data are examined to determine compliance with appropriate and applicable standards. Data for the OU 2 RI were validated in accordance with the USEPA CLP Functional Guidelines, discussed in Section 8.

10.2.4 Management of Site-Related Data

All environmental sampling data were evaluated for use in the quantitative HHRA. Data obtained by the following methods were not appropriate for the quantitative HHRA:

- Analytical methods that are not specific to a particular chemical, such as TOC or total organic halogen.

- Field screening instruments including total organic vapor monitoring units and organic vapor analyzers.

Data Management for Calculating UCL

The HHRA addresses limitations of analytical results by estimating concentrations of nondetected parameters. A nondetect indicates the analyte was not detected above the sample quantitation limit (*U*-qualified results), which is determined by the analytical method, the instrument used, and possible matrix interferences. However, a nondetected analyte could be present at any concentration between zero and the quantitation limit. For this reason, one-half the *U*-qualified results serves as an unbiased estimate of the nondetect. Because the estimated values of "J" qualified hits are frequently much lower than the sample quantitation limits of "U" qualified nondetects for organic compounds, one-half of each "U" value will be compared to one-half of the lowest hit (normally "J" qualified) at the same site. The lesser of these two values will be used as the best estimate of the concentration potentially present below the sample quantitation limit, and will be inserted into the adjusted dataset. For inorganic chemicals, one-half of each *U* value represented the concentration of the corresponding sample when compiling the adjusted data set. If a parameter was not detected, neither data management method was applied, and the parameter was not considered in screening or formal assessment.

Once the data set was complete, statistical methods were used to evaluate the analytical results identifying COPCs and establishing EPCs at potential receptor locations. The rationale used to develop this methodology and the statistical techniques to implement it are based on the following sources:

- *RAGS Part A*
- *Statistical Methods for Environmental Pollution Monitoring* (Gilbert, 1987)
- *Supplemental Guidance to RAGS: Calculating the Concentration Term* (USEPA, 1992d)
- *Supplemental Guidance to RAGS: Human Health Risk Assessment* (USEPA, 1995b)

Microsoft FoxPro and Borland Quattro Pro[1] were used to manage data and calculate statistics. For each set of data describing the concentration of chemicals in a contaminated area, the following information was tabulated: frequency of detection, range of nondetected values, range of detected values, average of detected concentrations, and the calculated 95% upper confidence limit (UCL) for the mean of the concentration's log-transformed values. In accordance with *RAGS*, the lesser of either the maximum concentration detected or the UCL was used to quantify potential soil exposure. The greater of the arithmetic mean of detected concentrations or the UCL was used to quantify potential groundwater exposures. This procedure is detailed in Section 10.2.7, Exposure Assessment.

10.2.5 Selection of Chemicals of Potential Concern

This section of the HHRA screens the CPSS at each site in order to develop a list of COPCs. COPCs are selected by comparing CPSS with screening concentrations (risk-based and reference), intrinsic toxicological properties, persistence, fate and transport characteristics, and cross-media transport potential. For any COPC to be considered a COC, thus warranting assessment for remedial action, it must meet two criteria. First, it must contribute to an exposure pathway with an incremental lifetime excess cancer risk (ILCR) greater than 10^{-6} or a hazard index (HI) greater than 1 for any exposure scenario evaluated in the risk assessment. Secondly, the COPC must have an individual risk projection greater than 10^{-6} or an HQ greater than 0.1. ILCR, HQ, and HI are

[1] Reference to specific software products is not to be construed as an endorsement by the U.S. Navy or E/A&H.

discussed in Sections 10.2.8 and 10.2.9 of this report. Results of the COPC selection process for individual sites are provided in Section 10.3.

Before evaluating the potential risks/hazards associated with site media, it was first necessary to delineate site contamination. The chemicals detected in environmental media represent the CPSS for each site. To reduce the list of CPSS and focus the risk assessment on COPCs, two comparisons were made, as described below.

Comparison of Site-Related Data to Risk-Based Screening Concentrations

The maximum concentrations of CPSS were compared to risk-based screening values obtained from three sources: *Determination of COCs by Risk-Based Screening, USEPA Region III,* March 18, 1994 (USEPA, 1994c) and subsequent versions; Memorandum — Soil Cleanup Goals for Florida; and *Florida Groundwater Guidance Concentrations*. A risk goal of 10^{-6} was used to calculate screening concentrations for carcinogens. Target HQs of 1 or 0.1 were used to calculate Florida and USEPA Region IV noncarcinogenic screening concentrations, respectively.

Groundwater results were compared with USEPA's tap water RBCs or Florida Groundwater Guidance Concentrations. Reported soil concentrations were compared with residential soil ingestion RBCs or Florida residential soil cleanup goals. The soil screening value for lead was set at 400 mg/kg, consistent with recent OSWER directives considering protection of a hypothetical child resident. The lead groundwater screening value used was the USEPA Office of Water treatment technique action level (TTAL) of 15 μg/L. An Ra-226 soil screening value of 5 picoCuries per gram (pCi/g) for surface soil (0 to 15 centimeters) was established in the technical memorandum *Results of Radiological Investigations, Sites 25 & 27, Naval Air Station Pensacola* (Appendix D). Ra-226 MCL of 5 pCi/L established by FDEP was used as a screening value for radium in groundwater.

In accordance with Region IV *Supplemental Guidance to RAGS* (USEPA, 1993a), BEQs were computed, where appropriate, by multiplying the reported concentration of each of the seven carcinogenic PAHs (benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) by its corresponding TEF. The BEQ values were then summed for each sample, and the total was compared with the benzo(a)pyrene RBC during the screening process. Subsequent exposure quantification and risk/hazard projections for carcinogenic PAHs in soil and groundwater used total BEQ values for each sampling location rather than individual compound concentrations.

CPSS with maximum detected concentrations exceeding their corresponding concentrations, goals, levels, and/or standards were retained for further evaluation and reference screening in the risk assessment. Screening values based on surrogate compounds were used if no screening values were available. Selection of surrogate compounds was based on structural, chemical, or toxicological similarities.

Comparison of Site-Related Data to Background Concentrations

The background reference concentration is a fixed value determined exclusively for inorganics to represent naturally occurring levels for a chemical in a specific matrix. Soil and groundwater background concentrations were determined for NAS Pensacola using results from two background sampling locations. After risk- and hazard-based screening values were compared, CPSS were retained for further consideration as COPCs in the HHRA if their maximum detected concentrations exceeded corresponding background reference concentrations. This comparison helps account for chemicals that are common in nature, such as aluminum, manganese, and arsenic. Thus risk and/or hazard associated with naturally occurring chemicals are not addressed where concentrations are not above background concentrations.

If the maximum concentration of a CPSS was determined to be less than either the background or risk-based screening value, the CPSS was not considered further in the risk assessment unless deemed appropriate based on chemical-specific characteristics (e.g., degradation product with greater toxicity). Background radiation data are presented in the technical memorandum (Appendix D); however, only comparison to the soil screening value was used as a COPC trigger for radiological CPSS.

Elimination of Essential Elements: Calcium, Magnesium, Potassium, and Sodium

In accordance with *RAGS Part A*, essential elements that are potentially toxic only at extremely high concentrations may be eliminated as COPCs in a risk assessment. Specifically, an essential nutrient may be screened out of a risk assessment if its concentrations are not associated with adverse health effects. Based on *RAGS*, the lack of risk-related data, and USEPA Region IV's recommendations, the essential nutrients calcium, magnesium, potassium, and sodium were eliminated from the HHRA. In the same context, iron was considered an essential nutrient, but the provisional reference dose available for iron was used to establish a health-based screening concentration. Iron data were summarized and compared to the resultant RBCs in the tables used to select COPCs. The provisional reference dose for iron was not used to calculate hazard quotient values in the formal risk assessment. Uncertainty discussions were provided for instances where iron exceeded its RBC.

10.2.6 Calculation of Risk and Hazard

As previously discussed, CPSS exceeding their screening values are considered COPCs. The subsequent identification of COCs is a two-step process. First, exposure pathways exceeding the USEPA and FDEP screening criteria are identified. Identifying COCs from the refined list of COPCs involves calculating chemical-specific cancer risks and HQs for COPCs, estimating exposure-pathway risk/hazard, evaluating frequency and consistency of detection, determining relative chemical toxicity, and comparing the COPCs with background concentrations. In the next

step, COPCs that individually exceed 10^{-6} ILCR or an HQ greater than 0.1 in a pathway of concern are retained as COCs. Section 10.2.8 discusses cancer risk thresholds and noncancer toxicity.

10.2.7 Exposure Assessment

The HHRA determines the magnitude of contact a potential receptor may have with site-related COPCs. Exposure assessment involves four stages:

- Characterizing the exposure setting and land use.
- Identifying potentially exposed populations, under various land uses or site conditions, and the pathways through which they might be exposed.
- Identifying COPC release and migration pathway(s).
- Quantifying the intake rates, or contact rates, of COPCs as exposure point concentrations.

Exposure Setting and Land Use

This section of each HHRA describes the basic layout of the individual site as well as suspected source(s) of contamination. In addition, current and projected future use of the site is discussed if information was available. For many OU 2 sites, features such as asphalt/concrete surfaces, buildings, and fences would prevent and/or reduce exposure to impacted media if they are maintained under base re-use plans. Where site features affect how an individual might be exposed under current conditions, the impact for current land users is discussed. The assessments considered existing features as an additional exposure scenario within the site-specific HHRAs (exposure quantification and risk characterization sections).

Potentially Exposed Populations

In each site-specific HHRA, this section describes who may be exposed to contaminants in environmental media. For the OU 2 HHRAs, the potentially exposed populations considered were current and future site workers, as well as hypothetical future site residents. Because current workers at most sites within OU 2 would be expected to have limited contact with contaminated media, worker-related exposure was addressed exclusively for maximally exposed future site workers. This approach, while providing a reasonably conservative assessment of future site worker risk/hazard, also renders a highly conservative approximation of risk/hazard for current site workers. It also accounts for the fact that the specific nature of future industrial uses cannot be definitively stated. Although adolescent trespassers would not be likely to frequent all OU 2 sites, some of the sites were considered attractive to this exposure population. As a result, the adolescent trespasser scenario is addressed for all sites. Construction events normally last less than a year and are therefore not likely to result in chronic, direct, uniform exposure to subsurface soil conditions (defined as 2 feet to the top of the water table). To provide a reference point for the potential risk and hazard resulting from direct contact to subsurface soil conditions, construction worker PRGs were developed and compared to subsurface soil data. A formal risk assessment was not performed for the construction worker, but the PRGs could be used as remedial goals for subsurface soil, assuming indirect exposure to contaminants through a secondary medium (e.g., soil-to-groundwater migration) is not an overriding concern at the site.

Exposure Pathways

This section of each HHRA summarizes how potential receptors (site workers, residents, etc.), may be exposed to contaminated media. In general, soil matrix-related pathways include incidental ingestion and dermal contact. For groundwater, ingestion and inhalation of volatilized contaminants were the primary exposure pathways evaluated. Indirect exposure to contaminants in soil is addressed by comparing data with soil screening levels governing the migration of contaminants between media. When screening results identify areas where indirect exposure to

soil contaminants is significant, additional pathways are considered in the site-specific risk assessment.

Exposure Point Concentrations

The EPC is the contaminant concentration in an exposure medium that will be contacted by an actual or hypothetical receptor. Determining the EPC depends on factors such as:

- Availability of data
- Amount of data available to perform statistical analysis
- Reference concentrations not attributed to site impacts
- Location of the potential receptor

USEPA Region IV guidance assumes lognormal distributions for environmental data and calculates the 95% UCL for mean concentrations to quantify exposure. Applying the UCL is generally inappropriate with fewer than 10 samples, and thus the maximum concentration detected was used instead. In general, outliers were included when calculating the UCL because high values seldom appear as outliers for a lognormal distribution. Including outliers increases the overall uncertainty of the calculated risks and conservatively increases the estimate of the human health threat.

For sample sets of 10 and greater, the UCL was calculated for a lognormal distribution as follows:

$$\left(\bar{a} + 0.5 s_a^2 + \frac{H_{0.95} \; x \; s_a}{\sqrt{n-1}} \right)$$

$$UCL = e$$

where:

$\bar{a}$	=	$\Sigma a/n$ = sample arithmetic mean of the log-transformed data, $a = \ln(x)$
s_a	=	sample standard deviation of the log-transformed data
n	=	number of samples in the data set
$H_{0.95}$	=	value for computing the one-sided 95% upper confidence limit for a lognormal mean from standard statistical tables (Gilbert, 1987)

Calculated values for the 95% UCL are tabulated (where applicable) in each HHRA. The tables statistically summarize COPCs identified in each environmental medium. Included for each COPC are the number of samples analyzed, mean and standard deviation of the natural log-transformed data (including nondetect values), the H-statistic, the maximum of detected concentrations, and background concentrations (where available). For media from which fewer than 10 samples were collected, the maximum positive detection of each COPC was used as the EPC to compute exposure.

In some instances, factors were derived to modify the EPC to account for the fraction ingested/fraction contacted (FI/FC) from the contaminated source. This approach was used where impacts were found to be extremely limited in areal extent (hot spots). Where this approach was taken, the basis for the decision is discussed in the site-specific HHRA (Section 10.3).

As previously discussed in Section 10.2.4 of this document, analytical results are presented as "nondetects" whenever chemical concentrations in samples do not exceed the detection or quantitation limits for the analytical procedures as applied to each sample. Generally, the quantitation limit is the lowest concentration of a chemical that can be reliably quantified at a concentration exceeding the normal, random noise of an analytical instrument or method. To apply the above-mentioned statistical procedures to a data set with reported nondetects for organic

compounds, one-half of the sample quantitation limit was inserted as a proxy concentration. If the detected concentrations for an individual site were consistently lower than the sample quantitation limits, then one-half of the lowest detected value at the site was used as a proxy concentration. For inorganic chemicals, one-half of the sample quantitation limit was used as the proxy concentration. This is a reasonable way to address the uncertainty of unusually high sample quantitation limits, and it reduces the bias (positive or negative) in the calculated UCL.

USEPA Region IV supports use of the arithmetic mean of concentrations in the most concentrated area of a plume as an EPC for estimating groundwater exposures (*Supplemental Guidance to RAGS: Region IV Bulletins*, 1995b). Most sampling regimes are designed to define the extent of a plume, potentially resulting in biased placement of monitoring wells in uncontaminated areas of the aquifer, thus causing a low concentration bias. Since many groundwater COPCs were not members of a well-defined plume, a simplifying assumption was made defining a separate plume for each COPC at a given site. To guard against inadequacies in this simplification, the traditional 95% UCL was calculated based on the data from all site monitoring wells. Whichever was larger — the arithmetic mean of detected concentrations or the 95% UCL — was selected as the EPC for a given parameter at each site, producing a reasonable maximum exposure (RME) concentration for assessing risk. To supplement the groundwater risk assessment, risk maps equating risk with each monitoring well are provided along with supporting tables listing concentration, risk, and hazard for each COPC. These tables were used to estimate the groundwater risk and hazard based on the maximum concentration of each COPC. This method is preferred by FDEP when presenting RME risk. Since a production well could be established in areas of high contamination in future use scenarios, the risk assessment uses the above-mentioned reasonable worst case assumptions to estimate potential exposure to and subsequent risk/hazard from groundwater. The RME risk/hazard projections could exceed those estimated for any specific point at the site.

Quantification of Exposure

This section describes the models, equations, and input parameter values used to quantify doses or intakes of COPCs for the surface soil and groundwater exposure pathways. The models are designed to estimate route- and medium-specific factors, which are multiplied by the EPC to estimate chronic daily doses. The intake model variables generally reflect 50th or 95th percentile values, which ensure that the estimated intakes represent the RME when applied to the EPC. Formulae were derived from *RAGS, Part A*, unless otherwise indicated. Table 10.2.7-1 lists input parameters used to compute chronic daily intake (CDI) for potential receptors of surface soil and/or groundwater contaminants. These pathway assumptions were applied for each site. Where other exposure routes/pathways were identified (or predicted), additional exposure quantification formulae are presented. Because future site use cannot be assumed with any certainty, conservative assumptions were used to account for any reasonable future use. Age-adjusted ingestion factors for potential future residential receptors (resident adult and resident child combined) were derived for carcinogenic endpoints. These factors consider the difference in daily ingestion rates for soil and drinking water, body weights, and exposure durations for children (ages 1 to 6) and adults (ages 7 to 31). The exposure frequency is assumed to be identical for the adult and child exposure groups.

Table 10.2.7-1
Parameters Used to Estimate CDI at RME for Surface Soil Ingestion and Dermal Contact

Pathway Parameters	Resident Adult	Resident Child	Adolescent Trespasser	Adult Worker	Units
Ingestion Rate (soil)	100[a]	200[a]	100[a]	50[a]	mg/day
Ingestion Rate (water)	2	1	NA	1	L/day
Exposure Frequency	350[b]	350[b]	52[b]	250[b]	days/year
Exposure Duration	24[c]	6[c]	10[c]	25[c]	years
Dermal Contact Area	4,100[d]	2,900[d]	4,100[d]	4,100[d]	cm^2
Skin Adherence Factor	1	1	1	1	mg/cm^2
Absorbance Factor:					
Organic	0.01	0.01	0.01	0.01	unitless
Inorganic	0.001	0.001	0.001	0.001	
Dermal Adjustment Factor:					
VOCs	0.8	0.8	0.8	0.8	unitless
Other organics	0.5	0.5	0.5	0.5	
Inorganics	0.2	0.2	0.2	0.2	
Conversion Factor	1E-6	1E-6	1E-6	1E-6	kg/mg
Body Weight	70[a]	15[a]	45[a]	70[a]	kg
Averaging Time:					
Noncancer	8,760[e]	2,190[e]	520[e]	9125[e]	days
Cancer	25,550[f]	25,550[f]	25,550[f]	25,550[f]	days

Notes:

a = USEPA (1989b) *Risk Assessment Guidance for Superfund Vol. I, Human Health Evaluation Manual (Part A).*

b = USEPA (1991d) Risk Assessment Guidance for Superfund Vol. I: Human Health Evaluation Manual Supplemental Guidance, Standard Default Exposure Factors Interim Final, OSWER Directive: 9285.6-03.EPA/600/8-89/043.

c = USEPA (1991c), *Risk Assessment Guidance for Superfund: Vol. I — Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals)*, OSWER Directive 9285.7-01B.

d = Resident Adult accounts for head, hands, and forearms at 90th percentile values from Table 4B.1, *Exposure Factors Handbook*; assumes individual is clothed with shoes, long pants, and short sleeves; rounded up from 4,090 square centimeters (cm^2).
Resident Child accounts for head, hands, forearms, lower leg, and feet using 90th percentile total body surface area values for male children 1 to 6-years old (6,000 cm^2 assumed for 1 to 2 years old); because individual body part information is not available for 5 to 6 year-olds, mean of other groups was assumed. Forearm surface area set equal to 46% of full arm; lower leg set equal to 41% of full leg measurement.

e = Calculated as the product of exposure duration (years) x 365 days/year.

f = Calculated as the product of 70 years (assumed lifetime) x 365 days per year.

NA = Not applicable.

Surface Soil Pathway Exposure

Ingestion of COPCs in Surface Soil

The following equation is used to estimate the ingestion of COPCs in soil:

$$CDI_s = (C_s)(IR)(EF)(ED)(F)(FI)/(BW)(AT)$$

where:

CDI_s	=	ingested dose (mg/kg-day)
C_s	=	concentration of contaminant in soil (mg/kg)
IR	=	ingestion rate (mg/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
F	=	conversion factor (10^{-6} kg/mg)
FI	=	fraction ingested from contaminated source (unitless)
BW	=	body weight (kg)
AT	=	averaging time (days)

Dermal Contact with COPCs in Surface Soil

The following equation is used to estimate intake due to dermal contact with COPCs in soil:

$$CDI_{sd} = (C_s)(SA)(EF)(ED)(F)(FC)(DAF)(AF)/(BW)(AT)$$

where:

CDI_{sd}	=	dermal dose (mg/kg-day)
C_s	=	concentration of contaminant in soil (mg/kg)
SA	=	exposed skin surface area (cm^2/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
F	=	conversion factor (10^{-6} kg/mg)
FC	=	fraction contacted from contaminated source (unitless)
DAF	=	dermal absorption factor (unitless value, specific to organic versus inorganic compounds)
AF	=	adherence factor (mg/cm^2)
BW	=	body weight (kg)
AT	=	averaging time (days)

Groundwater Pathway Exposure

Ingestion and Inhalation of COPCs in Groundwater

The following equation estimates the ingestion and/or inhalation of COPCs in the GW pathway:

$$CDI_w = (C_w)(IR)(EF)(ED)(FI)/(BW)(AT)$$

where:

CDI_w	=	ingested/inhaled dose (mg/kg-day)
C_w	=	concentration of contaminant in water (mg/L)
IR	=	ingestion rate (L/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
FI	=	fraction ingested from contaminated source (unitless)
BW	=	body weight (kg)
AT	=	averaging time (days)

Figures 10-1 and 10-2 list formulae for calculating the CDIs for soil and groundwater, respectively. Tables in each HHRA quantify exposure through all applicable pathways. Future site worker and hypothetical site resident exposure are projected separately. In accordance with USEPA guidance, the potential exposure to volatiles originating from groundwater during showering and domestic use is estimated to be equivalent to that ingested by consuming 2 liters/day of contaminated groundwater. Although the inhalation CDI computed on this basis equals that for ingestion exposures, risk and/or hazard associated with inhaled volatile contaminants are characterized using toxicological values specific to the inhalation pathway (e.g., inhalation slope factors [SF_is] and reference doses [RfDs]).

Figure 10-1
Formulae for Calculating CDI for Surface Soil

SOIL INGESTION PATHWAY
Residential Scenario:
Noncarcinogens — Child:

$$CDI_{NC-C} = \frac{C_S * IR_{soil/child} * EF_{res} * F * FI * ED_{child}}{AT_{NC-C} * BW_{child}}$$

Noncarcinogens — Adult:

$$CDI_{NC-A} = \frac{C_S * IR_{soil/adult} * EF_{res} * F * FI * ED_{adult}}{AT_{NC-A} * BW_{adult}}$$

Carcinogens (based on a lifetime weighted average):

$$CDI_C = \frac{C_S}{AT_C}\left[\frac{IR_{soil/child} * EF_{res} * F * FI * ED_{child}}{BW_{child}} + \frac{IR_{soil/adult} * EF_{res} * F * FI * ED_{adult}}{BW_{adult}}\right]$$

SOIL DERMAL CONTACT PATHWAY
Residential Scenario:
Noncarcinogens — Child:

$$CDI_{NC-C} = \frac{C_S * SA_{child} * AF * DAF * EF_{res} * F * FC * ED_{child}}{AT_{NC-C} * BW_{child}}$$

Noncarcinogens — Adult:

$$CDI_{NC-A} = \frac{C_S * SA_{adult} * AF * DAF * EF_{res} * F * FC * ED_{adult}}{AT_{NC-A} * BW_{adult}}$$

Carcinogens (based on a lifetime weighted average):

$$CDI_C = \frac{C_S}{AT_C}\left[\frac{SA_{child} * EF_{res} * F * FC * DAF * AF * ED_{child}}{BW_{child}} + \frac{SA_{adult} * EF_{res} * F * FC * DAF * AF * ED_{adult}}{BW_{adult}}\right]$$

Figure 10-1 (continued)

Formulae for Calculating CDI for Surface Soil

Variable	Description
BW_{child}	average child body weight (ages 1-6) (kg)
BW_{adult}	average adult body weight (kg)
DAF	absorbance factor (unitless value specific to organic versus inorganic compounds)
AF	adherence factor (1 mg/cm^2)
ED_{child}	child exposure duration during ages 1-6 (yr)
ED_{adult}	adult exposure duration during ages 7-31 (yr)
$Ed_{adult-w}$	adult worker exposure duration (yr)
EF_{res}	residential exposure frequency (days/year)
EF_{w}	worker exposure frequency (days/year)
$IR_{soil/child}$	child soil intake rate (mg/day)
$IR_{soil/adult}$	adult soil intake rate (mg/day)
FC	fraction contacted from contaminated source (unitless)
SA_{child}	exposed skin surface area, child (cm^2/day)
SA_{adult}	exposed skin surface area, adult (cm^2/day)
AT_C	averaging time (carcinogen)
AT_{NC-A}	averaging time (noncarcinogen adult)
AT_{NC-C}	averaging time (noncarcinogen child)
C_s	chemical concentration in surface soil (mg/kg)
FI	fraction ingested from contaminated source (unitless)
F	conversion factor (10^{-6} kg/mg)

Notes:
CDI indicates chronic daily intake. The trespasser scenario risk and hazard were calculated by substituting trespasser-specific assumptions into the adult portions of the formulae and then deleting the child portions.

Figure 10-2
Formulae for Calculating CDI for Groundwater

GROUNDWATER INGESTION PATHWAY

Residential Scenario:

Noncarcinogens — Child:

$$CDI_{NC-A} = \frac{C_W * IR_{water/adult} * EF_{res} * ED_{adult}}{AT_{NC-A} * BW_{adult}}$$

Noncarcinogens — Adult:

$$CDI_{NC-A} = \frac{C_W * IR_{water/adult} * EF_{res} * ED_{adult}}{AT_{NC-A} * BW_{adult}}$$

Carcinogens (based on a lifetime weighted average):

$$CDI_C = \frac{C_W}{AT_C}\left[\frac{IR_{water/child} * EF_{res} * F * ED_{child}}{BW_{child}} + \frac{IR_{water/adult} * EF_{res} * F * ED_{adult}}{BW_{adult}}\right]$$

PATHWAY: GROUNDWATER INHALATION WHILE SHOWERING

Residential Scenario:

In accordance with *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering*, USEPA/ORD, July 10, 1991 (USEPA, 1991e):

$$CDI_{ingestion} = CDI_{inhalation}$$

Figure 10-2 (continued)
Formulae for Calculating CDI for Groundwater

Variable	Description
BW_{child}	average child body weight (ages 1-6) (kg)
BW_{adult}	average adult body weight (kg)
ED_{child}	child exposure duration during ages 1-6 (yr)
ED_{adult}	adult exposure duration during ages 7-31 (yr)
$Edadult\text{-}w$	adult worker exposure duration (yr)
EF_{res}	residential exposure frequency (days/year)
EF_{w}	worker exposure frequency (days/year)
$IR_{water/child}$	child water intake rate (mg/day)
$IR_{water/adult}$	adult water intake rate (mg/day)
AT_{C}	averaging time (carcinogen)
$AT_{NC\text{-}A}$	averaging time (noncarcinogen adult)
$AT_{NC\text{-}C}$	averaging time (noncarcinogen child)
C_{w}	chemical concentration in groundwater (mg/L)

Notes:
CDI indicates chronic daily intake. The worker scenario risk and hazard were calculated by substituting worker-specific assumptions into the adult portions of the formulae and then deleting the child portions of the formulae.

10.2.8 Toxicity Assessment

Carcinogenicity and Noncancer Effects

USEPA classifies the potential carcinogenicity of environmental contaminants based on the weight of scientific evidence. Cancer weight-of-evidence class "A" (human carcinogens) means that human toxicological data have proven a correlation between exposure and the onset of cancer (in varying forms). The "B1" classification indicates some human exposure studies have implicated the compound as a probable carcinogen. Weight-of-evidence class "B2" indicates a possible human carcinogen, based on positive laboratory animal data (for carcinogenicity) in the absence of human data. Weight-of-evidence class "C" identifies possible human carcinogens, and class "D" indicates a compound not classifiable for its carcinogenic potential. USEPA also has established cancer slope factors (SFs) for carcinogenic compounds, defined as a "... plausible upper-bound estimate of the probability of a response (cancer) per unit intake of a chemical over a lifetime" (*RAGS, Part A*).

Most substances can also produce other toxic responses at doses greater than experimentally derived threshold concentrations. USEPA has derived RfD values for these substances as an estimate, with uncertainty spanning an order of magnitude or greater of a daily exposure concentration for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Risk formulae use these toxicological values to assess the upper-bound level of cancer risk and noncancer hazard associated with exposure to a given contaminant concentration.

For carcinogens, the potential excess risk posed by a chemical is computed by multiplying the CDI (as mg/kg-day) by the SF (in reciprocal mg/kg-day). The HQ (for noncarcinogens) is computed by dividing the CDI by the RfD. USEPA sets standard limits (or points of departure) for carcinogens and noncarcinogens to evaluate whether significant risk is posed by a chemical (or combination of chemicals). For carcinogens, the point of departure is 10^{-6}, with a generally

accepted range of 10^{-6} to 10^{-4}. These risk values correlate with a one-in-10,000 and a one-in-1-million excess incidence of cancer resulting from exposure to xenobiotics (all pathways). Although USEPA considers a range of acceptable ILCR, FDEP fixes 1E-06 as the cumulative risk goal. Therefore, this one-in-1 million ILCR was used as the target for identifying COCs and/or problem pathways.

For noncarcinogens, other toxic effects are generally considered possible if the HQ (or sum of HQs for a pathway, HI) exceeds unity (a value of 1). Although both cancer risk and noncancer hazard are generally additive within each group only if the target organ is common to multiple chemicals, a most conservative estimate of each may be obtained by summing the individual risks or hazards, regardless of target organ. The following HHRAs take the universal summation approach for each toxicant class. The risk characterization section of this report details the use formulae as applied to site data.

Critical studies USEPA used in establishing toxicity classifications are shown in the Integrated Risk Information System (IRIS) database (primary source) and/or Health Effects Assessment Summary Tables (HEAST), Fiscal Year 1995 (secondary source). If toxicological information is unavailable in IRIS or HEAST, values were obtained from reports issued by the Environmental Criteria and Assessment Office (ECAO)/National Center for Environmental Assessment (NCEA). Where applicable, these values were also included in the database for these HHRAs. A table in Section 10.4, Brief Toxicology Profiles for COPCs, summarizes toxicological data for each COPC identified at OU 2 as RfDs and SFs obtained for the relevant COPCs, as well as their uncertainty/modifying factors, target organs, and cancer classes (where available).

Toxicity Profiles for COPCs

In accordance with *RAGS*, the HHRAs include brief toxicological profiles for all COPCs. Most information for the profiles was gleaned from IRIS and HEAST, and the toxicological database

information table. Any additional references are noted specifically in the profiles in Section 10.4, which summarize adverse effects of COPCs and the associated amounts.

10.2.9 Risk Characterization

Risk characterization combines exposure and toxicity assessment results to yield qualitative and quantitative expressions of risk and/or hazard for the exposed receptors. The quantitative component expresses the probability of developing cancer, or a nonprobabalistic comparison of the estimated dose with an RfD for noncancer effects. These quantitative estimates are developed for individual chemicals, exposure pathways, transfer, and source media, and for each receptor for all media to which one may be exposed. The, qualitative component compares COC concentrations in media with established criteria or standards for chemicals for which there are no corresponding toxicity values. The risk characterization guides risk management decisions.

The risk characterization follows the methodology prescribed by *RAGS Part A*, as modified by more recent information and supplemental guidance. USEPA methods are designed to be health-protective and tend to overestimate, rather than underestimate, risk. Risk results are conservative, because risk characterization involves multiplying conservative assumptions built into the exposure and toxicity assessments.

Each HHRA characterizes health risks associated with the intake of chemicals originating from each site. USEPA methods for estimating the types and magnitude of health effects associated with chemical exposure have been supplemented, where appropriate, by graphical representations of risk and hazard. This supplemental information is presented to more clearly depict problem areas at the relevant sites on scales specific to individual sampling points.

Risk Characterization Methodology

Potential excess risk to humans following exposure to COPCs is estimated using USEPA methods, where available, which are likely to overestimate risk. Risks from hazardous chemicals are calculated for either carcinogenic or noncarcinogenic effects. Some carcinogenic chemicals may also pose a noncarcinogenic hazard. The potential human health effects associated with chemicals that produce systemic toxic and carcinogenic influences are characterized for both types of health effects. As mentioned in Section 10.2.7, inhalation exposure-related risk and hazard were computed using appropriate route-specific SFs and RfDs (where available).

Unlike the methods for estimating amounts of inhaled or ingested COPCs, which quantify dosages presented to the barrier membranes (the pulmonary or gastrointestinal mucosa, respectively), dermal dosage is estimated according to what crosses the skin and is systemically absorbed. Thus, oral toxicity values must be adjusted to reflect the dermally absorbed dose.

Dermal RfD values and SFs are derived from the corresponding oral values. In deriving a dermal RfD, the oral RfD is multiplied by an oral absorption factor, expressed as a decimal fraction. The resulting dermal RfD is based on the absorbed dose, the appropriate value with which a dermal dose should be compared, because dermal doses are expressed as absorbed rather than administered (intake) doses. For the same reasons, a dermal SF is derived by dividing the oral SF by the oral absorption factor. The oral SF is divided rather than multiplied because SFs are expressed as reciprocal doses.

Appendix A of *RAGS, Part A*, states that in the absence of specific data, an assumption of 5% oral absorption efficiency would be relatively conservative. *Supplemental Guidance to RAGS: Region IV Bulletin* indicates that in the absence of specific data, USEPA Region IV suggests an oral-to-dermal absorption factor of 80% for VOCs, 50% for SVOCs, and 20% for inorganics.

These percentages (or associated fractions) were used in the HHRA and are reflected in the applicable risk/hazard results.

Carcinogenic Effects of Chemicals

Risk attributed to exposure to carcinogens is estimated as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. In the low-dose range, which would be expected for most environmental exposures, cancer risk is estimated from the following linear equation (*RAGS, Part A*):

$$ILCR = (CDI)(SF)$$

where:

ILCR = incremental lifetime excess cancer risk, a unitless expression of the probability of developing cancer, adjusted for reference incidence

CDI = chronic daily intake, averaged over 70 years (mg/kg-day)

SF = cancer slope factor $(mg/kg\text{-}day)^{-1}$

For a given pathway with simultaneous exposure of a receptor to several carcinogens, the following equation is used to sum cancer risks:

$$Risk_p = ILCR(chem_1) + ILCR(chem_2) + \ldots ILCR(chem_i)$$

where:

$Risk_p$ = total pathway risk of cancer incidence
$ILCR(chem_i)$ = incremental lifetime excess cancer risk for a specific chemical

Cancer risk for a given receptor across pathways and media is summed in the same manner.

Noncarcinogenic Effects of Chemicals

Risks associated with noncarcinogenic chemical effects are evaluated by comparing an exposure level or intake with an RfD. The HQ, defined as the ratio of intake to RfD, is defined as (*RAGS, Part A*):

$$HQ = CDI/RfD$$

where:

HQ	=	hazard quotient (unitless)
CDI	=	chronic daily intake (mg/kg-day)
RfD	=	reference dose (mg/kg-day)

Chemical noncarcinogenic effects are evaluated on a chronic basis, using chronic RfD values. An HQ of unity (or 1) indicates that the estimated intake equals the RfD. If the HQ is greater than unity, there may be a concern for potential adverse health effects.

For simultaneous exposure of a receptor to several chemicals, an HI will be calculated as the sum of the HQs by:

$$HI = HQ_1 + HQ_2 + \ldots HQ_i$$

where:

HI	=	Hazard Index (unitless)
HQ	=	Hazard Quotient (unitless)

Risk and hazard projections are tabulated for each medium following the general discussions of risk and hazard quantification methods. For most sites, surface soil, groundwater, and other pathways are included.

Surface Soil Pathways

This section of each HHRA summarizes estimated surface soil risk/hazard for each receptor group. In addition, the primary contributors to carcinogenic risk and/or noncarcinogenic hazard are discussed.

Groundwater Pathways

This section summarizes estimated groundwater risk/hazard for each receptor group. In addition, the primary contributors to carcinogenic risk and/or noncarcinogenic hazard are discussed.

Other Applicable Pathways

This section appears in HHRAs for sites with identified pathways other than soil and groundwater. It summarizes estimated risk/hazard for each receptor group and discusses the primary contributors to carcinogenic risk and/or noncarcinogenic hazard.

COCs Identified

The HHRA summarizes (in tabular form, where necessary) the outcome of risk/hazard projections by identifying COCs for each impacted environmental medium on cumulative (all pathway) risk and hazard projected for each site. USEPA has established a generally acceptable risk range of 10^{-4} to 10^{-6}, and an HI threshold of 1 (unity). To meet FDEP requirements, a COC was considered any chemical contributing to a cumulative risk level of 10^{-6} or greater and/or a cumulative HI above 1, and whose individual ILCR exceeds 10^{-6} or whose HQ exceeds 0.1. For carcinogens, this approach is conservative, as USEPA Region IV recognizes a cumulative risk of 10^{-4} (and individual ILCR of 10^{-6}) as the actionable trigger for establishing COCs. The COC

selection method provided a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGO development process.

Under the traditional risk-based COC trigger provisions, no carcinogenic COCs would be identified for a particular receptor group/pathway combination if the overall cumulative site risk is less than 10^{-4}. However, as described in Section 10.2.8 of this report, the cumulative risk threshold used to identify COCs in the following HHRAs is two orders of magnitude more conservative (10^{-6}), which supports the FDEP risk goal.

10.2.10 Risk Uncertainty

The HHRA presents and discusses the uncertainty and/or variability inherent in the risk assessment process in addition to medium-specific and exposure pathway-specific influences. Risk assessment sections are discussed separately below, and specific examples of uncertainty sources are included where appropriate.

General

Uncertainty is a factor in each step of the exposure and toxicity assessments summarized above. Overall, uncertainties associated with the initial stages of the risk assessment process become magnified when combined with other uncertainties. High-end estimates of potential exposure concentrations, frequencies, durations, and rates lead to conservative estimates of CDI. Toxicological values for chemicals from USEPA databases and other sources are generally derived from animal studies. Uncertainty and modifying factors are applied to predict potential human responses, providing a margin of safety based on confidence in the studies. During the risk characterization process, individual chemical risk is added to determine the ILCR for each exposure pathway. If the individual exposure predictions were calculated from the upper-limit estimates of exposure to each chemical, then the margin of safety of the cumulative incremental risk is the sum of all the individual safety margins applied throughout the process. Use of these

safety margins during all exposure and risk/hazard computations provides an extremely conservative prediction of potential human health effects. The margins of safety or "conservatisms" inherent in each step of the HHRA are addressed in the risk uncertainty discussions. It is not possible to eliminate all uncertainties or potential variability in the risk assessment process; however, recognizing the influences of these factors is fundamental to understanding and subsequently using risk assessment results.

The risk uncertainty section of each HHRA presents the uncertainty and/or variability of site-specific and medium/pathway-specific factors introduced as part of the risk assessment process, in addition to other factors influencing the uncertainty of the calculated ILCR and HQs/HIs. Calculated risk/hazard levels reflect the underlying variability of the analytical results on which they are based; they also embody uncertainty about potentially unsampled maxima and minima in the analytes. The exposure pathways selected in the exposure assessment section are extremely conservative.

Assumptions are based on population studies and USEPA guidance, which divides the assumptions into two basic categories: the upper-bound (90th to 95th percentile), and the mean or 50th percentile central tendency (CT) exposure assumptions. As discussed in the exposure assessment section, the RME exposure is based on the upper-bound assumptions, and CT exposure is based on mean assumptions. Therefore, risk and hazard calculated using RME exposure assumptions are generally overestimates rather than underestimates. The following paragraphs discuss sources of uncertainty and variability pertinent to each exposure pathway evaluated.

Quality of Data

Data collected during the OU 2 investigation are presented in Section 7 of this RI, which includes results from each site and review of those data. The data are evaluated to verify that the

QC requirements of the data set have been met and to characterize the weakness of questionable data.

Most analytical results for environmental samples have inherent uncertainty. This uncertainty is a function of the matrix characteristics and heterogeneity, the precision and accuracy of sampling, and preparation and analysis methods employed. Although data are typically considered to be exact values, they are in reality the laboratory's best estimate within a range defined by method control limits. As a result, reported concentrations for any chemical can under- or overestimate actual concentrations.

Exposure Pathways and Contaminants of Concern

Comparisons which used the most conservative set of screening values (residential land use), provided by USEPA and FDEP for each exposure medium, eliminated many CPSS from the formal assessment. Although potential cumulative effects associated with multiple chemicals dismissed through this process are a valid concern, the fact that maximum detected concentrations were used in the screening comparison alleviates much uncertainty. Although the screening method is highly conservative, inhalation and dermal exposure are not incorporated into the USEPA soil screening values. The FDEP screening values include inhalation and dermal exposures. If inhalation and dermal pathways were the primary concern (as opposed to ingestion) and an FDEP screening value did not exist, the screening method could eliminate contaminants that should otherwise be considered COPCs. Additional screening was done to evaluate OU 2 surface soil data relative to soil-to-air cross-media transport (via volatilization). Any constituents omitted based on comparison with residential RBCs that could significantly contribute to risk via other exposure pathways were reinstated on the list of COPCs, and the associated pathways were considered in the formal risk assessment.

Comparison With Reference Concentrations (Background)

Because the HHRA is intended to estimate the excess cancer risk or health hazard posed by COPCs, individual sample data values of inorganic chemicals were compared with background reference concentrations in the OU 2 RI after comparing the data to risk-based screening values. Additional uncertainty is introduced by comparing site data with nonspecific screening reference data. Although the background concentrations are specific to NAS Pensacola, they are not OU 2-specific.

Elimination of Essential Nutrients

In accordance with *RAGS*, the following nutrients were eliminated from OU 2 HHRAs: calcium, sodium, potassium, and magnesium. Toxicity from overexposure to these nutrients is possible only if human receptors are exposed to extremely high doses, and USEPA recommends eliminating these chemicals from formal risk assessment. Because no screening comparison was performed, the HIs calculated in the HHRA could be positively influenced by nutrient concentrations detected onsite. Therefore, the HIs are possibly underestimates.

Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative assumptions (e.g., future residential use) recommended by USEPA Region IV and FDEP when assessing potential and current exposure. Exposure assumptions for the site worker and adolescent trespasser scenarios are also very conservative and would tend to overestimate exposure. Current site workers are not exposed to site groundwater, and contact with soil is expected to be minimal due to coverage by existing features.

Hypothetical future site resident exposure to current soil conditions is unlikely. If this area were developed as residential, most of the present buildings would be demolished and surface soil conditions would likely change — the soil could be covered with roads, paved driveways,

landscaping soil, houses, and/or playgrounds. These factors indicate that exposure pathways assessed in the HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

To assess potential exposure under current site conditions, existing features were evaluated to determine whether they might preclude or minimize contact. Soil samples were collected underneath asphalt parking lots and road surfaces, buildings, and concrete slabs. Assuming future site use involves maintaining these structures, onsite workers would not be chronically exposed to soil beneath them. These factors were considered in calculating alternative EPCs for sites with significant surface features (where applicable) and generating descriptive text where formal analysis was deemed unnecessary.

CT was analyzed where chronic RME estimates of risk/hazard indicate that a significant threat would be posed to human health. CT exposure scenarios were constructed consistent with standard assumptions provided in *Superfund's Standard Default Exposure Factors for the CT and Reasonable Maximum Exposure-Draft* (USEPA, 1993b).

Groundwater is not currently used at NAS Pensacola as a source of potable or process water; water is obtained from a well field across Bayou Grande at NAS Correy Station, approximately 3 miles away. Thus, groundwater is not expected to be used under future use scenarios, and projections of risk/hazard from shallow groundwater exposure are highly conservative since associated pathways are not expected to be completed.

Determination of Exposure Point Concentrations

Based on USEPA guidance, EPCs are used to estimate CDI. The uncertainty associated with EPCs stems primarily from their statistical determination or the imposition of maximum concentrations, described below.

Statistical Estimation of Exposure Point Concentrations

USEPA's *Supplemental Guidance to RAGS: Calculating the Concentration Term* (USEPA, 1992d) outlines a statistical estimation of EPC. These calculated concentrations are 95% UCLs for the mean, based on the assumption that most environmental data are lognormally distributed. This assumption can lead to over- or underestimation of the concentration term because many environmental data are neither normally nor lognormally distributed.

The UCL calculation method includes a statistical value, the *H*-statistic, which is based on the number of samples analyzed for each COPC and the standard deviation of the results. To obtain this number, a table must be referenced and the value interpolated from the table. The equation for the *H*-statistic has not been provided in the supplemental guidance. Although the statistic appears to be nonlinear, local linearity was assumed to facilitate interpolation for each COPC addressed in the HHRAs.

Linear interpolation provides a good estimate of *H*; however, both the UCL formula and *H* are natural log values. The effect of multiplying natural log numbers is not equivalent to multiplying untransformed values. When data are log-transformed, adding two numbers is the equivalent of multiplying the untransformed values. The effect of multiplying a number in log form is exponential; and here, *H* is applied as a multiplier. In summary, using this method to calculate the UCL has the effect of overestimating, and often provides concentrations greater than the maximum detected onsite. For all data sets with fewer than 10 samples for a specific medium, the maximum concentrations detected were used as EPCs. The limited number of soil and groundwater samples used to assess site conditions often resulted in considerable variability between data points, and thus relatively high standard deviations about the mean. This high standard deviation elevates UCL projections.

Although *RAGS* advocates using neither worst-case scenarios nor maximum concentrations as EPCs, use of the *H*-statistic often necessitates using the maximum reported concentration as the EPC. In accordance with *RAGS*, the lesser value — either the maximum concentration or the UCL — is used as the EPC. As reviewed above, summation of risk based on maximum concentrations overestimates exposure, especially in the case of low detection frequency or spatially segregated COPCs. This concept is further discussed below.

Frequency of Detection and Spatial Distribution

Because of the influence of standard deviation on EPC, low detection frequency can cause COPCs to be addressed inappropriately. COPCs detected only once or twice in all samples analyzed (having concentrations exceeding the RBCs and reference concentrations) would be expected to have relatively higher standard deviations as concentration variability or range widens. Higher standard deviation results in a high *H*-statistic, typically leading to a UCL greater than the maximum concentration detected onsite. If that occurs, then using the UCL or maximum detected concentration as the EPC (or possibly including the COPC in question as a COC) may not be appropriate when EPC is assumed to be widely distributed spatially. It is not likely that a receptor would be simultaneously exposed to maximum concentrations of different contaminants at several locations. Using the maximum concentrations (or the UCL) is questionable for these contaminants, and the calculated risk and hazard could be skewed upward due to the low frequency of detection.

In some instances, hot spots may occur in the investigation area. A hot spot is an isolated area of concentrated contamination within a larger area which is not impacted, or much less so. Exposure in a hot spot may be quantified by calculating an FI/FC from contaminated source factor based on the percentage of the total hot spot area, then using this term to modify the maximum (or restricted area average) contaminant concentration to derive the EPC.

Phase I and Phase II Groundwater Data

Two phases of groundwater sampling were conducted at OU 2. The first phase was conducted in 1993 using a sampling technique which may have resulted in samples with artificially high concentrations of sediment-bound parameters such as inorganics and pesticides, and artificially low concentrations of VOCs. The second phase was conducted in 1995 to assess the validity of Phase I data, using a quiescent sampling technique which limits such interferences. The groundwater samples collected and parameters analyzed are presented in Section 5.2.4 of this report.

Phase I and Phase II groundwater data comparisons seem to support the initial premise regarding the Phase I sampling technique. Since groundwater samples were not filtered prior to analysis, Phase I results reflect sediment-borne constituents rather than true groundwater quality. Also, natural attenuation and dispersion may account for differences in sampling results due to the length of time between them. These factors contribute uncertainty to the risk assessment process.

Toxicity Assessment Information

In human toxicological risk assessment, values developed from experimental data generally contain uncertainty primarily due to the uncertainty of data extrapolation in the areas of: (1) high to low dose exposure, and (2) animal data to human experience. The site-specific uncertainty occurs mainly in the degree of accuracy of the exposure assumptions. Most assumptions used in this and any risk assessment have not been verified. For example, the degree of chemical absorption from the gut or through the skin or the amount of soil contact is not known with certainty.

Where available, the uncertainty of IRIS and HEAST toxicological values is summarized in each HHRA. The uncertainty factors assigned to these values account for acute to chronic dose extrapolation, study inadequacies, and sensitive subpopulations, among other factors. Although uncertainty factors for a specific compound may be 1,000 or higher, they are applied by USEPA

to help guarantee that the overall assessment of risk/hazard is conservative toward human health concerns. In the presence of such uncertainty, USEPA and the risk assessor are obligated to make conservative assumptions so that the chance is very small that the actual health risk isgreater than that determined by the risk assessment process. However, the process is not intended to yield overly conservative risk values with no basis in actual conditions. This balance was considered in developing exposure assumptions and pathways and in interpreting data and guidance.

Evaluation of Chemicals for Which No Toxicity Values Are Available

In addition to the typical uncertainties inherent in toxicity values, parameters without corresponding RBCs (due to lack of approved toxicological values) were not included in the CDI calculation data. This does not imply that chemicals lacking approved toxicological values pose no risk/hazard. As stated previously, essential nutrients were eliminated based on their low potential for toxicity and were not assessed further in the HHRA.

Evaluation of Potential Acute Cadmium Toxicity

During the January 27, 1998 Tier I Partnering Team Meeting, FDEP recommended that the potential for acute cadmium toxicity be evaluated (January 27, 1998 Tier I Partnering Team Meeting Minutes). Since that time, FDEP developed the April 30, 1998 Final Report *Soil Cleanup Target Levels (SCTLs)*, which contains an acute cadmium screening value of 0.05 mg/kg.

The acute cadmium SCTL would not be appropriate to assess OU 2 soil for several reasons:

- The background concentration for cadmium in surface soil is higher than the SCTL.
- The future land use of the site will not likely be residential.
- The toxic benchmark would not be applicable.
- A more applicable screening value was already used and agreed upon by the Tier I Partnering Team.

Page 32 of FDEP's document states that the high ingestion rate is used "... to address the possibility that some children may exhibit soil pica (ingestion) in quantities far greater than the 200 mg/day value." USEPA recommends an ingestion rate of 200 mg/day for children and has suggested 5 g/day to address pica. The FDEP document used 10 g to address pica and used the chronic oral RfD rather than an acute toxic effect to address acute exposure. As stated in the document on page 37, "... because this RfD is based on an effect (renal toxicity) that is not a concern with acute ingestion, it could be argued that this value is too conservative." The screening value for chronic effects is 39 mg/kg cadmium in soil for residential land use, which was used in this HHRA, as discussed in Section 10.2.5. The industrial screening value would likely be more appropriate for cadmium concentrations in soil at this site, based on the most likely future land use scenario.

Quantification of Risk/Hazard

This section of each HHRA discusses potential sources of uncertainty or variability in the quantification of risk and hazard not covered above. Each exposure medium addressed in the formal risk assessment process is discussed briefly.

10.2.11 Risk Summary

In each site-specific HHRA, this section summarizes the risk and hazard projected for each receptor group, exposure medium, and exposure pathway.

10.2.12 Remedial Goal Options

RGOs are chemical concentrations computed to equate with specific risk and/or hazard goals which may be established for a particular site. As previously discussed, COCs are any COPCs that significantly contribute to a pathway of concern. A pathway having an ILCR greater than 10^{-6} or an HI greater than 1 is defined as a pathway of concern, and an individual chemical which contributes either 10^{-6} ILCR or 0.1 HQ is considered a significant contributor to the pathway ILCR

or HI. Based on this method, COCs were identified which required calculating RGOs. These are listed in the risk characterization section for each site. RGOs were calculated for all COPCs contributing to a pathway risk of 10^{-6} or greater. Inclusion in the RGO table does not necessarily indicate that remedial action is needed to address a specific chemical. Instead, RGOs are provided to facilitate risk management decisions.

In accordance with USEPA Supplemental RGO Guidance, RGOs were calculated at 10^{-4}, 10^{-5}, and 10^{-6} risk levels for carcinogenic COCs, and HQ goals of 3, 1, and 0.1 for noncarcinogenic COCs. RGOs for carcinogens were based on the lifetime weighted average (LWA) and the adult site worker. Groundwater RGOs for the site resident and site worker are presented in separate tables (where applicable) in each site-specific HHRA. Hazard-based RGOs were calculated for either the hypothetical child resident or the adult site worker, as noted in each corresponding table.

Preliminary Remediation Goals

As mentioned in Section 10.2.7, construction worker PRGs were developed to evaluate potential risk and hazard from direct contact with subsurface soil during construction events. Tables 10.2.12-1 and 10.2.12-2 present the PRGs and the volatilization factors calculated for chemicals reported in subsurface soil samples collected for the OU 2 RI. These PRGs are calculated assuming the construction worker will be exposed to chemicals in subsurface soil through incidental ingestion, dermal contact, and inhalation of volatiles and particulates. The equations used to calculate construction worker PRGs were adapted from *RAGS Part B* and are as follows:

Noncarcinogens:

$$PRG = \frac{THQ * BW * AT_{nc}}{EF * ED * (A + B + C)}$$

where:

$A = IR_S * CF * 1/RfD_o$ $B = SA * CF * ABS * AF * 1/(RfD_o * ADJ)$ $= IR_A * (1/VF + 1/PEF) * 1/RfD$

Carcinogens:

$$PRG = \frac{TR * BW * AT_c}{EF * ED * (A + B + C)}$$

where:

$A = IR_S * CF * SF_o$ $B = SA * CF * ABS * AF * SF_o * 1/ADJ$ $C = IR_A * (1/VF + 1/PEF) * SF_i$

Variable	Description	Value
THQ	Target hazard index (unitless)	0.1, 1, and 3
TR	Target risk (unitless)	1E-06, 1E-05, and 1E-04
BW	Body weight (kg)	70
AF	adherence factor (mg/cm^2)	1
ED	Exposure duration (yr)	1
EF	Exposure frequency (days/year)	120
IR_s	Soil ingestion rate (mg/day)	115
IR_a	Air inhalation rate (m^3/day)	20
CF	Conversion factor (kg/mg)	1E-06
SA	Exposed skin surface area (cm^2/day)	4100
ABS	Dermal absorption (unitless)	Chemical specific
ADJ	Dermal adjustment to oral RfD/SF (unitless)	Chemical specific
AT_{NC}	Averaging time (noncarcinogen)	182.5
AT_C	Averaging time (carcinogen)	25,550

The equations used to calculate the particulate emission factor (PEF) and the volatilization factors (VFs) were adapted from USEPA Soil Screening Guidance and are as follows:

Particulate emission factor (PEF) and volatilization factor (VF):

$$PEF = Q/C * \frac{3600}{0.036 * (1 - V) * (U_m/U_t)^3 * F}$$

$$VF = Q/C * \frac{(3.14 * D_A * T)^{1/2} * 10^{-4}}{2 * \rho_b * D_A}$$

$$D_A = \frac{[(\theta_a^{10/3} * D_i * H' + \theta_w^{10/3} * D_w)/n^2]}{\rho_b * K_d + \theta_w + \theta_a * H'}$$

Variable	Description	Value
PEF	Particulate emission factor (m^3/kg)	1.24E+09
VF	Volatilization factor (m^3/kg)	Calculated
Q/C	Inverse of the mean concentration at the center of 0.5 acre source (g/m^2-sec per kg/m^3)	85.61
V	Fraction of site that is vegitated (fraction)	0.5
U_m	Mean annual windspeed (m/sec)	4.69
U_t	Equivalent threshold value of windspeed at 7 m (m/sec)	11.32
F	Function dependent on U_m/U_t (Cowherd et. al.) (unitless)	0.194
D_A	Apparent diffusivity (cm^2/sec)	Calculated
T	Exposure interval (sec)	9.5E+08
ρ_b	Soil dry bulk density (g/cm^3)	1.5
θ_a	Air-filled soil porosity (Lair/Lsoil)	0.28
θ_w	Water-filled soil porosity (Lair/Lsoil)	0.15

Variable	Description	Value
D_i	Diffusivity in air (cm^2/sec)	Chemical-specific
D_i	Diffusivity in water (cm^2/sec)	Chemical-specific
H'	Henry's Law constant (unitless)	Chemical-specific
K_d	Soil-water partitioning coefficient	Chemical-specific
n	Total soil porosity	0.43

Most of the exposure parameters (BW, AT_c, IR_a, and SA) used to calculate PRGs were taken from *RAGS Part A*. Exposure frequency and noncancer averaging time are based on a construction activity lasting six months. The soil ingestion rate calculated using Table 4-16 of the *Exposure Factors Handbook* (USEPA, August 1997), represents a yearly average assuming that the construction worker ingests 480 mg/day for the first three months of the project (60 days), 200 mg/day over the remainder of the project (60 days), 0.5 mg/day at home, and 110 mg/day while working in dusty household areas for an annual average of 115 mg/day. This simulates a construction activity where contact with soil is assumed to be more intense during the initial phase of the project, such as is the case with installing foundations or building footings. In the later stages of the project, contact with soil is assumed to be less intense. Soil ingestion at home assumes that 80% of household dust is comprised of contaminated soil from the site. The variables used to calculate VF and PEF are mainly default values taken from *USEPA Soil Screening Guidance*. The value used for Q/C represents the dispersion characteristics of a one-half acre site in Miami, Florida.

Annual Average Soil Intake

Scenarios	Medium	Exposure (mg/day)	Days/Year Activity	Fraction Soil Content	Annual Average Soil Intake (mg/day)
Work in Attic	Dust	110	12	0.8	3
Living Space	Dust	0.5	365	0.8	0.5
Construction (initial phase)	Soil	480	60	1	78.9
Construction (latter phase)	Soil	200	60	1	32.9
				Total	115 mg/day

Lead Preliminary Remediation Goal

USEPA has developed an interim approach to assessing risk from adult exposures to lead in soil(*Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposures to Lead in Soil*, [Adult Lead Mode]), December 1996). The Adult Lead Model considers a woman of child-bearing age and sets a maternal blood lead level which is protective of a developing fetus. This model was used to evaluate the significance of lead in subsurface soil at OU 2. The target maternal blood lead level (PbB_T) is 4.22 μg/dL below which is considered protective of a developing fetus.

The equation used to calculate the construction worker PRG for lead is:

$$PRG(\mu g/g) = \frac{(PbB_T - PbB_O) * AT}{BKSF * AF_s * EF * ED * IR_s}$$

where:

$$PbB_T = \frac{PbB_{fetal95}/R}{GSD_i^{1.645}}$$

PRG = Preliminary health-based remedial goal for lead in soil (1,000 μg/g = 1 mg/kg)

PbB_T = Target average blood lead level in a population of pregnant women exposed to Pb-contaminated soil in worker scenario (4.22 μg/dL)

PbB_O = Average blood Pb level in population of women of child-bearing age NOT exposed to Pb-contaminated soil in worker scenario (1.9 μg/dL)

BKSF = Biokinetic slope factor; increase in PbB per unit Pb dose absorbed (0.4 μg/dL PbB per μg/day Pb absorbed)

IR_s = Annual average intake rate of Pb-contaminated soil (0.115 g/day)

AF_s = Absorption fraction of administered Pb dose (0.15)

EF = Exposure frequency (120 days/year)

ED = Exposure duration (1 year)

$PbB_{fetal95}$ = 95th percentile fetal PbB in population of pregnant women exposed to Pb-contaminated soil in worker scenario (10 μg/dL)

R = Average ratio of fetal to maternal PbB (0.9)

GSD_i = Individual geometric standard deviation of PbB among population of pregnant women exposed to Pb-contaminated soil in worker scenario (1.8)

AT = Averaging time (365 days)

Table 10.2.12-1
Construction Worker Preliminary Remediation Goals for Subsurface Soil
NAS Pensacola, OU 2
Pensacola, Florida

Chemical	Oral Slope Factor (mg/kg-day)-1	Oral Reference Dose (mg/kg-day)	Inhalation Slope Factor (mg/kg-day)-1	Inhalation Reference Dose (mg/kg-day)	Reciprocal Volatilization Factor (kg/m3)	Dermal Absorption Factor (--)	Absorption Efficiency (--)	Hazard-Based Preliminary Remediation Goal 3 ng/kg	1 mg/kg	0.1 mg/kg	Risk-Based Preliminary Remediation Goal 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg
Inorganics													
Aluminum	NA	1	NA	NA	NA	0.001	0.2	2357048	785683	78568	ND	ND	ND
Antimony	NA	0.0004	NA	NA	NA	0.001	0.2	943	314	31	ND	ND	ND
Arsenic	1.5	0.0003	15.1	NA	NA	0.001	0.2	707	236	24	73.2	732	7322
Barium	NA	0.07	NA	0.000143	NA	0.001	0.2	155914	51971	5197	ND	ND	ND
Beryllium	4.3	0.005	8.4	NA	NA	0.001	0.2	11785	3928	393	25.6	255.7	2557
Cadmium	NA	0.001	6.3	5.71E-05	NA	0.001	0.2	2352	784	78	146717	1467171	14671708
Chromium (III)	NA	1	NA	5.71E-07	NA	0.001	0.2	11259	3753	375	ND	ND	ND
Chromium (VI)	NA	0.005	42	NA	NA	0.001	0.2	11785	3928	393	22008	220076	2200756
Cobalt	NA	0.06	NA	NA	NA	0.001	0.2	141423	47141	4714	ND	ND	ND
Copper	NA	3.5	NA	NA	NA	0.001	0.2	8249668	2749889	274989	ND	ND	ND
Cyanide	NA	0.02	NA	NA	NA	0.001	0.2	47141	15714	1571	ND	ND	ND
Manganese	NA	0.047	NA	1.43E-05	NA	0.001	0.2	79641	26547	2655	ND	ND	ND
Mercury	NA	0.0003	NA	8.57E-05	NA	0.001	0.2	707	236	24	ND	ND	ND
Nickel	NA	0.02	0.84	NA	NA	0.001	0.2	47141	15714	1571	1100378	11003781	110037812
Selenium	NA	0.005	NA	NA	NA	0.001	0.2	11785	3928	393	ND	ND	ND
Silver	NA	0.005	NA	NA	NA	0.001	0.2	11785	3928	393	ND	ND	ND
Thallium	NA	8E-05	NA	NA	NA	0.001	0.2	189	63	6	ND	ND	ND
Vanadium	NA	0.007	NA	NA	NA	0.001	0.2	16499	5500	550	ND	ND	ND
Zinc	NA	0.3	NA	NA	NA	0.001	0.2	707114	235705	23570	ND	ND	ND
Semivolatile Organics													
Acenaphthene	NA	0.06	NA	NA	NA	0.01	0.5	97273	32424	3242	ND	ND	ND
Acenaphthylene	NA	0.03	NA	NA	NA	0.01	0.5	48637	16212	1621	ND	ND	ND
Anthracene	NA	0.3	NA	NA	NA	0.01	0.5	486365	162122	16212	ND	ND	ND
Benzo(a)pyrene equivalent	7.3	NA	3.1	NA	NA	0.01	0.5	ND	ND	ND	10.4	104	1036
Benzo(g,h,i)perylene	NA	0.03	NA	NA	NA	0.01	0.5	48637	16212	1621	ND	ND	ND
Butylbenzylphthalate	NA	0.2	NA	NA	NA	0.01	0.5	324244	108081	10808	ND	ND	ND
Dibenzofuran	NA	0.004	NA	NA	NA	0.01	0.5	6485	2162	216	ND	ND	ND
Di-n-butylphthalate	NA	0.1	NA	NA	NA	0.01	0.5	162122	54041	5404	ND	ND	ND
2,6-Dinitrotoluene	NA	0.001	NA	NA	NA	0.01	0.5	1621	540	54	ND	ND	ND
bis(2-Ethylhexyl)phthalate	0.014	0.02	0.014	NA	NA	0.01	0.5	32424	10808	1081	5402.0	54020	540202
Fluoranthene	NA	0.04	NA	NA	NA	0.01	0.5	64849	21616	2162	ND	ND	ND
Fluorene	NA	0.04	NA	NA	NA	0.01	0.5	64849	21616	2162	ND	ND	ND
2-Methylnaphthalene	NA	0.04	NA	NA	NA	0.01	0.5	64849	21616	2162	ND	ND	ND
Naphthalene	NA	0.04	NA	NA	NA	0.01	0.5	64849	21616	2162	ND	ND	ND
Phenanthrene	NA	0.03	NA	NA	NA	0.01	0.5	48637	16212	1621	ND	ND	ND
Pyrene	NA	0.04	NA	NA	NA	0.01	0.5	64849	21616	2162	ND	ND	ND
Pesticides/PCBs													
Aldrin	17	3E-05	17.1	NA	NA	0.01	0.5	49	16	1.6	4.4	44	445
Aroclor 1248	2	NA	2	NA	NA	0.01	0.5	ND	ND	ND	37.8	378	3781
Aroclor 1254	2	2E-05	2	NA	NA	0.01	0.5	32	11	1.1	37.8	378	3781
Aroclor 1260	2	NA	2	N[illegible]	NA	0.01	0.5	ND	ND	ND	37.8	378	[illegible]781
lpha-BHC	6.3	NA	6.3	N	NA	0.01	0.5	ND	ND	ND	12.0	120	[illegible]200
gamma-BHC	1.3	NA	NA	NA	NA	0.01	0.5	ND	ND	ND	58.2	582	5818

Table 10.2.12-1
Construction Worker Preliminary Remediation Goals for Subsurface Soil
NAS Pensacola, OU 2
Pensacola, Florida

Chemical	Oral Slope Factor (mg/kg-day)-1	Oral Reference Dose (mg/kg-day)	Inhalation Slope Factor (mg/kg-day)-1	Inhalation Reference Dose (mg/kg-day)	Reciprocal Volatilization Factor (kg/m3)	Dermal Absorption Factor (--)	Absorption Efficiency (--)	Hazard-Based Preliminary Remediation Goal 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Preliminary Remediation Goal 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg
alpha-Chlordane	0.35	0.0005	0.35	NA	NA	0.01	0.5	811	270	27.0	216.1	2161	21608
gamma-Chlordane	0.35	0.0005	0.35	NA	NA	0.01	0.5	811	270	27.0	216.1	2161	21608
4,4'-DDD	0.24	NA	NA	NA	NA	0.01	0.5	ND	ND	ND	315.1	3151	31514
4,4'-DDE	0.34	NA	NA	NA	NA	0.01	0.5	ND	ND	ND	222.5	2225	22245
4,4'-DDT	0.34	0.0005	0.34	NA	NA	0.01	0.5	811	270	27.0	222.4	2224	22244
Dieldrin	16	5E-05	16	NA	NA	0.01	0.5	81	27	2.7	4.7	47	473
Endosulfan	NA	0.006	NA	NA	NA	0.01	0.5	9727	3242	324.2	ND	ND	ND
Endrin	NA	0.0003	NA	NA	NA	0.01	0.5	486	162	16.2	ND	ND	ND
Heptachlor	4.5	0.0005	4.55	NA	1.22E-06	0.01	0.5	811	270	27.0	14.9	149	1494
Heptachlor epoxide	9.1	1.3E-05	9.1	NA	2.54E-07	0.01	0.5	21	7.0	0.70	8.1	81	810
Methoxychlor	NA	0.005	NA	NA	NA	0.01	0.5	8106	2702	270.2	ND	ND	ND
Volatile Organics													
Acetone	NA	0.1	NA	NA	2.75E-05	0.01	0.8	192108	64036	6404	ND	ND	ND
Benzene	0.029	0.003	0.029	0.00171	1.24E-04	0.01	0.8	212	71	7	193.6	1936.1	19361
2-Butanone	NA	0.08	NA	0.0229	2.35E-05	0.01	0.8	14153	4718	472	ND	ND	ND
Carbon Disulfide	NA	0.1	NA	0.2	2.85E-04	0.01	0.8	10579	3526	353	ND	ND	ND
Chlorobenzene	NA	0.02	NA	0.00571	5.42E-05	0.01	0.8	1611	537	54	ND	ND	ND
Chloroform	0.0061	0.01	0.0805	0.01	1.28E-04	0.01	0.8	1176	392	39	72.2	722.1	7221
1,2-Dichloroethane	0.091	0.03	0.091	0.0014	8.68E-05	0.01	0.8	256	85	9	86.1	860.7	8607
1,2-Dichloroethene (cis)	NA	0.01	NA	0.01	1.17E-04	0.01	0.8	1276	425	43	ND	ND	ND
1,2-Dichloroethene (trans)	NA	0.02	NA	0.02	1.46E-04	0.01	0.8	2067	689	69	ND	ND	ND
Ethylbenzene	NA	0.1	NA	0.286	6.29E-05	0.01	0.8	52672	17557	1756	ND	ND	ND
1,1,2,2-Tetrachloroethane	0.2	NA	0.203	NA	2.41E-05	0.01	0.8	ND	ND	ND	113.7	1136.6	11366
Tetrachloroethene	0.052	0.01	NA	0.00203	1.33E-04	0.01	0.8	240	80	8	1723.5	17235.4	172354
Toluene	NA	0.2	NA	0.114	8.53E-05	0.01	0.8	20214	6738	674	ND	ND	ND
1,1,1-Trichloroethane	NA	0.02	NA	0.286	1.54E-04	0.01	0.8	16765	5588	559	ND	ND	ND
Vinyl chloride	1.9	NA	0.3	NA	3.28E-04	0.01	0.8	ND	ND	ND	6.5	65.3	653
Xylene, m	NA	2	NA	NA	5.57E-05	0.01	0.8	3842165	1280722	128072	ND	ND	ND
Xylene, p	NA	2	NA	NA	4.23E-05	0.01	0.8	3842165	1280722	128072	ND	ND	ND
Xylene, o	NA	2	NA	NA	6.19E-05	0.01	0.8	3842165	1280722	128072	ND	ND	ND

EXPOSURE ASSUMPTIONS:

Body weight-adult (kg) -	70
Averaging time-cancer (days) -	25550
Averaging time-noncancer (days) -	182.5
Conversion factor (kg/mg) -	1E-06
Exposure frequency (days/year) -	120
Exposure duration (years) -	1
Ingestion rate (mg/day) -	115
Inhalation rate (m3/day) -	20
Skin surface area (cm2/day) -	4100
Adherence factor (mg/cm2) -	1
Reciprocal particulate emission factor (kg/m3)	8.06E-10

Table 10.2.12-2
Determination of Volatilization Factor
NAS Pensacola, OU 2
Pensacola, Florida

Chemical	Air Diffusivity (cm2/s)	Water Diffusivity (cm2/s)	Henry's Law (--)	OC-Water Partitioning (--)	Soil-Water Partitioning (--)	Apparent Diffusivity (cm2/s)	VF (m3/kg)
Pesticides							
Heptachlor	0.0112	5.69E-06	0.0241	11749	70.494	3.71E-08	821387
Heptachlor epoxide	0.0132	4.23E-06	0.00034	7244	43.464	1.61E-09	3939134
Volatile Organics							
Acetone	0.124	1.14E-05	0.00159	0.575	0.00345	1.89E-05	36400
Benzene	0.088	9.8E-06	0.228	58.9	0.3534	3.88E-04	8040
2-Butanone	0.0808	9.8E-06	0.00191	1.905	0.01143	1.38E-05	42628
Carbon Disulfide	0.104	1E-05	1.24	45.7	0.2742	2.04E-03	3505
Chlorobenzene	0.073	8.7E-06	0.152	219	1.314	7.37E-05	18437
Chloroform	0.104	1E-05	0.15	39.8	0.2388	4.08E-04	7841
1,2-Dichloroethane	0.104	9.9E-06	0.0401	17.4	0.1044	1.89E-04	11520
1,2-Dichloroethene	0.0736	1.13E-05	0.167	35.5	0.213	3.42E-04	8556
1,2-Dichloroethene trans	0.0707	1.19E-05	0.385	52.5	0.315	5.36E-04	6840
Ethylbenzene	0.075	7.8E-06	0.323	363	2.178	9.93E-05	15889
1,1,2,2-Tetrachloroethane	0.071	7.9E-06	0.0141	93.3	0.5598	1.46E-05	41497
Tetrachloroethene	0.072	8.2E-06	0.754	155	0.93	4.44E-04	7511
Toluene	0.087	8.6E-06	0.272	182	1.092	1.82E-04	11720
1,1,1-Trichloroethane	0.078	8.8E-06	0.705	110	0.66	5.91E-04	6513
Vinyl chloride	0.106	1.23E-06	1.11	18.6	0.1116	2.69E-03	3052
Xylene, m	0.07	7.8E-06	0.301	407	2.442	7.77E-05	17959
Xylene, p	0.087	1E-05	0.213	636	3.816	4.49E-05	23628
Xylene, o	0.0796	8.44E-06	0.314	389	2.334	9.61E-05	16151
Trichloroethene	0.079	9.1E-06	0.422	166	0.996	2.72E-04	9601

EXPOSURE ASSUMPTIONS:

Fracton organic carbon	0.006
Dry soil bulk density (g/cm3)	1.5
Air-filled porosity	0.28
Water-filled porosity	0.15
Total porosity	0.43
Exposure interval (sec)	980000000
Inverse mean concentration, 0.5 acre source	85.61

10.3 Site-Specific Human Health Risk Assessments

The following subsections present the HHRA for individual sites.

10.3.1 Human Health Risk Assessment for Site 11

10.3.1.1 Site Background and Investigative Approach

The North Chevalier Field Disposal Area, Site 11, is an 18-acre area with two large prefabricated buildings (3627 and 3628) in the center and Building 3445 in the southwest corner. From the late 1930s to the mid 1940s, industrial wastes from aircraft overhauls, waste oils, lumber, and other ignitable material were incinerated and disposed of at Site 11. Currently, the former landfill portion of Site 11 is a low-lying, swampy, overgrown limited access area.

As part of the RI, 19 surface soil samples were collected and analyzed for full scan TCL/TAL, gross alpha and beta radioactivity, and cyanide. Table 10.3.1-1 (at the end of Section 10.3.1) lists the soil sample depths and analytical methods.

Twenty-four groundwater samples were collected from 16 shallow wells and eight intermediate wells during the Phase I investigation, and 12 wells (eight shallow and four intermediate) during the Phase II investigation. Water samples collected from temporary exploratory trenches were not considered in the HHRA since the sampling technique caused turbidity uncharacteristic of monitoring well samples. Trench water quality may reflect sediment-borne contaminants. All Phase I groundwater samples were analyzed for full-scan TCL/TAL parameters, including cyanide. The scope of Phase II parameters was focused using Phase I data. Table 10.3.1-2 lists the analytical methods used for Phase I and II groundwater samples. For groundwater, TAL metals were not filtered. Due to incomplete and/or questionable data sets, conclusions of this HHRA should be interpreted with caution and are preliminary. Supplemental, full scope (all monitoring wells) groundwater sampling and analysis should precede any formal remedial design.

10.3.1.2 COPC Identification for Site 11

Soil

Based on the screening comparisons described in Section 10.2.5 of this RI and presented in Table 10.3.1-3, this HHRA will focus on these COPCs: aluminum, Aroclor-1254, Aroclor-1260, arsenic, BEQs, cadmium, chromium, and lead.

Groundwater

As shown in Table 10.3.1-4, the COPCs identified in Phase I are: aldrin, aluminum, arsenic, barium, beryllium, cadmium, chloroform, chromium, 1,2-dichloroethane, 1,2-DCE (total), dieldrin, heptachlor epoxide, lead, manganese, nickel, 1,1,2,2-tetrachloroethane, tetrachloroethene, TCE, vanadium, and vinyl chloride. Chlorobenzene, ethylbenzene, and xylene were detected in Site 11 Phase I groundwater at concentrations within 10% of their RBCs but in excess of RBCs at other OU 2 sites. Thus these three parameters were added to the list of COPCs. Table 10.3.1-5 presents the COPCs identified in Phase II groundwater. Based on this list, benzene, 1,1-DCE, 1,2-DCE (cis), and 1,2-dichloropropane were added to the list of COPCs. 1,1-DCA was also added since it was detected in Site 11 Phase II groundwater at a concentration within 10% of its RBC, and at other OU 2 sites at concentrations exceeding RBCs.

10.3.1.3 Exposure Assessment for Site 11

Exposure Setting

Site 11 is on the eastern side of OU 2; the former landfill is a low-lying swampy area with limited access. The northern edge of the landfill is near the yacht basin. The two prefabricated buildings are to the east, across the street from the former landfill. Development plans are being drafted and cannot yet be definitively stated. The area will likely remain unchanged for the next five years.

Potentially Exposed Populations

Potentially exposed populations are current and future site workers, and future site residents. Additionally, due to its proximity to the yacht basin, adolescent trespassers are a potentially exposed population. Future site resident, future site worker, and current adolescent trespasser exposure scenarios were addressed.

Potential site construction workers were considered to be potentially exposed to chemicals in subsurface soil. Therefore, construction worker PRGs were calculated as described in Section 10.2.12, and compared to maximum detected chemical concentrations in subsurface soil.

The hypothetical future site worker scenario assumed continuous exposure to surface soil and the use of groundwater for drinking. Current site workers' exposure would be less than that assumed for the hypothetical future worker because of their limited soil contact and the fact that groundwater is not currently used onsite as a source of potable or process water. The future site resident scenario assumes existing buildings would be removed and replaced with dwellings. In addition, future use scenarios assumed use of onsite underlying aquifers as a source of drinking water. The current site trespasser is characterized as an adolescent who visits the site once a week during the summer.

Exposure Pathways

Dermal contact and incidental ingestion of surface soil are the exposure pathways for the site workers, future resident, and current trespasser. Additional pathways for future site residents and workers include ingestion of groundwater and inhalation of VOCs through domestic use of groundwater. The maximum detected concentration of chromium in surface soil exceeded its soil-to-air SSL and as a result, exposure to chromium via the dust inhalation pathway was added and evaluated in the formal risk assessment. Uniform exposure was assumed for all sample locations. Table 10.3.1-6 justifies exposure pathways assessed in this HHRA.

Exposure Point Concentrations

Table 10.3.1-7 summarizes statistical analysis of the data for COPCs identified in surface soil. The soil EPC for aluminum, Aroclor-1254, Aroclor-1260, arsenic, BEQs, cadmium, chromium, and iron was set equal to the 95% UCL. For nondetected concentrations, one-half the sample quantitation limits served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL for all COPCs. No SVOCs were detected in sample RA12, so the data from this sample were eliminated from the data set used to calculate the BEQ EPC due to an unusually high sample quantitation limit. Exposure to lead in soil and groundwater is addressed in Section 10.3.1.5.

Table 10.3.1-8 provides the data set used to determine the Site 11 groundwater EPC for COPCs identified above. Twelve monitoring wells were resampled during Phase II. Nine were analyzed for VOCs (six shallow and three intermediate wells), seven were analyzed for inorganics (five shallow and two intermediate wells), and one was analyzed for SVOCs (a shallow well). No pesticide or PCB samples were repeated in Phase II. The Phase I sample from monitoring well GI015 shows comparatively higher inorganic parameters than other samples, regardless of sampling phase. This monitoring well was not resampled during Phase II; it is across a wetland from the other Site 11 monitoring wells. Additionally, several VOCs were detected in Phase II samples but not in Phase I samples, or were detected at higher concentrations in Phase II samples compared with Phase I samples. With these exceptions the data are reasonably consistent, both spatially and temporally, and thus have been combined for consideration in the risk assessment.

The data presented in Table 10.3.1-8 have been managed according to Section 10.2.4, except where differences between sampling phases warrant other action. For inorganic parameters, chlorobenzene, 1,2-DCA, ethylbenzene, TCE, vinyl chloride, and xylene, nondetected concentrations were substituted with one-half the sample quantitation limits. The SQLs for chlorobenzene, 1,2-DCA, and ethylbenzene were considered unusually high for Phase I samples

from monitoring wells GGS52 and GI014, and were eliminated from the data set. Both of these monitoring wells were resampled during Phase II. Phase II resampling results for GGS52 and GI014 were nondetect for chlorobenzene and ethylbenzene; 1,2-DCA concentrations were much lower than the Phase I SQLs. For aldrin, chloroform, dieldrin, and heptachlor epoxide one-half the lowest detected concentrations were inserted into the data set as proxies for nondetects, because their sample quantitation limits exceeded their maximum detected concentrations. The more sensitive VOC analysis used for Phase II caused proxy concentrations to be determined differently for each phase of PCE data. Proxy concentrations for PCE nondetects consisted of one-half the lowest detected concentration for Phase I data, since the Phase I SQL was greater than the highest detected concentration, and one-half the SQL for Phase II data. Benzene, 1,1-DCE, and 1,2-dichloropropane were not detected in Phase I groundwater samples, and their EPCs are based on Phase II groundwater data, only because the Phase I SQLs were higher than the Phase II detections. EPCs for 1,2-DCE (total) and 1,2-DCE (cis) are based on Phase I data only since there are no Phase II data. 1,1,2,2-Tetrachloroethane was detected in one Phase I monitoring well, which was not resampled during Phase II. As a result, the only detected concentration of 1,1,2,2-tetrachloroethane was used as an EPC. The methods described above provide a conservative yet reasonable data set for determining EPCs.

Table 10.3.1-9 summarizes the statistical analysis of the combined groundwater data set for COPCs identified in either Phase I or Phase II samples. Groundwater data variability beyond the anticipated spatial and temporal trends is introduced through increased method sensitivity and improved sampling techniques used during Phase II. Historically, the most conservative method for providing point estimates when using data with different degrees of variability was to use the 95% UCL statistic. As mentioned in Section 10.2, the placement of monitoring wells may cause a low bias on the 95% UCL. Additionally, since there is no readily definable plume for Site 11 groundwater COPCs, the Region IV guidance for groundwater EPCs applies only marginally. As a result, the larger value — the arithmetic mean of detected concentrations or the 95% UCL — was

selected as the EPC. In cases with less than 10 data points, the maximum concentration was selected as the EPC. Data variability caused the chlorobenzene 95% UCL to exceed its maximum concentration. Chlorobenzene was detected during both sampling phases in monitoring well GS011, at a concentration of 3 μg/L (Phase I) and 5 μg/L (Phase II). As a result, the maximum concentration was selected as the chlorobenzene EPC.

Quantification of Exposure

Soil

CDIs for ingestion, dermal contact, and inhalation pathways are shown in, Tables 10.3.1-10, 10.3.1-11, and 10.3.1-12, respectively.

Groundwater

The CDIs for groundwater ingestion are presented in Table 10.3.1-13. The CDIs for inhalation of VOCs are assumed to be approximately equal to the CDIs for ingestion, as indicated in the *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering* (USEPA, 1991e).

10.3.1.4 Toxicity Assessment

Table 10.4.1-1 presents toxicological information for COPCs identified at Site 11, which was used to quantify risk/hazard associated with soil and groundwater contaminants. Toxicological profiles are provided in Section 10.4.

Some constituents detected in soil and groundwater at Site 11 have no toxicity criteria available. The RBC for endosulfan was cross-assigned to endosulfan I, endosulfan II, and endosulfan sulfate. The RBC for naphthalene was cross-assigned to 2-methylnaphthalene. The RBC for acenaphthene was cross-assigned to acenaphthylene.

10.3.1.5 Risk Characterization

Surface Soil Pathways

The incidental ingestion, dermal contact, and dust inhalation exposure pathways were evaluated for surface soil under residential, industrial (site worker), and trespasser scenarios. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.3.1-14, 10.3.1-15, and 10.3.1-16 present the computed carcinogenic risks and/or HQs associated with incidental ingestion of, dermal contact with, and inhalation of site surface soil, respectively.

Hypothetical Site Residents

The ingestion, dermal contact, and inhalation ILCRs (based on the adult and child LWA) for Site 11 surface soil are 4E-05, 1E-05, and 2E-06, respectively. Aroclor-1260, arsenic, and BEQs were primary risk contributors for the ingestion pathway, Aroclor-1260 and BEQs were the primary risk contributors for the dermal pathway, and chromium was the primary risk contributor to the inhalation pathway.

The computed HIs for the adult and child resident were 0.03 and 1, respectively, for the soil ingestion pathway. The computed HIs for the adult and child dermal contact pathways were both less than 1. Aluminum, arsenic, cadmium, chromium, and iron were the primary risk contributors for the ingestion pathways.

Hypothetical Site Workers

Ingestion, dermal contact, and inhalation ILCRs for the site worker are 4E-06, 6E-06, and 8E-07, respectively. BEQs were the primary risk contributors for both the ingestion and dermal contact pathways, and HIs were less than 0.1 for both.

Hypothetical Adolescent Trespasser

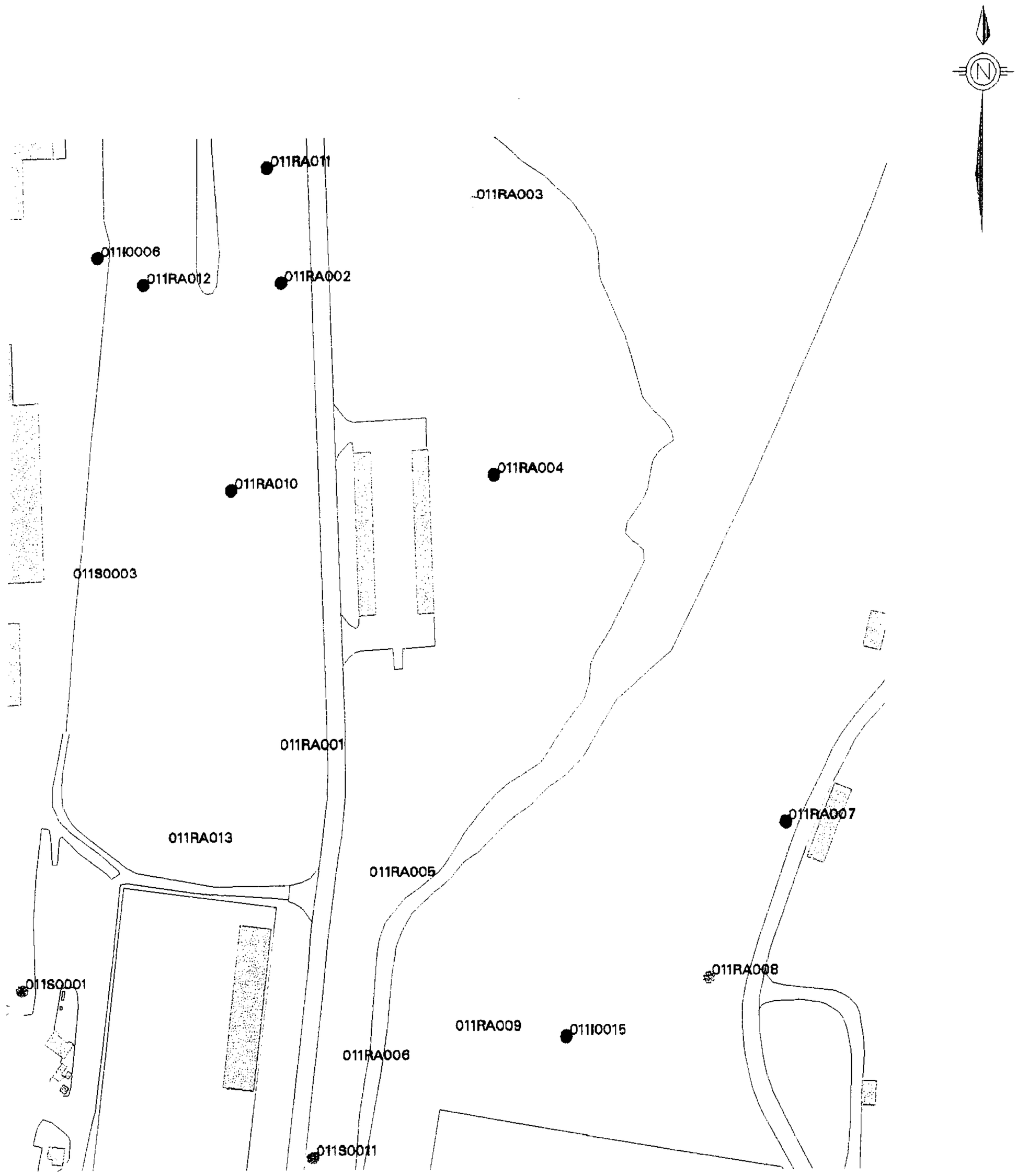
Ingestion, dermal contact, and inhalation ILCRs for the adolescent trespasser are 1E-06, 8E-07, and 9E-08, respectively. BEQs were the primary risk contributors for the ingestion pathway. HIs for the ingestion and dermal pathways were less than 0.1.

Construction Worker

Table 10.3.1-17 summarizes subsurface soil compared to construction worker PRGs. As shown, except for lead, the maximum concentrations of chemicals reported in Site 11 subsurface soil did not exceed their construction worker PRGs. Of the 20 samples with reported lead concentrations, only three (011SLF0303, 1,850 mg/kg; 011SLF0405, 1,670 mg/kg; and 011SLF1305, 3,080 mg/kg) exceeded the PRG for lead. The average lead concentration reported in subsurface soil was 420 mg/kg, which is below its PRG.

Point Risk and Point Hazard Estimates for Soil Pathways

Figures 10-3 and 10-4 are the risk and hazard maps for Site 11 soil. Table 10.3.1-18 provides the residential scenario risk and/or hazard contributed by each COPC at each sample location. As shown, four of 19 locations had reported concentrations equal to a cumulative hazard index of greater than unity (1) generally due to concentrations of cadmium, chromium, and iron. Reported concentrations of BEQs, Aroclor-1260, arsenic, and beryllium in Site 11 soil samples generally equate to a cumulative risk between 1E-06 and just above 1E-05. Reported BEQ concentrations contributed almost all of the 1E-04 risk projection for the area represented by sample location RA07.



LEGEND - RISK VALUES

- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 400

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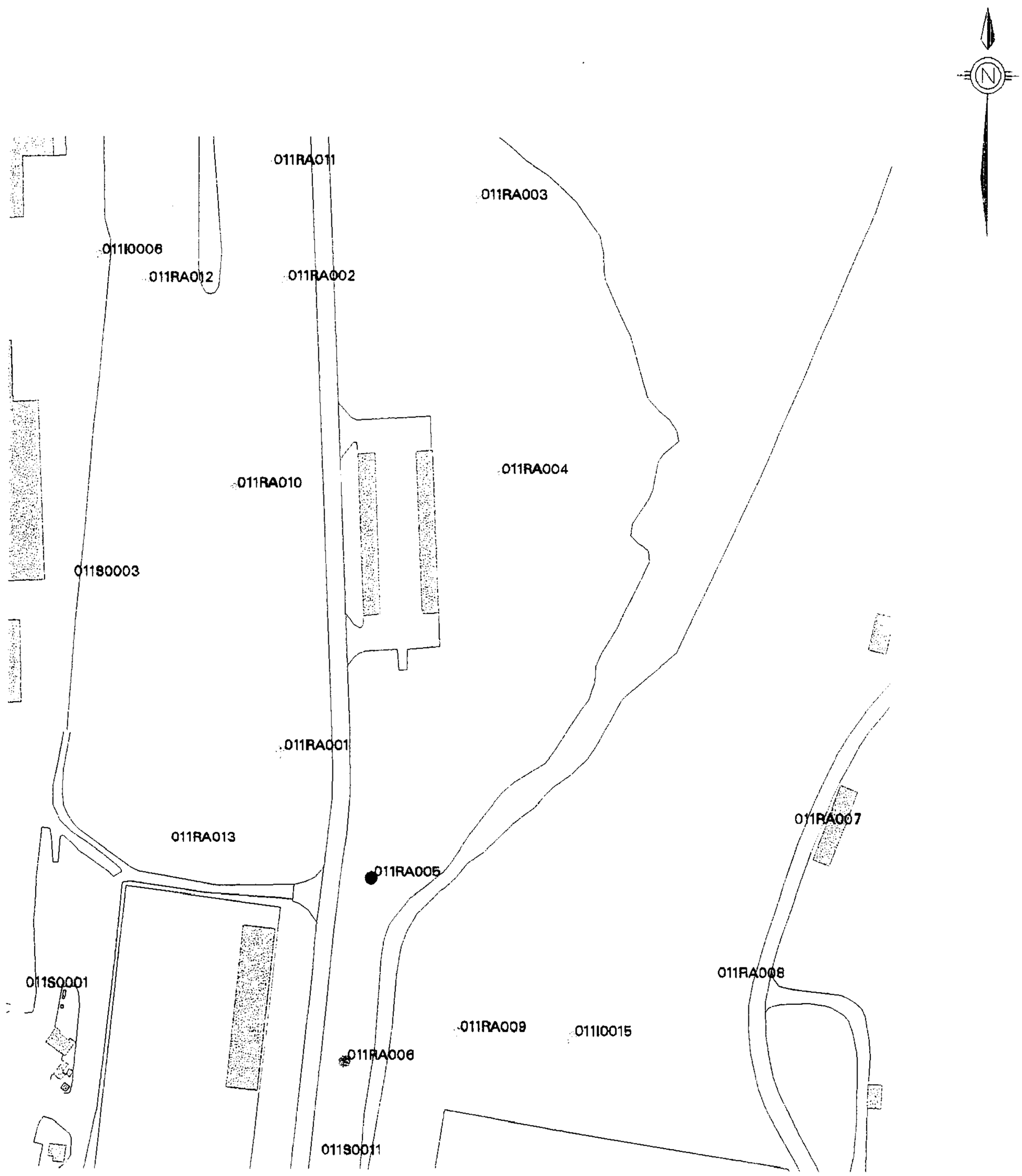
PENSACOLA, FLORIDA

FIGURE 10-3
SAMPLE POINT ESTIMATES OF RISK
SITE 11, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/soil_dir/main.aml



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 400

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REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-4
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 11, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/soil_dir/main.aml

Groundwater Pathways

Exposure to onsite groundwater was evaluated under both residential and industrial scenarios. Each phase of groundwater data was analyzed separately to focus on the temporal differences between phases. The groundwater exposure pathways were evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed separately for child and adult receptors. Tables 10.3.1-19 and 10.3.1-20 present the ingestion and inhalation risk/hazard for groundwater.

Hypothetical Site Residents

For the groundwater ingestion and inhalation pathways, the LWA ILCRs were computed to be 3E-03 and 3E-04, respectively. Arsenic, beryllium, and vinyl chloride were the primary contributors to the ingestion pathway risk; secondary contributors were aldrin, benzene, 1,1-DCE, 1,2-DCA, 1,2-dichloropropane, dieldrin, 1,1,2,2-tetrachloroethane, PCE, and TCE. The primary contributor to inhalation risk was vinyl chloride, with secondary contributions from benzene, chloroform, 1,1-DCE, 1,2-DCA, and TCE.

HIs for the adult and child resident are 8 and 19 for the groundwater ingestion pathway and 3 and 8 for the inhalation pathway. Arsenic, chromium, 1,2-DCE (cis), and manganese were the primary contributors to ingestion HI; secondary contributors were aluminum, barium, cadmium, 1,2-DCE (total), nickel, TCE, and vanadium. 1,2-DCE (cis) was the primary contributor to inhalation HI, with secondary contributions from benzene, 1,2-DCA, 1,2-DCE (total), 1,2-dichloropropane, and TCE.

Hypothetical Site Workers

For the ingestion and inhalation pathways, the ILCRs were computed to be 8E-04 and 1E-04, respectively. Arsenic, beryllium, and vinyl chloride were the primary contributors to ingestion risk; secondary contributions were made by aldrin, benzene, 1,1-DCE, 1,2-DCA, dieldrin, 1,1,2,2-tetrachloroethane, and PCE. 1,1-DCE, 1,2-DCA, and vinyl chloride were the primary contributors to inhalation risk.

Ingestion and inhalation pathway HIs were computed to be 3 and 1, respectively. Aluminum, arsenic, barium, cadmium, chromium, 1,2-DCE (cis), 1,2-DCE (total), and manganese were the primary contributors to ingestion HI.

Point Risk and Point Hazard Estimates for Groundwater Pathways

Figures 10-5 and 10-6 are the risk and hazard maps for Site 11 groundwater. Table 10.3.1-21 provides the residential risk and/or hazard contributed by each COPC at each monitoring well for both phases of groundwater sampling. Phase I groundwater data have been used to generate the groundwater maps because not all monitoring wells were resampled during Phase II. As shown, 13 of 24 monitoring wells had concentrations of COPCs equal to a cumulative HI of greater than unity (1), generally due to arsenic and 1,2-DCE. Groundwater concentrations of arsenic, aluminum, chromium, 1,2-DCE, and manganese reported in samples from monitoring well GI15 equate to an HI above 70. Reported concentrations of aldrin, arsenic, beryllium, chloroform, 1,2-DCA, dieldrin, 1,1,2,2-tetrachloroethane, PCE, TCE, and vinyl chloride in Site 11 groundwater samples generally equate to a cumulative risk between 1E-06 and just above 7E-03. Risk projections of 1E-03 or greater are due almost entirely to concentrations of vinyl chloride and/or arsenic.

Using maximum concentrations of COPCs in groundwater to estimate risk and hazard, as prescribed by FDEP when calculating RME risk and hazard, would yield a residential groundwater

LEGEND - RISK VALUES

- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 500

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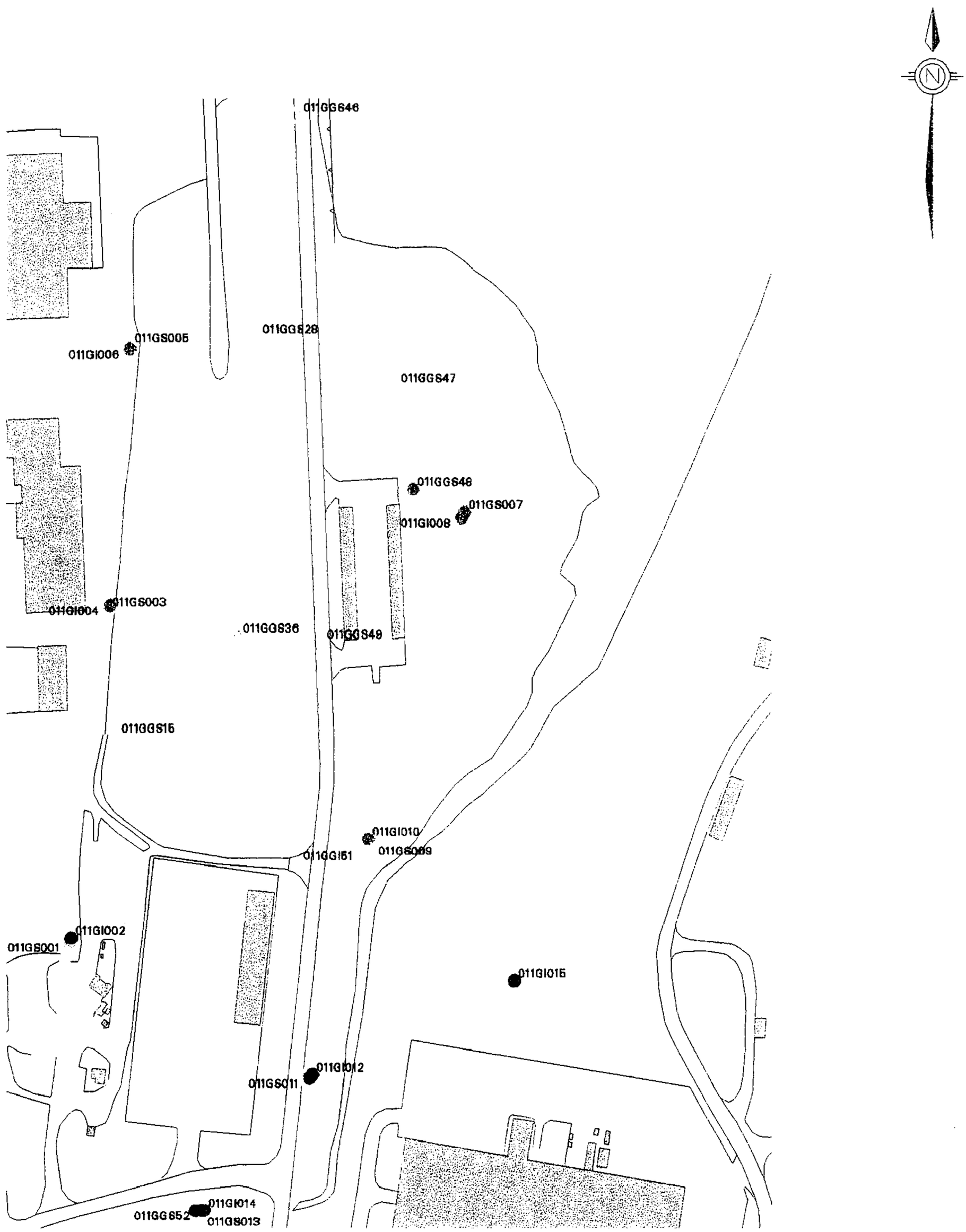
PENSACOLA, FLORIDA

FIGURE 10-5
SAMPLE POINT ESTIMATES OF RISK
SITE 11, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/well_dir/main.aml



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 500

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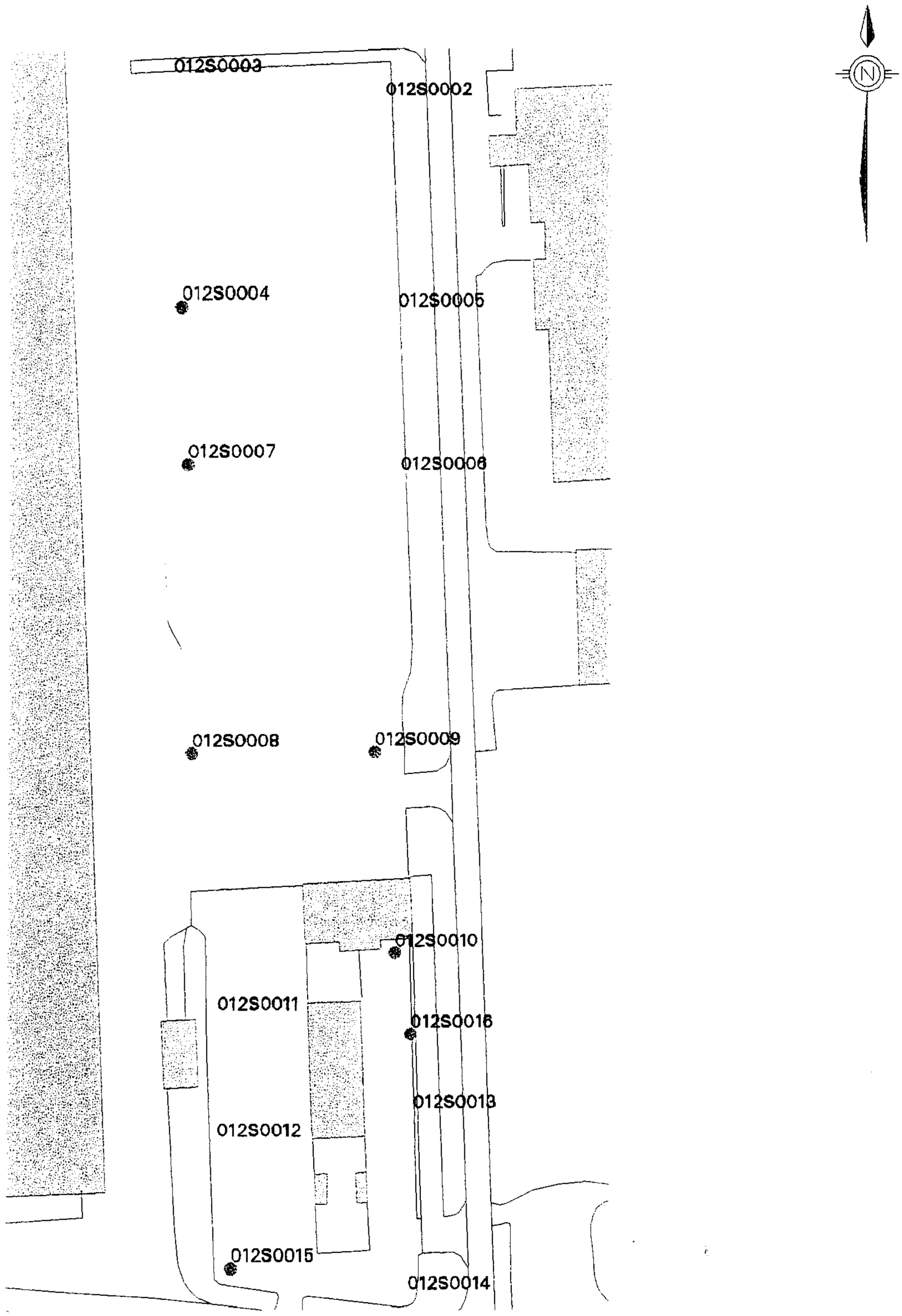
FIGURE 10-6
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 11, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/well_dir/main.aml



LEGEND - RISK VALUES

- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 250

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NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-7
SAMPLE POINT ESTIMATES OF RISK
SITE 12, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/soil dir/main.aml

pathway risk of 1E-02 and a hazard quotient of 86. This is shown on 10.3.1-21 as a summary of point risks and hazards associated with the maximum detected concentrations for each COPC identified in Site 11 groundwater.

Current Site Workers

Groundwater is not currently used as a potable water source for Site 11 or other areas of NAS Pensacola. Without a completed exposure pathway, no threat to human health is posed by reported groundwater contamination.

Lead Toxicity

Background

Currently, USEPA has established neither an SF nor an RfD for lead. USEPA believes that available studies in animals and humans do not sufficiently quantify information for their calculation. Although lead is currently classified as a B2 carcinogen, the USEPA considers noncarcinogenic neurotoxic effects in children to be the critical toxic effect for establishing health-based environmental cleanup objectives. The neurotoxic effects of chronic low-level lead exposure in children may occur at blood levels as low as 10 micrograms per deciliter (μg/dL).

In the absence of lead health criteria, USEPA Region IV's Office of Health Assessment sanctions using the Lead Uptake/Biokinetics Model (Version 0.99d) (Lead Model) to predict mean blood lead levels in children, based on exposure to impacted environmental media. This model assesses the potential health effects of elevated surface-soil lead concentrations at Site 11. The maximum lead concentration in surface soil and the 95% UCL groundwater concentration were used in the lead model. The maximum lead concentration reported in surface soil was 790 mg/kg. Since a hypothetical future child resident will not likely be continually exposed to a maximally impacted area, use of the maximum lead surface soil concentration is a highly conservative assumption.

Lead Uptake/Biokinetics Model

Blood lead levels in the age group 0 to 7 can be predicted using the lead model. Such estimates can assist in risk management decisions regarding cleanup of lead at hazardous waste sites. The effects of lead exposure are complex, and the assumptions used in the lead model are continually updated to reflect recent research findings. The results presented are hypothetical estimates since many of the model assumptions are subject to change.

Table 10.3.1-22 summarizes the lead model input values. Default concentrations are used for exposure to air (0.1 Pb grams per cubic meter [g/m^3]) and maternal blood lead level (2.5 μg/dL). Variability in the lead soil data caused the 95% UCL to exceed the maximum detected concentration (790 mg/kg) which was used as the input for soil and house dust. The mean detected soil concentration was calculated to be 143 mg/kg. As a conservative measure, the maximum concentration was used to model lead exposure and the mean was used to provide a range of health impact from lead concentrations in soil. The 95% UCL for lead in groundwater (0.011 mg/L) was used as the input for drinking water.

Based on this model output using the maximum soil lead concentration, the geometric mean blood concentration is estimated to be 9.5 μg/dL for hypothetical child receptors, and the probability of blood lead concentration exceeding 10 μg/dL is 43%. USEPA generally considers that media concentrations resulting in probability percentage estimates of 5% or less sufficiently protect potential child receptors. Using the mean soil lead concentration results in an estimated geometric mean blood level of 3.6 μg/dL, the probability of blood lead concentrations exceeding 10 μg/dL is 1.4%. As a result, the maximum surface soil lead concentrations at Site 11 would require corrective action under this hypothetical exposure scenario. However, the disparity between the maximum and mean lead soil concentrations indicate that corrective action would be limited to a few hot spots. Groundwater concentrations exceeded the TTAL in three of 24 Phase I samples, but the average Phase I lead concentration was 10.4 μg/L, which is less than the TTAL of

15 μg/L. Seven monitoring wells were resampled during Phase II. During Phase I, lead was detected in all seven wells ranging from 1 to 30 μg/L. Lead was detected once at 13 μg/L in the seven Phase II wells. The more recent Phase II results do not indicate that Site 11 contributes significantly to elevated blood lead concentrations.

COCs Identified

COCs were identified based on cumulative (all pathway) risk and hazard projected for this site. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and an HI threshold of 1.0 (unity). In accordance with FDEP guidance, a COC was considered any chemical contributing to a cumulative risk level of 1E-6 or greater and/or a cumulative HI above 1.0, if its individual ILCR exceeded 1E-6 or its HQ exceeded 0.1. For carcinogens this approach is relatively conservative, because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is the USEPA Region IV recommended trigger for establishing COCs. The COC selection method was used to more comprehensively evaluate chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGO development process. Table 10.3.1-23 lists COCs identified for surface soil, while Table 10.3.1-24 lists COCs identified for groundwater.

Surface Soil

Hypothetical Site Residents (Future Land Use)

Aluminum, arsenic, cadmium, and chromium were identified as COCs based on their contribution to the cumulative HI. Aroclor-1260, arsenic, BEQs, and chromium were identified as COCs based on their contribution to the cumulative ILCR. Lead was identified as a COC for childhood exposures based on the lead model output.

Hypothetical Site Workers (Future Land Use)

BEQs were identified as COCs based on their contribution to the cumulative ILCR.

Adolescent Trespasser (Current Land Use)

No COCs were identified.

Groundwater

Hypothetical Site Residents (Future Land Use)

Aluminum, arsenic, barium, benzene, cadmium, chromium, 1,2-DCA, 1,2-DCE (cis), 1,2-DCE (total), 1,2-dichloropropane, manganese, nickel, TCE, and vanadium were identified as groundwater COCs based on contributions to the cumulative HI. Aldrin, arsenic, benzene, beryllium, chloroform, 1,1-DCE, 1,2-DCA, 1,2-dichloropropane, dieldrin, 1,1,2,2-tetrachloroethane, PCE, TCE, and vinyl chloride were identified as COCs based on their contribution to the cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

Aluminum, arsenic, barium, cadmium, chromium, 1,2-DCE (cis), 1,2-DCE (total), and manganese were identified as groundwater COCs for this scenario based on their contributions to the HI. Aldrin, arsenic, beryllium, 1,1-DCE, 1,2-DCA, dieldrin, 1,1,2,2-tetrachloroethane, PCE, and vinyl chloride were identified as COCs based on contributions to the cumulative ILCR.

10.3.1.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

Highly conservative assumptions (i.e., future residential use) are used in assessing current and future exposure. Residential use of the site is not anticipated. If this area were ever used as a residential site or redeveloped for continued commercial use, buildings would be demolished, asphalt/concrete surfaces removed, and wetlands filled. Surface soil conditions would be dramatically changed. Consequently, uniform exposure to current surface soil conditions would be unlikely under true future residential and industrial scenarios. These factors indicate that

exposure pathways assessed in this HHRA would generally overestimate the risks and hazards posed to future site residents and site workers.

Groundwater is not currently used at Site 11 for potable or industrial purposes. Drinking water is provided from NAS Correy Station, across Bayou Grande, approximately 3 miles away. Since this system will likely remain in operation under current plans, Site 11 groundwater has no anticipated future use. Therefore, projected risk/hazard associated with groundwater exposure is highly conservative.

Determination of Exposure Point Concentrations

Ninety-five percent UCLs and maximum detected concentrations were used as EPCs to estimate risk and hazard for COPCs in soil. The 95% UCL, the arithmetic mean of the detected concentrations, or the maximum concentration of each COC identified in groundwater, was applied as the EPC. Using upper-bound estimates or maximum concentrations provides a conservative EPC and tends to overestimate risk. When a COPC was detected in relatively few samples, inclusion of nondetected concentrations in the 95% UCL calculation occasionally caused the upper-bound estimate to drop below the arithmetic mean of detected concentrations. In such cases, a single detected concentration or the arithmetic mean of multiple detected concentrations served as the EPC.

Nondetected samples were given proxy concentrations for calculating the 95% UCL. In most cases for Site 11 soil and groundwater, one-half the sample quantitation limit replaced any nondetect data in the data set. One-half the lowest detected concentration was used as a proxy for aldrin, chloroform, dieldrin, heptachlor epoxide, and PCE in groundwater, since the sample quantitation limits were higher than the maximum detected concentrations.

Frequency of Detection and Spatial Distribution

Aluminum, cadmium, chromium, copper, and lead were present in surface soil throughout Site 11. Arsenic was detected in only five of 19 surface soil samples, all at concentrations exceeding the RBC. Aluminum, cadmium, chromium, copper, and lead exceeded RBCs in only three to five samples. As a result, chronic exposure to these inorganic constituents is unlikely. Aroclor-1254 was detected in only one of 19 surface soil samples and Aroclor-1260 exceeded the RBC in only four surface soil samples, so chronic exposure to these organic COCs is unlikely. BEQs exceeded the RBC in five of 19 surface soil samples; all of which are next to roads and parking areas. Point risk/hazard estimates were included in the Risk Characterization Section (10.3.1.5) to provide a forum for discussion of the spatial relationship of soil COCs which will facilitate focus on potential areas of concern.

Aluminum, arsenic, and barium were detected frequently in Site 11 Phase I monitoring wells. Beryllium, cadmium, chromium, nickel, and vanadium were detected in only a few Phase I monitoring wells. Inorganic COCs were detected predominantly in Phase I monitoring wells next to wetlands and along the western boundary of Site 11.

Based on 24 samples, chlorinated VOCs were detected in Phase I monitoring wells throughout Site 11 shallow and intermediate groundwater:

VOCs	Frequency
1,2-DCA	2
Chloroform	3
1,2-DCE (total)	9
1,1,2,2-tetrachloroethane	1
Tetrachloroethene	1
TCE	4
Vinyl chloride	4

Except for 1,2-DCE (total), individual chlorinated VOCs were detected infrequently in the Site 11 shallow and intermediate Phase I groundwater. Aldrin and dieldrin detections in two Phase I monitoring wells were isolated to the western site boundary.

Twelve of the 24 Site 11 monitoring wells (11GS01, 11GS03, 11GS05, 11GS11, 11GS13, 11GS15, 11GS47, 11GS52, 11GI02, 11GI04, 11GI12, and 11GI14) were resampled in Phase II. Samples from seven monitoring wells were analyzed for inorganic parameters, nine for VOC parameters, and one for SVOC parameters. Pesticide and PCB parameters were not analyzed for Phase II groundwater. Variability introduced by combining the two phases of groundwater data would tend to inflate the 95% UCL, especially since the sampling routine was considerably different between phases. Except for monitoring well GI015, the inorganics detected in the two phases of groundwater sampling were the same. Conversely, many of the repeated VOC analyses were considerably different between sampling phases, forcing the use of inflated UCLs and maximum concentrations as EPCs, resulting in overestimated risks/hazards.

A further source of uncertainty is introduced by the lack of a definable plume. It is possible that arithmetic means do not represent "the most concentrated area of the plume" as described in USEPA Region IV's guidance. Point risk/hazard estimates were included in the Risk Characterization Section (10.3.1.5) to provide a forum for discussion of the spatial relationship of soil COCs which will facilitate focus on potential areas of concern.

Quantification of Risk/Hazard

Soil

Of the organic CPSS screened and eliminated from formal assessment, only two were reported at a maximum concentration within approximately 10% of their RBCs. Use of maximum concentrations for the screening comparison reduces the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSS. Elimination of antimony and

beryllium whose maximum concentrations exceeded their corresponding RBCs, was based on comparison to their corresponding reference concentrations.

Aluminum, arsenic, and chromium were significant contributors to soil-based risk and HI projections. Aluminum is a naturally occurring element found abundantly in nature. In the absence of toxicity data for aluminum, a provisional RfD has been supplied by the Environmental Criteria and Assessment Center/National Center for Environmental Assessment (ECAO/NCEA). Chromium exists predominantly in two valence states. At OU 2, all chromium data were assumed to be in the more toxic hexavalent valence state. Realistically, chromium exists in a balance of hexavalent and trivalent chromium. Hexavalent chromium was not analyzed for in Site 11 soil. Due to past usage of OU 2 sites (plating, scrap metal recycling), and the former use of Site 11 as a landfill, conservative assumptions regarding chromium exposure are warranted. The RfD for chromium VI is 0.005 mg/kg/day as opposed to 1 mg/kg/day for chromium III. In general, once chromium is released into the environment, it is mostly transformed into its more stable chromium III valence. As a result, risk estimates and HIs based on exposure to these inorganic elements in Site 11 surface soil are considered overestimates.

CT analysis was not formally performed for Site 11 surface soil, but a simplified approach was taken to assess the potential influences of CT assumptions. The CT assumption for residential exposure duration is nine years compared to the 30-year assumption for RME. The CT exposure frequency assumption is 234 days/year compared to 350 days/year RME. If all other exposure assumptions remain fixed, application of the CT exposure duration and frequency would result in risk projections approximately 80% below the RME. At CT, the residential surface-soil pathway-related risk (incidental ingestion and dermal contact) would drop from 5E-05 to approximately 1E-5, but would still exceed the 1E-6 point of departure. CT analysis for HQ — based on residential child exposure and exposure frequency adjusted to 234 days/year would drop the HI from 2 (incidental ingestion and dermal contact) to 1.

Although the future land use of Site 11 is unknown, both the worker and residential exposure scenarios were assessed. Base redevelopment plans for NAS Pensacola are drafted every five years. Under the next five-year plan, Site 11 is likely to maintain its current use. As previously discussed, these scenarios are likely to lead to overestimates of risk and/or hazard.

Groundwater

Of the organic CPSS screened and eliminated from formal assessment, bis(2-ethylhexyl)phthalate, acetone, 4,4'-DDD, and 2-methylnaphthalene were reported at concentrations within approximately 10% of the RBC. Using maximum concentrations for the screening comparison reduces the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSS. No inorganic parameters were eliminated from formal assessment based strictly on comparison to background reference concentrations.

Aluminum, barium, chromium, and manganese were significant contributors to groundwater-based HI projections. Arsenic was a significant contributor to groundwater-based risk and hazard projections. Aluminum and manganese naturally occur abundantly in nature. Aluminum is an essential nutrient. As mentioned above, in the absence of toxicity data for aluminum a provisional RfD has been supplied by the ECAO/NCEA. The EPCs used to estimate exposure to arsenic (0.020 mg/L; MCL = 0.05 mg/L) and barium (0.72 mg/L; MCL = 2 mg/L) are lower than their MCLs. All chromium data were assumed to be present in the more toxic chromium VI valence state. Risk estimates and HIs based on exposures to these inorganic elements in Site 11 groundwater are considered overestimates. Iron was detected in a single groundwater sample (Phase I, GI015) at a concentration of 170 mg/L which is above its tap water RBC of 11 mg/L. However, iron was not carried through the formal risk assessment due to the uncertainty associated with its provisional RfD. As a result, the elimination of iron from the formal risk assessment may have caused an underestimation of the hazard from exposure to Site 11 groundwater.

An informal CT analysis of site groundwater was performed using the CT residential exposure duration of nine years, the CT exposure frequency assumption of 234 days per year, and the CT ingestion rate of 1.4 liters/day. If all other exposure assumptions remain fixed, applying the CT exposure parameters would result in risk projections more than 85% below the RME. At CT, the residential groundwater-pathway-related risk (ingestion and inhalation) would drop from 3E-03 to approximately 4E-4 and would still exceed the upper end of USEPA's risk range of 1E-4. CT analysis for HQs based on residential child exposure, using an exposure frequency of 234 days/year and an ingestion rate of 1.4 liters/day, would drop the HI from 27 to 13, or approximately 53%.

Groundwater is not currently used as a potable water source at NAS Pensacola. Municipal water is provided from a well field at NAS Correy Station. As previously mentioned, it is highly unlikely that the site will be developed as a residential area, and it is unlikely that a potable-use well would be installed onsite. If residences were constructed onsite and an unfiltered well were installed, the salinity and dissolved solids probably would preclude this aquifer from being an acceptable potable water source.

Iron

Iron was detected in soil at a maximum concentration (21,100 mg/kg) that did not exceed its RBC (23,000 mg/kg; THQ = 1). Iron was detected in groundwater (Phase I) at a maximum concentration (170 mg/L) which exceeds its RBC (11 mg/L; THQ = 1). The maximum iron concentration of iron reported in Phase II groundwater samples (5.76 mg/L) did not exceed its RBC. As a result, hazard estimates for groundwater have potentially been underestimated due to the uncertainty associated with the iron reference dose.

10.3.1.7 Risk Summary

The risk and hazard posed by contaminants at Site 11 were assessed for the hypothetical site worker, the hypothetical future site resident, and the hypothetical adolescent trespasser under RME assumptions. For surface soil, the incidental ingestion and dermal contact pathways were assessed. The ingestion and inhalation pathways were evaluated for groundwater. Table 10.3.1-25 presents the risk summary for each pathway/receptor group evaluated at Site 11.

10.3.1.8 Remedial Goal Options

Soil

Surface soil RGOs are presented in Table 10.3.1-26 for hypothetical site residents and workers. Risk-based RGOs were based on the LWA site resident and adult site worker. Calculation of hazard-based RGOs was based on either the hypothetical child resident or the adult site worker, as noted in each corresponding table. The adolescent trespasser scenario is the least conservative pathway for calculating RGOs. As a result, the residential and site worker scenarios became the basis for deriving RGOs for Site 11. The lowest residential-based RGO for aluminum, cadmium, and chromium equate to an HQ of 0.1. The lowest residential-based RGO for arsenic, Aroclor-1260, and BEQs equal a risk of 1E-06. All RGOs are lower than the Florida soil cleanup goal. The background concentration of arsenic would equate with a risk between 1E-06 and 1E-05.

Groundwater

Groundwater RGOs based on site residents and site workers, shown in Table 10.3.1-27, were based on the LWA site resident and adult site worker. Calculation of hazard-based RGOs was based on either the hypothetical child resident or the adult site worker, as noted in the table. Both ingestion and inhalation (VOCs only) exposures are used to calculate groundwater RGOs. The lowest residential-based RGO for aluminum, barium, cadmium, 1,1-DCE (total), manganese, nickel, and vanadium equals an HQ of 0.1. The lowest residential-based RGO for aldrin, arsenic,

beryllium, chloroform, 1,2-dichloroethane, dieldrin, 1,1,2,2-tetrachloroethane, tetrachloroethene, trichloroethene, and vinyl chloride equates to a risk of 1E-06. Except for 1,1,2,2-tetrachloroethane and trichloroethane, all RGOs are lower than the Florida Groundwater Guidance Concentrations.

Table 10.3.1-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 11

Depth (feet)	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
0 to 2	I006	X	X	X	X
0 to 1	I015	X	X	X	X
RA	RA01	X	X	X	X
RA	RA02	X	X	X	X
RA	RA03	X	X	X	X
RA	RA04	X	X	X	X
RA	RA05	X	X	X	X
RA	RA06	X	X	X	X
RA	RA07	X	X	X	X
RA	RA08	X	X	X	X
RA	RA09	X	X	X	X
RA	RA10	X	X	X	X
RA	RA10	X	X	X	X
RA	RA11	X	X	X	X
RA	RA12	X	X	X	X
RA	RA13	X	X	X	X
0 to 1	S001	X	X	X	X
0 to 1	S003	X	X	X	X
0 to 2	S011	X	X	X	X
0 to 1	S013	X	X	X	X

Notes:
RA: Samples collected specifically for risk assessment; depth not specified.
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides: Method 8080
Volatile Organic Analysis: Method 8240
Semivolatile Organic Analysis: Method 8720
X = Sample analyzed for indicated suite of parameters.

Table 10.3.1-2
Samples and Analytical Methods Used for Risk Assessment
Phase I and II Groundwater at Site 11

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
Intermediate	GI51	1	1	1	1
Intermediate	I002	1	1	1,2	1,2
Intermediate	I004	1	1	1	1,2
Intermediate	I006	1	1	1	1
Intermediate	I008	1	1	1	1
Intermediate	I010	1	1	1	1
Intermediate	I012	1	1	1,2	1
Intermediate	I014	1	1	1,2	1
Intermediate	I015	1	1	1	1
Shallow	GS15	1	1	1	1,2
Shallow	GS28	1	1	1	1
Shallow	GS36	1	1	1	1
Shallow	GS46	1	1	1	1
Shallow	GS47	1	1,2	1,2	1,2
Shallow	GS48	1	1	1	1
Shallow	GS49	1	1	1	1
Shallow	GS52	1	1	1,2	1
Shallow	S001	1	1	1,2	1,2
Shallow	S003	1	1	1	1,2
Shallow	S005	1	1	1,2	1,2
Shallow	S007	1	1	1	1
Shallow	S009	1	1	1	1
Shallow	S011	1	1	1,2	1
Shallow	S013	1	1	1,2	1

Notes:
1 = Sample collected during Phase I.
2 = Sample collected during Phase II.
Metals: TAL Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides: Method 8080
Volatile Organic Analysis: Method 8240
Semivolatile Organic Analysis: Method 8720

Table 10.3.1-3
Chemicals Present in Site Samples
Site 11, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC		Soil-to-air SSL		Reference Conc.	Units	Number Exceeding RBC	Ref.
Carcinogenic PAHs																
Benzo(a)pyrene Equivalents	C	7	19	61.7	6958.8	1250	762.63	122483	88	a	NA		NA	ug/kg	5	
Benzo(a)anthracene	C	7	19	45	4600	932	330	53000	880	a	NA		NA	ug/kg	1	
Benzo(b)fluoranthene	C	7	19	66	5200	1210	330	53000	880	a	NA		NA	ug/kg	2	
Chrysene	N	6	19	50	4800	1160	330	53000	88000	a	NA		NA	ug/kg		
Dibenz(a,h)anthracene	C	2	19	210	1200	705	330	53000	88	a	NA		NA	ug/kg	2	
Indeno(1,2,3-cd)pyrene	C	2	19	460	2400	1430	330	53000	880	a	NA		NA	ug/kg	1	
Benzo(k)fluoranthene	N	5	19	55	3400	893	330	53000	8800	a	NA		NA	ug/kg		
Benzo(a)pyrene	C	5	19	50	4500	1110	330	53000	88	a	NA		NA	ug/kg	3	
Inorganics																
Aluminum (Al)	C	19	19	109	26700	5270	NA	NA	7800	a	NA		3833.36	mg/kg	3	7
Arsenic (As)	C	5	19	0.47	4.1	2.43	0.36	3.8	0.43	a	750	d	1.56	mg/kg	5	4
Barium (Ba)	N	11	19	5.8	134	33.6	0.35	5	550	a	690000	d	4.63	mg/kg		11
Beryllium (Be)	N	5	19	0.26	0.37	0.31	0.17	0.22	0.15	a	1300	d	0.41	mg/kg	5	
Cadmium (Cd)	C	8	19	1.3	23.3	8.81	0.87	1.1	3.9	a	1800	d	1.00	mg/kg	8	8
Calcium (Ca)	N	6	19	1830	14900	5030	21.7	3220	NA		NA		912.37	mg/kg		6
Chromium (Cr)	C	17	19	2.3	1610	125	1.9	2	39	a	270	d	6.13	mg/kg	3	10
Copper (Cu)	N	12	19	3.3	50	17.9	1.7	2.1	310	a	NA		5.74	mg/kg		8
Iron (Fe)	U	19	19	119	21100	4080	NA	NA	2300	a	NA		2745.00	mg/kg	9	8
Lead (Pb)	C	18	19	1.2	790	143	0.38	0.38	400	b	NA		7.32	mg/kg	4	11
Magnesium (Mg)	N	6	19	113	1360	489	6.5	451	NA		NA		133.33	mg/kg		4
Manganese (Mn)	N	12	19	27	91.9	50.8	0.39	11.5	180	a	NA		21.36	mg/kg		12
Mercury (Hg)	N	3	19	0.13	0.8	0.53	0.08	0.11	2.3	a	NA		0.10	mg/kg		3
Nickel (Ni)	N	7	19	4.3	16.9	7.04	3.5	4.2	160	a	13000	d	6.38	mg/kg		2
Potassium (K)	N	2	19	227	241	234	173	221	NA		NA		460.67	mg/kg		
Selenium (Se)	N	2	19	0.54	0.62	0.58	0.36	0.45	39	a	NA		0.62	mg/kg		1
Silver (Ag)	N	3	19	1.1	5.8	2.8	0.87	7.3	39	a	NA		2.07	mg/kg		1
Vanadium (V)	N	14	19	2.1	47.9	12.8	1.7	2	55	a	NA		5.83	mg/kg		9
Zinc (Zn)	N	6	19	20.6	177	113	1.3	45.1	2300	a	NA		16.87	mg/kg		6
Pesticides and PCBs																
Aroclor-1254	C	1	19	220	220	220	33	40	83	a	NA		NA	ug/kg	1	
Aroclor-1260	C	6	19	43	1400	362	33	37	83	a	NA		NA	ug/kg	4	
alpha-Chlordane	N	2	19	3.8	4.6	4.2	1.7	1.9	470	a	20000	d	NA	ug/kg		
gamma-Chlordane	N	3	19	2	4.4	3.53	1.7	1.9	470	a	20000	d	NA	ug/kg		
4,4'-DDD	N	4	19	4.5	35	13.9	3.3	30	2700	a	NA		NA	ug/kg		
4,4'-DDE	N	8	19	4.7	190	45.2	3.3	3.7	1900	a	NA		NA	ug/kg		
4,4'-DDT	N	7	19	3.7	340	67.3	3.3	100	1900	a	NA		NA	ug/kg		
Dieldrin	N	2	19	6.5	22	14.3	3.3	3.7	40	a	1000	d	NA	ug/kg		
Endosulfan II	N	1	19	8	8	8	3.3	4	47000	a	NA		NA	ug/kg		
Endosulfan sulfate	N	1	19	4.4	4.4	4.4	3.3	4	47000	a	NA		NA	ug/kg		
Endrin	N	1	19	4.3	4.3	4.3	3.3	4	2300	a	NA		NA	ug/kg		
Heptachlor epoxide	N	1	19	1.8	1.8	1.8	1.7	2	70	a	100	d	NA	ug/kg		
Semivolatile Organics																
Acenaphthene	N	1	19	1400	1400	1400	330	53000	470000	a	NA		NA	ug/kg		
Acenaphthylene	N	2	19	220	260	240	330	53000	310000	a	NA		NA	ug/kg		
Anthracene	N	4	19	40	1600	523	330	53000	2300000	a	NA		NA	ug/kg		
Benzo(g,h,i)perylene	N	2	19	520	2400	1460	330	53000	14000	c	NA		NA	ug/kg		
bis(2-Ethylhexyl)phthalate	N	1	19	47	47	47	220	53000	46000	a	31000000	d	NA	ug/kg		
Carbazole	N	2	19	110	820	465	330	53000	32000	a	NA		NA	ug/kg		
Dibenzofuran	N	1	19	380	380	380	330	53000	31000	a	NA		NA	ug/kg		
Fluoranthene	N	8	19	72	9100	1730	330	53000	310000	a	NA		NA	ug/kg		
Fluorene	N	1	19	900	900	900	330	53000	310000	a	NA		NA	ug/kg		
Naphthalene	N	2	19	82	430	256	330	53000	310000	a	NA		NA	ug/kg		
Phenanthrene	N	5	19	89	6900	1940	330	53000	310000	a	NA		NA	ug/kg		
Pyrene	N	8	19	80	8000	1500	330	53000	230000	a	NA		NA	ug/kg		
Volatile Organics																
Acetone	N	2	19	15	59	37	10	1400	260000	c	100000000	d	NA	ug/kg		
Benzene	N	3	19	1	1	1	10	1300	1400	c	800	d	NA	ug/kg		
Carbon tetrachloride	N	1	19	1	1	1	10	1300	600	c	300	d	NA	ug/kg		
Ethylbenzene	N	2	19	1	1	1	10	1300	780000	a	400000	d	NA	ug/kg		
Toluene	N	11	19	2	190	34.5	10	1300	520000	c	650000	d	NA	ug/kg		
Xylene (Total)	N	5	19	1	160	33.2	10	11	3000000	c	410000	d	NA	ug/kg		

C - Selected as a COPC based on the screening process explained in Section 10.2.5
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5
U - The hazard associated with iron is discussed qualitatively in the uncertainty section.
PAHs - Polynuclear Aromatic Hydrocarbons
SQL - Sample Quantitation Limits
a - USEPA Region III residential risk-based concentration
b - USEPA's action level of lead in soil
c - Florida residential soil cleanup goal
d - USEPA Soil Screening Guidance

Table 10.3.1-4
Chemicals Present in Site Samples
Site 11, Groundwater, Phase I
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium (Ca)	N	21	24	2570	458000	66500	10500	12200	NA	NA	NA	ug/L		13
Magnesium (Mg)	N	20	24	724	120000	17900	1270	2700	NA	NA	NA	ug/L		
Potassium (K)	N	19	24	1210	32700	7220	1110	3530	NA	NA	NA	ug/L		3
Sodium (Na)	N	16	24	2800	1220000	222000	3000	16100	NA	NA	NA	ug/L		7
Inorganics														
Aluminum (Al)	C	15	24	172	58900	5560	29	151	3700	RBC	3882.8	ug/L	4	4
Arsenic (As)	C	13	24	1	230	24	1	2	0.045	RBC	2.8	ug/L	13	11
Barium (Ba)	C	20	24	8	3790	385	5	33	260	RBC	13.2	ug/L	5	17
Beryllium (Be)	C	2	24	1	11	6	1	1	0.016	RBC	1.1	ug/L	2	1
Cadmium (Cd)	C	2	24	4	7	5.5	2	2	1.8	RBC	3.4	ug/L	2	2
Chromium (Cr)	C	4	24	9	771	203	3	3	18	RBC	35	ug/L	2	1
Cobalt (Co)	B	1	24	25	25	25	4	4	220	RBC	4.1	ug/L		1
Copper (Cu)	B	6	24	3	103	24.3	3	10	150	RBC	16.2	ug/L		2
Iron (Fe)	U	16	24	184	170000	14800	38	3000	1100	RBC	1707.8	ug/L	11	9
Lead (Pb)	C	19	24	1	94	10.4	2	2	15	TTAL	1.6	ug/L	3	14
Manganese (Mn)	C	16	24	21	935	178	2	46	84	RBC	22	ug/L	9	15
Nickel (Ni)	C	3	24	18	512	191	7	11	73	RBC	39.9	ug/L	1	2
Selenium (Se)	B	2	24	6	11.5	8.75	2	2	18	RBC	3.9	ug/L		2
Vanadium (V)	C	6	24	6	489	99.8	4	4	26	RBC	9.6	ug/L	4	4
Zinc (Zn)	B	3	24	53	560	306	2	41	1100	RBC	153.2	ug/L		2
Chlorinated Pesticides														
Aldrin	C	2	24	0.0075	0.026	0.017	0.02	0.15	0.004	RBC	NA	ug/L	2	
4,4'-DDD	N	1	24	0.071	0.071	0.071	0.02	0.3	0.1	FDEP	NA	ug/L		
Dieldrin	C	2	24	0.0094	0.03	0.02	0.1	0.3	0.0042	RBC	NA	ug/L	2	
Heptachlor epoxide	C	1	24	0.0059	0.0059	0.0059	0.05	0.15	0.0012	RBC	NA	ug/L	1	
Methoxychlor	N	1	24	0.039	0.039	0.039	0.5	0.5	18	RBC	NA	ug/L		
Semivolatile Organics														
Acenaphthene	N	1	24	1	1	1	10	10	220	RBC	NA	ug/L		
bis(2-Ethylhexyl)phthalate	N	3	24	1	2	1.33	10	10	4.8	RBC	NA	ug/L		
2-Chloronaphthalene	N	1	24	4	4	4	10	10	290	RBC	NA	ug/L		
Di-n-butylphthalate	N	2	24	1	2	1.5	10	10	370	RBC	NA	ug/L		
2-Methylnaphthalene	N	3	24	2	25	12.3	10	10	150	RBC	NA	ug/L		
Naphthalene	N	2	24	2	47	24.5	10	10	150	RBC	NA	ug/L		
Volatiles Organics														
Acetone	N	3	24	11	140	70.3	10	56	370	RBC	NA	ug/L		
Carbon disulfide	N	1	24	1	1	1	10	50	100	RBC	NA	ug/L		
Chlorobenzene	N	1	24	3	3	3	10	50	3.9	RBC	NA	ug/L		
Chloroform	C	3	24	1	2	1.33	10	50	0.15	RBC	NA	ug/L	3	
1,1-Dichloroethane	N	1	24	9	9	9	10	50	81	RBC	NA	ug/L		
1,2-Dichloroethane	C	1	24	9	9	9	10	50	0.12	RBC	NA	ug/L	1	
1,2-Dichloroethene (total)	C	9	24	2	580	128	10	10	5.5	RBC	NA	ug/L	6	
Ethylbenzene	N	1	24	58	58	58	10	50	130	RBC	NA	ug/L		
1,1,2,2-Tetrachloroethane	C	1	24	2	2	2	10	50	0.052	RBC	NA	ug/L	1	
Tetrachloroethene	C	1	24	2	2	2	10	50	1.1	RBC	NA	ug/L	1	
Toluene	N	2	24	1	6	3.5	10	50	75	RBC	NA	ug/L		
Trichloroethene	C	4	24	3	20	10.3	10	50	1.6	RBC	NA	ug/L	4	
Vinyl chloride	C	4	24	2	230	93.8	10	10	0.019	RBC	NA	ug/L	4	
Xylene (Total)	N	2	24	1	200	101	10	50	1200	RBC	NA	ug/L		

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B - The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
U - The hazard associated with iron is discussed qualitatively in the uncertainty section.
SQL - Sample Quatitation Limits
RBC - USEPA Region III residential risk-based concentration
TTAL - Treatment technique action level
FDEP - Florida risk-based groundwater guidance concentration

Table 10.3.1-5
Chemicals Present in Site Samples
Site 11, Groundwater, Phase II
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium (Ca)	N	6	7	3680	52300	27900	1190	1190	NA	NA	NA	ug/L		4
Magnesium (Mg)	N	6	7	542	14200	3640	181	181	NA	NA	NA	ug/L		1
Potassium (K)	N	6	7	809	12300	3900	637	637	NA	NA	NA	ug/L		1
Sodium (Na)	N	7	7	1910	169000	31000	NA	NA	NA	NA	NA	ug/L		2
Inorganics														
Aluminum (Al)	N	5	7	310	1110	755	62.8	197	3700	RBC	3882.8	ug/L		
Antimony (Sb)	R	1	7	4.3	4.3	4.3	2.3	2.3	1.5	RBC	30.2	ug/L	1	
Arsenic (As)	C	4	7	1.9	12.6	6.3	1.5	1.5	0.045	RBC	2.8	ug/L	4	3
Barium (Ba)	B	3	7	34.2	72.1	49.9	4.1	14.1	260	RBC	13.2	ug/L		3
Beryllium (Be)	C	1	7	1.8	1.8	1.8	0.08	0.2	0.016	RBC	1.1	ug/L	1	1
Cadmium (Cd)	C	1	7	8	8	8	0.22	0.38	1.8	RBC	3.4	ug/L	1	1
Chromium (Cr)	N	1	7	10.6	10.6	10.6	0.86	5.4	18	RBC	35	ug/L		
Cobalt (Co)	N	2	7	0.74	0.77	0.755	0.67	2.2	220	RBC	4.1	ug/L		
Iron (Fe)	U	7	7	376	5760	2350	NA	NA	1100	RBC	1707.8	ug/L	4	4
Lead (Pb)	B	1	7	13	13	13	0.81	3.5	15	TTAL	1.6	ug/L		1
Manganese (Mn)	C	3	7	24.2	108	55.5	1.8	29.6	84	RBC	22	ug/L	1	3
Mercury (Hg)	N	1	7	0.07	0.07	0.07	0.06	0.07	1.1	RBC	0.2	ug/L		
Selenium (Se)	N	1	7	3.6	3.6	3.6	2	2	18	RBC	3.9	ug/L		
Vanadium (V)	B	4	7	1.5	12	6.65	1.3	2.6	26	RBC	9.6	ug/L		1
Zinc (Zn)	N	1	7	20.8	20.8	20.8	4.3	9.7	1100	RBC	153.2	ug/L		
Semivolatile Organics														
Dibenzofuran	N	1	1	0.76	0.76	0.76	NA	NA	15	RBC	NA	ug/L		
Fluorene	N	1	1	1.4	1.4	1.4	NA	NA	150	RBC	NA	ug/L		
2-Methylnaphthalene	N	1	1	40	40	40	NA	NA	150	RBC	NA	ug/L		
Naphthalene	N	1	1	60	60	60	NA	NA	150	RBC	NA	ug/L		
Phenanthrene	N	1	1	0.22	0.22	0.22	NA	NA	10	FDEP	NA	ug/L		
Volatile Organics														
Acetone	N	1	9	70	70	70	5	11	370	RBC	NA	ug/L		
Benzene	C	3	9	0.3	3	1.23	1	1	0.36	RBC	NA	ug/L		2
2-Butanone (MEK)	N	1	9	3	3	3	5	5	190	RBC	NA	ug/L		
Chlorobenzene	C	1	9	5	5	5	1	1	3.9	RBC	NA	ug/L		1
Chloroform	C	1	9	0.3	0.3	0.3	1	1	0.15	RBC	NA	ug/L		1
1,1-Dichloroethane	N	5	9	0.1	72	19.9	1	1	81	RBC	NA	ug/L		
1,2-Dichloroethane	C	2	9	0.2	1	0.6	1	1	0.12	RBC	NA	ug/L		2
1,1-Dichloroethene	C	4	9	0.4	10	3.33	1	1	0.044	RBC	NA	ug/L		4
cis-1,2-Dichloroethene	C	7	9	2	970	186	1	1	6.1	RBC	NA	ug/L		6
trans-1,2-Dichloroethene	N	5	9	0.2	4	1.24	1	1	12	RBC	NA	ug/L		
1,2-Dichloropropane	C	1	9	3	3	3	1	1	0.16	RBC	NA	ug/L		1
Ethylbenzene	N	2	9	2	70	36	1	1	130	RBC	NA	ug/L		
Methylene chloride	N	1	9	0.3	0.3	0.3	2	2	4.1	RBC	NA	ug/L		
Tetrachloroethene	C	3	9	0.3	23	10.1	1	1	1.1	RBC	NA	ug/L		2
Toluene	N	4	9	0.2	5	1.55	1	1	75	RBC	NA	ug/L		
1,1,1-Trichloroethane	N	1	9	0.3	0.3	0.3	1	1	79	RBC	NA	ug/L		
Trichloroethene	C	6	9	0.7	50	11.8	1	1	1.6	RBC	NA	ug/L		4
Vinyl chloride	C	5	9	0.8	74	31.8	1	1	0.019	RBC	NA	ug/L		5
Xylene (Total)	N	2	9	21	250	136	1	1	1200	RBC	NA	ug/L		

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
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SQL - Sample Quatitation Limits
RBC - USEPA Region III residential risk-based concentration
TTAL - Treatment technique action level
FDEP - Florida risk-based groundwater guidance concentration

Table 10.3.1-6
Exposure Pathways Summary — Site 11

Medium and Exposure Pathway	Resident	Worker	Trespasser	Reason for Selection or Exclusion
Air: Inhalation of volatile contaminants emanating from soil	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Air: Inhalation of chemicals entrained in fugitive dust	Yes	Yes	Yes	Fate and transport screening determined this to be a significant pathway for chromium.
Groundwater: Ingestion of contaminants during potable or general use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Groundwater: Inhalation of volatilized contaminants during domestic use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Soil: Incidental ingestion	Yes	Yes	Yes	COPCs were identified after risk-based and background screening comparisons.
Soil: Dermal contact	Yes	Yes	Yes	COPCs were identified after risk-based and background screening comparisons.
Wild game or domestic animals: Ingestion of tissue impacted by media contamination	No	No	No	Hunting/taking of game and/or raising livestock is prohibited at NAS Pensacola.
Fruits and vegetables: Ingestion of plant tissues grown in media	No	No	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Table 10.3.1-7
Statistical Analysis of COPCs
Surface Soils at Site 11
NAS Pensacola OU2
Pensacola, Florida
Table 10.3.1-7
Statistical Analysis of COPCs
Surface Soils at Site 11
NAS Pensacola OU2
Pensacola, Florida

COPC	n	Natural Log Transformed mean	SD	H-stat	UCL (mg/kg)	MAX (mg/kg)	EPC (mg/kg)	
Aluminum	19	7.70	1.51	3.43	23654	26700	23654	UCL Used
Aroclor-1254	19	-3.91	0.58	2.10	0.032	0.22	0.032	UCL Used
Aroclor-1260	19	-3.34	1.29	3.24	0.29	1.4	0.29	UCL Used
Arsenic	19	-0.54	1.17	2.88	2.6	4.1	2.6	UCL Used
Benzo(a)pyrene Equiv.	18	-0.14	0.99	2.64	2.6	7.0	2.6	UCL Used
Cadmium	19	0.30	1.40	3.25	10	23	10	UCL Used
Chromium	19	2.40	1.85	4.03	357	1610	357	UCL Used
Lead	19	3.02	2.37	4.96	5427	790	790	MAX Used

Notes:

mean Arithmetic mean of the logtransformed data
n Number of samples analyzed
SD Standard deviation for a sample of data
H-stat "H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA Not applicable
EPC Exposure point concentration
UCL 95 percentile upper confidence level mean
MAX Maximum reported concentration

Table 10.3.1-8
Groundwater Data Used to Determine EPC
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Phase I
units are in micrgrams per liter (ug/L)

	GS001	GS003	GS005	GS007	GS009	GS011	GS013	GGS15	GGS28	GGS36	GGS46	GGS47	GGS48	GGS49	GGS52	GI002	GI004	GI006	GI008	GI010	GI012	GI014	GI015	GGI51
Aluminum	16	769	409	15	14.5	21.5	458	14.5	919	172	587	60	14.5	75.5	398	8730	4880	368	824	745	1130	4070	58900	14.5
Aldrin	0.0038	0.026	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0075	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038	0.0038
Arsenic	1	1	1	1	0.5	11	4	0.5	1	0.5	0.5	0.5	0.5	0.5	14	13	6	6	5	3	6	17	230	0.5
Barium	12	8	46	716	382	1520	3790	20	20	2.5	2.5	16.5	759	3.5	53	27	18	13	37	37	18	23	147	61
Benzene																								
Beryllium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	11	0.5
Cadmium	1	1	1	7	1	1	1	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Chlorobenzene	5	5	5	5	5	3	5	5	5	5	5	5	5	5		5	5	5	5	5	5		5	5
Chloroform	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2	0.5	0.5	1	0.5	0.5	0.5	0.5
Chromium	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	23	10	1.5	1.5	1.5	1.5	9	771	1.5
1,1-Dichloroethene																								
1,1-Dichloroethane																								
1,2-Dichloroethane	5	5	5	5	5	5	5	5	5	5	5	5	5	5		5	5	5	5	9	5		5	5
1,2-Dichloroethene (cis)																								
1,2-Dichloroethene (total)	5	5	6	5	5	2	4	5	5	5	5	9	5	5	420	16	5	5	5	3	110	580	5	5
1,2-Dichloropropane																								
Dieldrin	0.0047	0.0094	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.03	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047
Ethylbenzene	5	5	5	5	5	5	5	5	5	5	5	58	5	5		5	5	5	5	5	5		5	5
Heptachlor epoxide	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.0059	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295	0.00295
Lead	1	1	30	6	4	7	17	3	2	1	4	1	2	2	1	14	4	1	1	1	1	4	94	1
Manganese	2	1.5	95	365	212	120	133	1	83	5.5	16.5	17.5	206	125	23	29	21	55	71	32	52	10.5	935	316
Naphthalene	5	5	2	5	5	5	5	5	5	5	5	47	5	5	5	5	5	5	5	5	5	5	5	5
Nickel	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	18	3.5	44	3.5	3.5	3.5	3.5	512	3.5
1,1,2,2-Tetrachloroethane	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tetrachloroethene	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Trichloroethene	5	5	4	5	5	5	5	5	5	5	5	5	5	5	20	3	5	5	5	5	14	25	5	5
Vanadium	2	2	2	2	2	2	2	2	8	2	2	2	2	2	2	36	30	2	2	2	6	30	489	2
Vinyl chloride	5	5	5	5	5	5	5	5	2	5	5	55	5	5	330	5	5	5	5	5	5	88	5	5
Xylene	5	5	5	5	5	5	5	5	1	5	5	200	5	5	5	5	5	5	5	5	5	5	5	5

Shading denotes a detected value

Table 10.3.1-8
Groundwat ata Used to Determine EPC
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

	Phase II units are in micrgrams per liter (ug/L)											
	GS001	GS003	GS005	GS011	GS013	GGS15	GGS47	GGS52	GI002	GI004	GI012	GI014
Aluminum	900	98.5	310			1090	31.4		1110	363		
Aldrin												
Arsenic	3.1	0.75	1.9			7.6	0.75		12.6	0.75		
Barium	7.05	4.35	43.5			72.1	34.2		2.05	2.8		
Benzene	0.5		0.5	0.5	0.4		3	0.3	0.5		0.5	0.5
Beryllium	1.8	0.04	0.04			0.1	0.04		0.04	0.04		
Cadmium	8	0.11	0.11			0.15	0.19		0.11	0.11		
Chlorobenzene	0.5		0.5	5	0.5		0.5	0.5	0.5		0.5	0.5
Chloroform	0.15		0.15	0.15	0.15		0.15	0.3	0.15		0.15	0.15
Chromium	10.6	1.15	1.35			2.7	0.5		1.45	0.43		
1,1-Dichloroethene	0.5		0.5	0.5	2		0.5	10	0.4		0.5	0.9
1,1-Dichloroethane	0.5		0.5	0.4	22		0.5	72	5		0.5	0.1
1,2-Dichloroethane	0.5		0.5	0.5	0.5		0.5	1	0.5		0.5	0.2
1,2-Dichloroethene (cis)	0.5		17	2	28		0.5	970	15		32	240
1,2-Dichloroethene (total)												
1,2-Dichloropropane	0.5		0.5	0.5	0.5		0.5	0.5	0.5		0.5	3
Dieldrin												
Ethylbenzene	0.5		2	0.5	0.5		70	0.5	0.5		0.5	0.5
Heptachlor epoxide												
Lead	1.75	0.47	13			0.95	0.405		0.405	0.5		
Manganese	7.45	1.3	36.2			106	14.8		0.9	24.2		
Naphthalene							60					
Nickel	2.6	0.5	0.8			2.15	0.85		0.5	0.85		
1,1,2,2-Tetrachloroethane	0.1		0.1	0.1	0.5		0.1	0.1	0.1		0.1	0.1
Tetrachloroethene	0.5		0.5	0.5	7		0.5	23	0.3		0.5	0.5
Trichloroethene	0.5		0.7	0.5	5		0.5	50	3		11	1
Vanadium	6.7	0.65	1.3			12	1.5		6.4	0.75		
Vinyl chloride	0.5		0.5	0.8	3		48	74	0.5		0.5	33
Xylene	0.5		21	0.5	0.5		250	0.5	0.5		0.5	0.5

Table 10.3.1-9
Statistical Analysis of COPCs
Groundwater at Site 11
Naval Air Station, Pensacola
Pensacola, Florida

COPC	Number of Detects	Number of Samples (n)	Average ln(a)	Sample Standard Deviation sd(a)	H Statistic	Arithmetic Mean Detected Concentration (mg/L)	95% UCL (mg/L)	Maximum Detected Concentration (mg/L)	EPC (mg/L)	
Aluminum	20	31	5.625	2.139	4.027	4.4	13	59	13	UCL
Aldrin	2	24	-5.436	0.426	1.899	0.000017	0.0000054	0.000026	0.000017	Mean
Arsenic	17	31	0.815	1.505	3.084	0.020	0.016	0.23	0.020	Mean
Barium	23	31	3.446	1.919	3.691	0.34	0.72	3.8	0.72	UCL
Benzene	3	9	-0.576	0.652	NA	0.0012	NA	0.0030	0.0030	Max
Beryllium	3	31	-0.989	1.203	2.679	0.0046	0.0014	0.011	0.0046	Mean
Cadmium	3	31	-0.225	1.069	2.510	0.0063	0.0023	0.0080	0.0063	Mean
Chlorobenzene	2	31	0.999	1.018	2.446	0.0040	0.0072	0.0050	0.0050	Max
Chloroform	4	33	-0.916	0.640	2.042	0.0011	0.00062	0.0020	0.0011	Mean
Chromium	5	31	0.807	1.357	2.883	0.16	0.011	0.77	0.16	Mean
1,1-Dichloroethene	4	9	-0.166	1.048	NA	0.0033	NA	0.010	0.010	Max
1,1-Dichloroethane	6	9	0.332	2.165	NA	0.018	NA	0.072	0.072	Max
1,2-Dichloroethane	3	31	0.953	1.111	2.563	0.0034	0.0081	0.0090	0.0081	UCL
1,2-Dichloroethene (cis)	7	9	2.667	2.579	NA	0.19	NA	0.97	0.97	Max
1,2-Dichloroethene (total)	9	24	2.133	1.446	3.160	0.13	0.062	0.58	0.13	Mean
1,2-Dichloropropane	1	9	-0.494	0.597	NA	NA	NA	0.0030	0.0030	Max
Dieldrin	2	24	-5.254	0.398	1.889	0.000020	0.0000066	0.000030	0.000020	Mean
Ethylbenzene	3	31	1.224	1.243	2.728	0.043	0.014	0.070	0.043	Mean
Heptachlor epoxide	1	24	-5.797	0.141	1.735	NA	0.0000032	0.0000059	0.0000059	Max
Lead	20	31	0.829	1.327	2.842	0.0106	0.0110	0.094	0.011	UCL
Manganese	18	31	3.388	1.826	3.552	0.17	0.51	0.94	0.51	UCL
Naphthalene	3	25	1.762	0.691	2.146	0.036	0.010	0.060	0.036	Mean
Nickel	3	31	1.258	1.265	2.758	0.19	0.015	0.51	0.19	Mean
1,1,2,2-Tetrachloroethane	1	33	-0.558	1.017	2.432	NA	0.0015	0.0020	0.0020	Max
Tetrachloroethene	4	33	0.012	0.759	2.152	0.0081	0.0018	0.0230	0.0081	Mean
Trichloroethene	10	33	1.470	1.028	2.445	0.0112	0.0115	0.050	0.0115	UCL
Vanadium	10	31	1.262	1.353	2.876	0.063	0.018	0.49	0.063	Mean
Vinyl chloride	9	33	1.715	1.478	3.027	0.059	0.036	0.23	0.059	Mean
Xylene	4	33	1.346	1.462	3.006	0.12	0.024	0.25	0.12	Mean

NOTES:

ln(a)	arithmetic mean of the logtransformed data
n	number of samples analyzed
sd(a)	standard deviation for a sample of data
H-statistic	"H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA	not applicable
ND	not determined
EPC	exposure point concentration
UCL	95 percentile upper confidence level mean
Mean	Arithmetic mean of the detected concentrations
Max	Maximum detected concentration used when chemical is only detected in one groundwater sample

Table 10.3.1-10
Chronic Daily Intakes (CDI)
Incidental Ingestion of Surface Soil
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	FI *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	1	23654	3.24E-02	3.02E-01	3.70E-02	1.16E-02	4.13E-03	7.50E-03	1.07E-03
Aroclor-1254	1	0.032	4.34E-08	4.05E-07	4.96E-08	1.55E-08	5.53E-09	1.00E-08	1.43E-09
Aroclor-1260	1	0.29	4.00E-07	3.73E-06	4.57E-07	1.43E-07	5.10E-08	9.25E-08	1.32E-08
Arsenic	1	2.6	3.50E-06	3.27E-05	4.00E-06	1.25E-06	4.46E-07	8.10E-07	1.15E-07
Benzo(a)pyrene Equiv.	1	2.6	3.63E-06	3.39E-05	4.15E-06	1.30E-06	4.63E-07	8.40E-07	1.20E-07
Cadmium	1	10	1.43E-05	1.33E-04	1.63E-05	5.10E-06	1.82E-06	3.30E-06	4.71E-07
Chromium	1	357	4.89E-04	4.56E-03	5.59E-04	1.75E-04	6.24E-05	1.13E-04	1.61E-05
Lead	1	790	1.08E-03	1.01E-02	1.24E-03	3.86E-04	1.38E-04	2.50E-04	3.57E-05

Notes:

lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.1-11
Chronic Daily Intakes (CDI)
Dermal Contact with Surface Soil
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/kg)	FC*	DAF (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	23654	1	0.001	1.33E-03	4.39E-03	8.31E-04	9.49E-04	3.39E-04	3.07E-04	4.38E-05
Aroclor-1254	0.032	1	0.01	1.78E-08	5.87E-08	1.11E-08	1.27E-08	4.53E-09	4.11E-09	5.86E-10
Aroclor-1260	0.29	1	0.01	1.64E-07	5.41E-07	1.03E-07	1.17E-07	4.18E-08	3.79E-08	5.40E-09
Arsenic	2.6	1	0.001	1.44E-07	4.74E-07	8.98E-08	1.03E-07	3.66E-08	3.32E-08	4.73E-09
Benzo(a)pyrene Equiv.	2.6	1	0.01	1.49E-06	4.91E-06	9.31E-07	1.06E-06	3.79E-07	3.44E-07	4.90E-08
Cadmium	10	1	0.001	5.85E-07	1.93E-06	3.66E-07	4.18E-07	1.49E-07	1.35E-07	1.93E-08
Chromium	357	1	0.001	2.00E-05	6.62E-05	1.25E-05	1.43E-05	5.11E-06	4.64E-06	6.60E-07
Lead	790	1	0.001	4.44E-05	1.46E-04	2.78E-05	3.17E-05	1.13E-05	1.03E-05	1.46E-06

Notes:

CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.1-12
Chronic Daily Intakes (CDI)
Inhalation of Surface Soil COPCs Resulting from Dust Emission
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Fraction Contacted from Contaminated Source *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Site Worker adult H-CDI (mg/kg-day)	Site Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Inorganics									
Chromium	1	357	7.41E-08	2.07E-07	4.32E-08	5.29E-08	1.89E-08	1.50E-08	2.14E-09

Notes:

lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.1-13
Chronic Daily Intakes (CDI)
Ingestion of COPCs in Shallow Groundwater
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/liter)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Aluminum	13	3.6E-01	8.4E-01	2.0E-01	1.3E-01	6.3E-02
Aldrin	0.000017	4.6E-07	1.1E-06	2.5E-07	1.6E-07	8.1E-08
Arsenic	0.020	5.5E-04	1.3E-03	3.0E-04	2.0E-04	9.7E-05
Barium	0.72	2.0E-02	4.6E-02	1.1E-02	7.0E-03	3.5E-03
Benzene	0.0030	8.2E-05	1.9E-04	4.5E-05	2.9E-05	1.4E-05
Beryllium	0.0046	1.3E-04	2.9E-04	6.9E-05	4.5E-05	2.2E-05
Cadmium	0.0063	1.7E-04	4.0E-04	9.5E-05	6.2E-05	3.0E-05
Chlorobenzene	0.0050	1.4E-04	3.2E-04	7.5E-05	4.9E-05	2.4E-05
Chloroform	0.0011	2.9E-05	6.9E-05	1.6E-05	1.1E-05	5.2E-06
Chromium	0.16	4.5E-03	1.1E-02	2.5E-03	1.6E-03	7.9E-04
1,1-Dichloroethene	0.010	2.7E-04	6.4E-04	1.5E-04	9.8E-05	4.8E-05
1,1-Dichloroethane	0.072	2.0E-03	4.6E-03	1.1E-03	7.0E-04	3.5E-04
1,2-Dichloroethane	0.0081	2.2E-04	5.2E-04	1.2E-04	7.9E-05	3.9E-05
1,2-Dichloroethene (cis)	0.97	2.7E-02	6.2E-02	1.5E-02	9.5E-03	4.7E-03
1,2-Dichloroethene (total)	0.13	3.5E-03	8.2E-03	1.9E-03	1.3E-03	6.2E-04
1,2-Dichloropropane	0.0030	8.2E-05	1.9E-04	4.5E-05	2.9E-05	1.4E-05
Dieldrin	0.000020	5.4E-07	1.3E-06	3.0E-07	1.9E-07	9.5E-08
Ethylbenzene	0.043	1.2E-03	2.8E-03	6.5E-04	4.2E-04	2.1E-04
Heptachlor epoxide	0.0000059	1.6E-07	3.8E-07	8.9E-08	5.8E-08	2.8E-08
Lead	0.011	3.0E-04	7.0E-04	1.7E-04	1.1E-04	5.3E-05
Manganese	0.51	1.4E-02	3.3E-02	7.7E-03	5.0E-03	2.5E-03
Naphthalene	0.036	1.0E-03	2.3E-03	5.5E-04	3.6E-04	1.7E-04
Nickel	0.19	5.2E-03	1.2E-02	2.9E-03	1.9E-03	9.2E-04
1,1,2,2-Tetrachloroethane	0.0020	5.5E-05	1.3E-04	3.0E-05	2.0E-05	9.6E-06
Tetrachloroethene	0.0081	2.2E-04	5.2E-04	1.2E-04	7.9E-05	3.9E-05
Trichloroethene	0.011	3.1E-04	7.3E-04	1.7E-04	1.1E-04	5.5E-05
Vanadium	0.063	1.7E-03	4.0E-03	9.4E-04	6.1E-04	3.0E-04
Vinyl chloride	0.059	1.6E-03	3.8E-03	8.9E-04	5.8E-04	2.9E-04
Xylene	0.12	3.2E-03	7.5E-03	1.8E-03	1.2E-03	5.7E-04

Notes:

lwa Lifetime weighted average
CDI Chronic Daily Intake
H-CDI Non-carcinogenic hazard-based Chronic Daily Intake
C-CDI Carcinogenic risk-based Chronic Daily Intake

Table 10.3.1-14
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Surface Soil Ingestion
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	1	NA	0.032	0.30	ND	0.0116	ND	0.0075	ND
Aroclor-1254	2E-05	2	0.0022	0.020	9.9E-08	0.00077	1.1E-08	0.00050	2.9E-09
Aroclor-1260	NA	2	ND	ND	9.1E-07	ND	1.0E-07	ND	2.6E-08
Arsenic	0.0003	1.5	0.0117	0.109	6.0E-06	0.0042	6.7E-07	0.0027	1.7E-07
Benzo(a)pyrene Equiv.	NA	7.3	ND	ND	3.0E-05	ND	3.4E-06	ND	8.7E-07
Cadmium	0.001	NA	0.014	0.13	ND	0.005	ND	0.0033	ND
Chromium	0.005	NA	0.10	0.9	ND	0.035	ND	0.023	ND
Lead	NA	NA	ND	ND	ND	ND	ND	ND	ND
SUM Hazard Index/ILCR			0.03	1	4E-05	0.06	4E-06	0.04	1E-06

Notes:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk
All chromium is assumed to be chromium VI

Table 10.3.1-15
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	ABS	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Potential Futur Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	0.2	0.2	NA	0.0066	0.022	ND	0.0047	ND	0.0015	ND
Aroclor-1254	0.5	1E-05	4	0.0018	0.0059	4.5E-08	0.0013	1.8E-08	0.00041	2.3E-09
Aroclor-1260	0.5	NA	4	ND	ND	4.1E-07	ND	1.7E-07	ND	2.2E-08
Arsenic	0.2	6E-05	7.5	0.0024	0.0079	6.7E-07	0.0017	2.7E-07	0.00055	3.5E-08
Benzo(a)pyrene Equiv	0.5	NA	14.6	ND	ND	1.4E-05	ND	5.5E-06	ND	7.2E-07
Cadmium	0.2	0.0002	NA	0.0029	0.010	ND	0.0021	ND	0.00068	ND
Chromium	0.2	0.0010	NA	0.020	0.07	ND	0.014	ND	0.0046	ND
Lead	0.2	NA	NA	ND	ND	ND	ND	ND	ND	ND
SUM Hazard Index/ILCR				0.03	0.1	1E-05	0.02	6E-06	0.01	8E-07

Notes:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk
ABS Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)
- All chromium assumed to be chromium VI

Table 10.3.1-16
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Surface Soil COPCs Resulting from Dust Emission
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation RfD Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Site Worker adult Hazard Quotient	Site Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Inorganics									
Chromium	ND	42	ND	ND	1.8E-06	ND	7.9E-07	ND	9.0E-08
SUM Hazard Index/ILCR			ND	ND	2E-06	ND	8E-07	ND	ERR

Notes:

ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Table 10.3.1-17
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU 2 — Site 11
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Volatiles (μg/kg)				
1,1,1-Trichloroethane	1/27	4.0 - 4.0	4.00	5600000
1,2-Dichloroethane	3/27	2.0 - 4.0	2.67	850000
1,2-Dichloroethene (total)	2/27	19.0 - 150.0	84.50	430000
2-Butanone (MEK)	4/27	28.0 - 430.0	307.00	4700000
Acetone	7/27	31.0 - 480.0	147.14	64000000
Benzene	4/27	2.0 - 8.0	3.75	71000
Carbon disulfide	1/27	2.0 - 2.0	2.00	3500000
Ethylbenzene	3/27	2.0 - 3500.0	1171.33	18000000
Tetrachloroethene	1/27	270.0 - 270.0	270.00	80000
Toluene	11/27	3.0 - 270.0	102.64	6700000
Vinyl chloride	1/27	79.0 - 79.0	79.00	6500
Xylene (Total)	4/27	7.0 - 19000.0	4804.00	1000000000
Semivolatiles (μg/kg)				
2,6-Dinitrotoluene	2/27	150.0 - 170.0	160.00	540000
2-Methylnaphthalene	5/27	71.0 - 24000.0	7304.20	22000000
Acenaphthene	6/27	130.0 - 1500.0	855.00	32000000
Acenaphthylene	5/27	44.0 - 1000.0	436.80	16000000
Anthracene	6/27	92.0 - 2700.00	820.33	160000000
Benzo(a)anthracene	9/27	190.0 - 7400.0	1395.56	100000
Benzo(a)pyrene	7/27	180.0 - 4500.0	1167.14	10000
Benzo(b)fluoranthene	9/27	220.0 - 5700.0	1066.67	100000
Benzo(g,h,i)perylene	3/27	450.0 - 3100.0	1346.67	16000000
Benzo(k)fluoranthene	8/27	180.0 - 3300.0	928.75	1000000
bis(2-Ethylhexyl)phthalate (BEHP)	8/27	47.0 - 3200.0	832.75	5400000
Chrysene	9/27	230.0 - 6100.0	1163.33	10000000

Table 10.3.1-17
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU 2 — Site 11
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Semivolatiles (μg/kg) (Continued)				
Dibenz(a,h)anthracene	1/27	1200.0 - 1200.0	1200.00	10000
Dibenzofuran	4/27	120.0 - 910.0	610.00	2200000
Di-n-butylphthalate	5/27	54.0 - 3900.0	845.20	54000000
Fluoranthene	10/27	460.0 - 12000.0	2404.00	22000000
Fluorene	6/27	90.0 - 3000.0	1156.67	22000000
Indeno(1,2,3-cd)pyrene	3/27	400.0 - 3100.0	1306.67	100000
Naphthalene	2/27	1400.0 - 14000.0	7700.00	22000000
Phenanthrene	10/27	59.0 - 11000.0	2185.90	16000000
Pyrene	11/27	350.0 - 13000.0	2310.91	22000000
Pesticides/PCBs (μg/kg)				
4,4'-DDD	8/28	6.7 - 140.0	48.21	320000
4,4'-DDE	7/28	4.9 - 230.0	53.99	220000
4,4'-DDT	5/28	4.6 - 2800.0	578.72	220000
Aldrin	1/28	4.5 - 4.5	4.50	4400
alpha-BHC	1/28	3.7 - 3.7	3.70	12000
alpha-Chlordane	1/28	3.8 - 3.8	3.80	220000
Aroclor-1248	1/28	48.0 - 48.0	48.00	38000
Aroclor-1254	1/28	45.0 - 45.0	45.00	11000
Aroclor-1260	4/28	43.0 - 210.0	125.50	38000
Dieldrin	1/28	26.0 - 26.0	26.00	4700
Endrin	1/28	22.0 - 22.0	22.00	160000
gamma-BHC (Lindane)	1/28	6.6 - 6.6	6.60	58000
Heptachlor	1/28	3.6 - 3.6	3.60	15000
Heptachlor epoxide	1/28	3.8 - 3.8	3.80	8100

Table 10.3.1-17
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU 2 — Site 11
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Inorganics (mg/kg)				
Aluminum (Al)	24/27	90.8 - 17000.0	2605.78	790000
Antimony (Sb)	3/27	6.7 - 36.3	17.97	310
Arsenic (As)	7/27	0.49 - 15.8	4.51	73
Barium (Ba)	15/27	6.1 - 1150.0	169.31	52000
Beryllium (Be)	2/27	0.24 - 0.26	0.25	26
Cadmium (Cd)	12/27	0.92 - 129.0	30.06	780
Calcium (Ca)	12/27	306.0 - 60900.0	15104.67	NA
Chromium (Cr) total	19/27	2.0 - 206.0	26.99	3900
Cobalt (Co)	3/27	4.9 - 14.7	8.67	47000
Copper (Cu)	17/27	2.0 - 1420.0	169.48	1000000
Cyanide (CN)	2/23	2.1 - 6.7	4.40	16000
Iron (Fe)	26/27	55.2 - 58600.0	5064.89	NA
Lead (Pb)	22/27	0.43 - 3080.0	392.64	1000
Magnesium (Mg)	10/27	9.5 - 1690.00	625.90	NA
Manganese (Mn)	11/27	7.4 - 1400.0	236.64	27000
Mercury (Hg)	3/27	0.1 - 1.6	0.72	240
Nickel (Ni)	6/27	4.3 - 43.3	13.25	16000
Potassium (K)	1/27	218.0 - 218.0	218.00	NA
Selenium (Se)	3/27	0.63 - 20.1	7.19	3900
Silver (Ag)	3/27	1.2 - 43.5	26.73	3900
Vanadium (V)	14/27	2.2 - 25.60	7.14	5500
Zinc (Zn)	9/27	45.0 - 3150.0	945.72	240000

Notes:
* = Preliminary remediation goal based on the lesser of a hazard-based assessment using a hazard quotient of 1.0 or a risk-based assessment using a cancer risk of 1E-06.
μg/kg = micrograms per kilogram

Table 10.3.1.18
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 11, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
I006	Aluminum (Al)	345	mg/kg	0.0047	NA
I006	Iron (Fe)	485	mg/kg	0.0222	NA
	Total			0.0269	NA
I015	Aluminum (Al)	2170	mg/kg	0.0298	NA
I015	Chromium (Cr)	2.3	mg/kg	0.0063	NA
I015	Iron (Fe)	1100	mg/kg	0.0503	NA
I015	Lead (Pb)	2.3	mg/kg	NA	NA
	Total			0.0863	NA
RA01	Aluminum (Al)	1050	mg/kg	0.0144	NA
RA01	Arsenic (As)	0.47	mg/kg	0.0215	1.2276
RA01	Chromium (Cr)	2.5	mg/kg	0.0069	NA
RA01	Iron (Fe)	958	mg/kg	0.0438	NA
RA01	Lead (Pb)	3.8	mg/kg	NA	NA
	Total			0.0865	1.2276
RA02	Aluminum (Al)	341	mg/kg	0.0047	NA
RA02	Chromium (Cr)	4.1	mg/kg	0.0112	NA
RA02	Iron (Fe)	262	mg/kg	0.0120	NA
RA02	Lead (Pb)	4.2	mg/kg	NA	NA
	Total			0.0279	NA
RA03	Aluminum (Al)	1750	mg/kg	0.0240	NA
RA03	Aroclor-1260	48	ug/kg	NA	0.2178
RA03	Cadmium (Cd)	2	mg/kg	0.0275	NA
RA03	Chromium (Cr)	13.4	mg/kg	0.0367	NA
RA03	Iron (Fe)	889	mg/kg	0.0406	NA
RA03	Lead (Pb)	83.2	mg/kg	NA	NA
	Total			0.1289	0.2178
RA04	Aluminum (Al)	194	mg/kg	0.0027	NA
RA04	Chromium (Cr)	4.7	mg/kg	0.0129	NA
RA04	Iron (Fe)	275	mg/kg	0.0126	NA
RA04	Lead (Pb)	6.6	mg/kg	NA	NA
	Total			0.0281	NA
RA05	Aluminum (Al)	4740	mg/kg	0.0650	NA
RA05	Aroclor-1260	350	ug/kg	NA	1.5880
RA05	B(a)P Equiv.	74	ug/kg	NA	1.2255
RA05	Cadmium (Cd)	23.3	mg/kg	0.3475	NA
RA05	Chromium (Cr)	1610	mg/kg	4.4154	NA
RA05	Iron (Fe)	5980	mg/kg	0.2733	NA
RA05	Lead (Pb)	790	mg/kg	NA	NA
	Total			5.1012	2.8134
RA06	Aluminum (Al)	6430	mg/kg	0.0882	NA
RA06	Aroclor-1260	1400	ug/kg	NA	6.3519
RA06	Beryllium (Be)	0.37	mg/kg	0.0010	2.7705
RA06	Cadmium (Cd)	15.9	mg/kg	0.2184	NA
RA06	Chromium (Cr)	305	mg/kg	0.8365	NA
RA06	Iron (Fe)	5930	mg/kg	0.2710	NA
RA06	Lead (Pb)	131	mg/kg	NA	NA
	Total			1.4151	9.1224
RA07	Aluminum (Al)	3390	mg/kg	0.0465	NA
RA07	B(a)P Equiv.	6958.8	ug/kg	NA	115.2399
RA07	Beryllium (Be)	0.32	mg/kg	0.0009	2.3961
RA07	Cadmium (Cd)	2.3	mg/kg	0.0316	NA
RA07	Chromium (Cr)	13	mg/kg	0.0357	NA
RA07	Iron (Fe)	2160	mg/kg	0.0987	NA
RA07	Lead (Pb)	89.5	mg/kg	NA	NA
	Total			0.2133	117.6360
RA08	Aluminum (Al)	3030	mg/kg	0.0415	NA
RA08	Aroclor-1260	230	ug/kg	NA	1.0435
RA08	B(a)P Equiv.	1000.82	ug/kg	NA	16.5739
RA08	Beryllium (Be)	0.31	mg/kg	0.0009	2.3212
RA08	Cadmium (Cd)	11.1	mg/kg	0.1525	NA
RA08	Chromium (Cr)	41.4	mg/kg	0.1135	NA
RA08	Iron (Fe)	5030	mg/kg	0.2299	NA
RA08	Lead (Pb)	413	mg/kg	NA	NA
	Total			0.5383	19.9386

Table 10.3.1.18
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 11, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

RA09	Aluminum (Al)	3490	mg/kg	0.0479	NA
RA09	B(a)P Equiv.	61.7	ug/kg	NA	1.0218
RA09	Cadmium (Cd)	1.9	mg/kg	0.0261	NA
RA09	Chromium (Cr)	5.3	mg/kg	0.0145	NA
RA09	Iron (Fe)	2330	mg/kg	0.1065	NA
RA09	Lead (Pb)	15.7	mg/kg	NA	NA
	Total			0.1950	1.0218
RA10	Aluminum (Al)	1020	mg/kg	0.0140	NA
RA10	Iron (Fe)	611	mg/kg	0.0279	NA
RA10	Lead (Pb)	1.2	mg/kg	NA	NA
	Total			0.0419	NA
RA11	Aluminum (Al)	109	mg/kg	0.0015	NA
RA11	Chromium (Cr)	2.3	mg/kg	0.0063	NA
RA11	Iron (Fe)	119	mg/kg	0.0054	NA
RA11	Lead (Pb)	1.3	mg/kg	NA	NA
	Total			0.0132	NA
RA12	Aluminum (Al)	1540	mg/kg	0.0211	NA
RA12	Chromium (Cr)	5.4	mg/kg	0.0148	NA
RA12	Iron (Fe)	1150	mg/kg	0.0526	NA
RA12	Lead (Pb)	488	mg/kg	NA	NA
	Total			0.0885	NA
RA13	Aluminum (Al)	5480	mg/kg	0.0751	NA
RA13	Aroclor-1260	99	ug/kg	NA	0.4492
RA13	B(a)P Equiv.	196.83	ug/kg	NA	3.2596
RA13	Cadmium (Cd)	12.7	mg/kg	0.1745	NA
RA13	Chromium (Cr)	29.3	mg/kg	0.0804	NA
RA13	Iron (Fe)	5460	mg/kg	0.2496	NA
RA13	Lead (Pb)	463	mg/kg	NA	NA
	Total			0.5796	3.7087
S001	Aluminum (Al)	9910	mg/kg	0.1359	NA
S001	Aroclor-1254	220	ug/kg	0.1814	0.9982
S001	Arsenic (As)	3	mg/kg	0.1371	7.8360
S001	B(a)P Equiv.	373.87	ug/kg	NA	6.1914
S001	Beryllium (Be)	0.26	mg/kg	0.0007	1.9468
S001	Cadmium (Cd)	1.3	mg/kg	0.0179	NA
S001	Chromium (Cr)	15.3	mg/kg	0.0420	NA
S001	Iron (Fe)	6600	mg/kg	0.3017	NA
S001	Lead (Pb)	37.4	mg/kg	NA	NA
	Total			0.8167	16.9724
S003	Aluminum (Al)	6710	mg/kg	0.0920	NA
S003	Aroclor-1260	43	ug/kg	NA	0.1951
S003	Arsenic (As)	1.9	mg/kg	0.0868	4.9628
S003	B(a)P Equiv.	113.66	ug/kg	NA	1.8822
S003	Chromium (Cr)	8.5	mg/kg	0.0233	NA
S003	Iron (Fe)	4300	mg/kg	0.1965	NA
S003	Lead (Pb)	14.6	mg/kg	NA	NA
	Total			0.3987	7.0401
S011	Aluminum (Al)	26700	mg/kg	0.3661	NA
S011	Arsenic (As)	4.1	mg/kg	0.1874	10.7092
S011	Beryllium (Be)	0.28	mg/kg	0.0008	2.0966
S011	Chromium (Cr)	33.1	mg/kg	0.0908	NA
S011	Iron (Fe)	21100	mg/kg	0.9644	NA
S011	Lead (Pb)	32.5	mg/kg	NA	NA
	Total			1.6095	12.8058
S013	Aluminum (Al)	21700	mg/kg	0.2976	NA
S013	Arsenic (As)	2.7	mg/kg	0.1234	7.0524
S013	Chromium (Cr)	24.3	mg/kg	0.0666	NA
S013	Iron (Fe)	12700	mg/kg	0.5805	NA
S013	Lead (Pb)	5.5	mg/kg	NA	NA
	Total			1.0681	7.0524

Table 10.[illegible]'9
Hazard Q[illegible]nts and Incremental Lifetime Cancer Risks
Shallow Groundwater Ingestion
Site 11
Naval Air Station, Pensacola

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Aluminum	1	NA	0.36	0.84	ND	0.13	ND
Aldrin	3E-05	17	0.015	0.036	4.3E-06	0.0055	1.4E-06
Arsenic	0.0003	1.5	1.8	4.3	4.5E-04	0.66	1.5E-04
Barium	0.07	NA	0.28	0.66	ND	0.10	ND
Benzene	NA	0.029	ND	ND	1.3E-06	ND	4.2E-07
Beryllium	0.005	4.3	0.025	0.059	3.0E-04	0.0090	9.5E-05
Cadmium	0.0005	NA	0.35	0.81	ND	0.12	ND
Chlorobenzene	0.02	NA	0.0068	0.016	ND	0.0024	ND
Chloroform	0.01	0.0061	0.0029	0.0069	9.9E-08	0.0011	3.2E-08
Chromium	0.005	NA	0.90	2.1	ND	0.32	ND
1,1-Dichloroethene	0.009	0.6	0.030	0.071	9.0E-05	0.011	2.9E-05
1,1-Dichloroethane	0.1	NA	0.020	0.046	ND	0.0070	ND
1,2-Dichloroethane	NA	0.091	ND	ND	1.1E-05	ND	3.5E-06
1,2-Dichloroethene (cis)	0.01	NA	2.7	6.2	ND	0.95	ND
1,2-Dichloroethene (total)	0.009	NA	0.39	0.91	ND	0.14	ND
1,2-Dichloropropane	NA	0.068	ND	ND	3.1E-06	ND	9.8E-07
Dieldrin	5E-05	16	0.011	0.025	4.7E-06	0.0039	1.5E-06
Ethylbenzene	0.1	NA	0.012	0.028	ND	0.0042	ND
Heptachlor epoxide	1.3E-05	9.1	0.012	0.029	8.1E-07	0.0044	2.6E-07
Lead	NA	NA	ND	ND	ND	ND	ND
Manganese*	0.047	NA	0.30	0.7	ND	0.11	ND
Naphthalene	0.04	NA	0.025	0.058	ND	0.0089	ND
Nickel	0.02	NA	0.26	0.61	ND	0.094	ND
1,1,2,2-Tetrachloroethane	NA	0.2	ND	ND	6.0E-06	ND	1.9E-06
Tetrachloroethene	0.01	0.052	0.022	0.052	6.3E-06	0.0079	2.0E-06
Trichloroethene	0.006	0.011	0.052	0.12	1.9E-06	0.019	6.1E-07
Vanadium	0.007	NA	0.24	0.57	ND	0.087	ND
Vinyl chloride	NA	1.9	ND	ND	1.7E-03	ND	5.4E-04
Xylene	2	NA	0.0016	0.0038	ND	0.00058	ND
SUM Hazard Index/ILCR			8	18	3E-03	3	8E-04

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.1-20
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Contaminants in Shallow Groundwater due to Domestic Use
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation Rf Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Benzene	0.00171	0.029	0.048	0.11	1.3E-06	0.017	4.2E-07
Chlorobenzene	0.00571	NA	0.024	0.056	ND	0.0086	ND
Chloroform	0.01	0.0805	0.0029	0.0069	1.3E-06	0.0011	4.2E-07
1,1-Dichloroethene	0.009	0.175	0.030	0.071	2.6E-05	0.011	8.4E-06
1,1-Dichloroethane	0.143	NA	0.014	0.032	ND	0.0049	ND
1,2-Dichloroethane	0.00286	0.091	0.077	0.18	1.1E-05	0.028	3.5E-06
1,2-Dichloroethene (cis)	0.01	NA	2.7	6.2	ND	0.95	ND
1,2-Dichloroethene (total)	0.009	NA	0.39	0.91	ND	0.14	ND
1,2-Dichloropropane	0.00114	NA	0.072	0.17	ND	0.026	ND
Ethylbenzene	0.286	NA	0.0042	0.010	ND	0.0015	ND
1,1,2,2-Tetrachloroethane	NA	0.00203	ND	ND	6.1E-08	ND	2.0E-08
Tetrachloroethene	0.01	0.00203	0.022	0.052	2.5E-07	0.0079	7.9E-08
Trichloroethene	0.006	0.006	0.052	0.12	1.0E-06	0.019	3.3E-07
Vinyl chloride	NA	0.3	ND	ND	2.7E-04	ND	8.6E-05
Xylene	NA	NA	ND	ND	ND	ND	ND
SUM Hazard Index/ILCR			3	8	3E-04	1	1E-04

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk

Table 10.3.1.21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 11, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
Summary of Risk and Hazard resulting from Maximum Concentration						
GS28	01	1,1,2,2-Tetrachloroethane	2	ug/L	NA	11.99
I010	01	1,2-Dichloroethane	9	ug/L	0.40	24.36
I014	01	1,2-Dichloroethene (total)	580	ug/L	8.24	NA
S003	01	Aldrin	0.026	ug/L	0.06	6.57
I015	01	Aluminum (Al)	58900	ug/L	3.77	NA
I015	01	Arsenic (As)	230	ug/L	49.01	5131.12
S013	01	Barium (Ba)	3790	ug/L	3.46	NA
I015	01	Beryllium (Be)	11	ug/L	0.14	703.48
S001	02	Cadmium (Cd)	8	ug/L	1.03	NA
I004	01	Chloroform	2	ug/L	0.03	2.58
I015	01	Chromium (Cr)	771	ug/L	9.86	NA
GS36	01	Dieldrin	0.03	ug/L	0.04	7.14
GS52	01	Heptachlor epoxide	0.0059	ug/L	0.06	1.60
I015	01	Lead (Pb)	94	ug/L	NA	NA
I015	01	Manganese (Mn)	935	ug/L	2.60	NA
I015	01	Nickel (Ni)	512	ug/L	1.64	NA
GS52	02	Tetrachloroethene	23	ug/L	0.29	18.48
GS52	02	Trichloroethene	50	ug/L	1.07	12.64
I015	01	Vanadium (V)	489	ug/L	4.47	NA
GS52	01	Vinyl chloride	230	ug/L	NA	7525.64
		Total			66	13446
Point Estimates of Risk and Hazard						
GI51	01	Barium (Ba)	61	ug/L	0.0557	NA
GI51	01	Manganese (Mn)	316	ug/L	0.8783	NA
		Total			0.9340	NA
GS15	01	Barium (Ba)	20	ug/L	0.0183	NA
GS15	01	Cadmium (Cd)	4	ug/L	0.5128	NA
GS15	01	Lead (Pb)	3	ug/L	NA	NA
		Total			0.5311	NA
GS15	02	Aluminum (Al)	1090	ug/L	0.0697	NA
GS15	02	Arsenic (As)	7.6	ug/L	1.6195	169.5499
GS15	02	Barium (Ba)	72.1	ug/L	0.0658	NA
GS15	02	Manganese (Mn)	106	ug/L	0.2946	NA
GS15	02	Vanadium (V)	12	ug/L	0.1096	NA
		Total			2.1592	169.5499
GS28	01	1,1,2,2-Tetrachloroethane	2	ug/L	NA	11.9875
GS28	01	Aluminum (Al)	919	ug/L	0.0587	NA
GS28	01	Arsenic (As)	1	ug/L	0.2131	22.3092
GS28	01	Barium (Ba)	20	ug/L	0.0183	NA
GS28	01	Lead (Pb)	2	ug/L	NA	NA
GS28	01	Manganese (Mn)	83	ug/L	0.2307	NA
GS28	01	Vanadium (V)	8	ug/L	0.0731	NA
GS28	01	Vinyl chloride	2	ug/L	NA	65.4403
		Total			0.5939	99.7370
GS36	01	Aluminum (Al)	172	ug/L	0.0110	NA
GS36	01	Dieldrin	0.03	ug/L	0.0384	7.1389
		Total			0.0494	7.1389
GS46	01	Aluminum (Al)	587	ug/L	0.0375	NA
GS46	01	Lead (Pb)	4	ug/L	NA	NA
		Total			0.0375	NA
GS47	01	1,2-Dichloroethene (total)	9	ug/L	0.1279	NA
GS47	01	Lead (Pb)	1	ug/L	NA	NA
GS47	01	Vinyl chloride	55	ug/L	NA	1799.6086
		Total			0.1279	1799.6086
GS47	02	Barium (Ba)	34.2	ug/L	0.0312	NA
GS47	02	Benzene	3	ug/L	0.2243	2.5879
GS47	02	Vanadium (V)	1.5	ug/L	0.0137	NA
GS47	02	Vinyl chloride	48	ug/L	NA	1570.5675
		Total			0.2692	1573.1554
GS48	01	Barium (Ba)	759	ug/L	0.6932	NA
GS48	01	Lead (Pb)	2	ug/L	NA	NA
GS48	01	Manganese (Mn)	206	ug/L	0.5726	NA
		Total			1.2657	NA

Table 10.3.1.21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 11, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

GS49	01	Lead (Pb)	2 ug/L	NA	NA
GS49	01	Manganese (Mn)	125 ug/L	0.3474	NA
		Total		0.3474	NA
GS52	01	1,2-Dichloroethene (total)	420 ug/L	5.9665	NA
GS52	01	Aluminum (Al)	398 ug/L	0.0254	NA
GS52	01	Arsenic (As)	14 ug/L	2.9833	312.3288
GS52	01	Barium (Ba)	53 ug/L	0.0484	NA
GS52	01	Heptachlor epoxide	0.0059 ug/L	0.0580	1.5970
GS52	01	Lead (Pb)	1 ug/L	NA	NA
GS52	01	Trichloroethene	20 ug/L	0.4262	5.0568
GS52	01	Vinyl chloride	230 ug/L	NA	7525.6360
		Total		9.5078	7844.6186
GS52	02	1,1-Dichloroethene	10 ug/L	0.1421	115.2642
GS52	02	1,2-Dichloroethane	1 ug/L	0.0447	2.7068
GS52	02	Benzene	0.3 ug/L	0.0224	0.2588
GS52	02	Chloroform	0.3 ug/L	0.0038	0.3864
GS52	02	Tetrachloroethene	23 ug/L	0.2941	18.4823
GS52	02	Trichloroethene	50 ug/L	1.0654	12.6419
GS52	02	Vinyl chloride	74 ug/L	NA	2421.2916
GS52	02	cis-1,2-Dichloroethene	970 ug/L	12.4018	NA
		Total		13.9744	2571.0320
I002	01	1,2-Dichloroethene (total)	16 ug/L	0.2273	NA
I002	01	Aluminum (Al)	8730 ug/L	0.5581	NA
I002	01	Arsenic (As)	13 ug/L	2.7702	290.0196
I002	01	Barium (Ba)	27 ug/L	0.0247	NA
I002	01	Beryllium (Be)	1 ug/L	0.0128	63.9530
I002	01	Chromium (Cr)	23 ug/L	0.2941	NA
I002	01	Lead (Pb)	14 ug/L	NA	NA
I002	01	Manganese (Mn)	29 ug/L	0.0806	NA
I002	01	Nickel (Ni)	18 ug/L	0.0575	NA
I002	01	Trichloroethene	3 ug/L	0.0639	0.7585
I002	01	Vanadium (V)	36 ug/L	0.3288	NA
		Total		4.4179	354.7311
I002	02	1,1-Dichloroethene	0.4 ug/L	0.0057	4.6106
I002	02	Aluminum (Al)	1110 ug/L	0.0710	NA
I002	02	Arsenic (As)	12.6 ug/L	2.6849	281.0959
I002	02	Tetrachloroethene	0.3 ug/L	0.0038	0.2411
I002	02	Trichloroethene	3 ug/L	0.0639	0.7585
I002	02	Vanadium (V)	6.4 ug/L	0.0584	NA
I002	02	cis-1,2-Dichloroethene	15 ug/L	0.1918	NA
		Total		3.0796	286.7060
I004	01	Aldrin	0.0075 ug/L	0.0160	1.8963
I004	01	Aluminum (Al)	4880 ug/L	0.3120	NA
I004	01	Arsenic (As)	6 ug/L	1.2785	133.8552
I004	01	Barium (Ba)	18 ug/L	0.0164	NA
I004	01	Chloroform	2 ug/L	0.0256	2.5760
I004	01	Chromium (Cr)	10 ug/L	0.1279	NA
I004	01	Lead (Pb)	4 ug/L	NA	NA
I004	01	Manganese (Mn)	21 ug/L	0.0584	NA
I004	01	Vanadium (V)	30 ug/L	0.2740	NA
		Total		2.1087	138.3274
I004	02	Aluminum (Al)	363 ug/L	0.0232	NA
I004	02	Manganese (Mn)	24.2 ug/L	0.0673	NA
		Total		0.0905	NA
I006	01	Aluminum (Al)	368 ug/L	0.0235	NA
I006	01	Arsenic (As)	6 ug/L	1.2785	133.8552
I006	01	Barium (Ba)	13 ug/L	0.0119	NA
I006	01	Lead (Pb)	1 ug/L	NA	NA
I006	01	Manganese (Mn)	55 ug/L	0.1529	NA
I006	01	Nickel (Ni)	44 ug/L	0.1406	NA
		Total		1.6074	133.8552
I008	01	Aluminum (Al)	824 ug/L	0.0527	NA
I008	01	Arsenic (As)	5 ug/L	1.0654	111.5460
I008	01	Barium (Ba)	37 ug/L	0.0338	NA
I008	01	Manganese (Mn)	71 ug/L	0.1973	NA
		Total		1.3493	111.5460
I010	01	1,2-Dichloroethane	9 ug/L	0.4023	24.3616
I010	01	1,2-Dichloroethene (total)	3 ug/L	0.0426	NA
I010	01	Aluminum (Al)	745 ug/L	0.0476	NA
I010	01	Arsenic (As)	3 ug/L	0.6393	66.9276
I010	01	Barium (Ba)	37 ug/L	0.0338	NA

Table 10.3.1.21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 11, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

I010	01	Chloroform	1 ug/L	0.0128	1.2880
I010	01	Manganese (Mn)	32 ug/L	0.0889	NA
		Total		1.2674	92.5772
I012	01	1,2-Dichloroethene (total)	110 ug/L	1.5627	NA
I012	01	Aluminum (Al)	1130 ug/L	0.0722	NA
I012	01	Arsenic (As)	6 ug/L	1.2785	133.8552
I012	01	Barium (Ba)	18 ug/L	0.0164	NA
I012	01	Manganese (Mn)	52 ug/L	0.1445	NA
I012	01	Trichloroethene	14 ug/L	0.2983	3.5397
I012	01	Vanadium (V)	6 ug/L	0.0548	NA
		Total		3.4275	137.3949
I012	02	Trichloroethene	11 ug/L	0.2344	2.7812
I012	02	cis-1,2-Dichloroethene	32 ug/L	0.4091	NA
		Total		0.6435	2.7812
I014	01	1,2-Dichloroethene (total)	580 ug/L	8.2395	NA
I014	01	Aluminum (Al)	4070 ug/L	0.2602	NA
I014	01	Arsenic (As)	17 ug/L	3.6225	379.2564
I014	01	Barium (Ba)	23 ug/L	0.0210	NA
I014	01	Chromium (Cr)	9 ug/L	0.1151	NA
I014	01	Lead (Pb)	4 ug/L	NA	NA
I014	01	Vanadium (V)	30 ug/L	0.2740	NA
I014	01	Vinyl chloride	88 ug/L	NA	2879.3738
		Total		12.5322	3258.6302
I014	02	1,1-Dichloroethene	0.9 ug/L	0.0128	10.3738
I014	02	1,2-Dichloroethane	0.2 ug/L	0.0089	0.5414
I014	02	1,2-Dichloropropane	3 ug/L	0.3365	6.0681
I014	02	Trichloroethene	1 ug/L	0.0213	0.2528
I014	02	Vinyl chloride	33 ug/L	NA	1079.7652
I014	02	cis-1,2-Dichloroethene	240 ug/L	3.0685	NA
		Total		3.4480	1097.0013
I015	01	Aluminum (Al)	58900 ug/L	3.7653	NA
I015	01	Arsenic (As)	230 ug/L	49.0107	5131.1155
I015	01	Barium (Ba)	147 ug/L	0.1342	NA
I015	01	Beryllium (Be)	11 ug/L	0.1406	703.4834
I015	01	Chromium (Cr)	771 ug/L	9.8575	NA
I015	01	Lead (Pb)	94 ug/L	NA	NA
I015	01	Manganese (Mn)	935 ug/L	2.5988	NA
I015	01	Nickel (Ni)	512 ug/L	1.6365	NA
I015	01	Vanadium (V)	489 ug/L	4.4658	NA
		Total		71.6094	5834.5989
S001	01	Barium (Ba)	12 ug/L	0.0110	NA
S001	01	Lead (Pb)	1 ug/L	NA	NA
		Total		0.0110	NA
S001	02	Aluminum (Al)	900 ug/L	0.0575	NA
S001	02	Arsenic (As)	3.1 ug/L	0.6606	69.1585
S001	02	Beryllium (Be)	1.8 ug/L	0.0230	115.1155
S001	02	Cadmium (Cd)	8 ug/L	1.0256	NA
S001	02	Chromium (Cr)	10.6 ug/L	0.1355	NA
S001	02	Vanadium (V)	6.7 ug/L	0.0612	NA
		Total		1.9635	184.2740
S003	01	Aldrin	0.026 ug/L	0.0554	6.5738
S003	01	Aluminum (Al)	769 ug/L	0.0492	NA
S003	01	Barium (Ba)	8 ug/L	0.0073	NA
S003	01	Chloroform	1 ug/L	0.0128	1.2880
S003	01	Dieldrin	0.0094 ug/L	0.0120	2.2369
S003	01	Lead (Pb)	1 ug/L	NA	NA
		Total		0.1367	10.0986
S003	02	No COPCs	376 ug/L	NA	NA
		Total		NA	NA
S005	01	1,2-Dichloroethene (total)	6 ug/L	0.0852	NA
S005	01	Aluminum (Al)	409 ug/L	0.0261	NA
S005	01	Barium (Ba)	46 ug/L	0.0420	NA
S005	01	Lead (Pb)	30 ug/L	NA	NA
S005	01	Manganese (Mn)	95 ug/L	0.2640	NA
S005	01	Tetrachloroethene	2 ug/L	0.0256	1.6072
S005	01	Trichloroethene	4 ug/L	0.0852	1.0114
		Total		0.5282	2.6185
S005	02	Aluminum (Al)	310 ug/L	0.0198	NA
S005	02	Arsenic (As)	1.9 ug/L	0.4049	42.3875

Table 10.3.1.21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 11, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

S005	02	Barium (Ba)	43.5 ug/L	0.0397	NA
S005	02	Lead (Pb)	13 ug/L	NA	NA
S005	02	Manganese (Mn)	36.2 ug/L	0.1006	NA
S005	02	Trichloroethene	0.7 ug/L	0.0149	0.1770
S005	02	cis-1,2-Dichloroethene	17 ug/L	0.2174	NA
		Total		0.7973	42.5645
S007	01	Arsenic (As)	1 ug/L	0.2131	22.3092
S007	01	Barium (Ba)	716 ug/L	0.6539	NA
S007	01	Cadmium (Cd)	7 ug/L	0.8974	NA
S007	01	Lead (Pb)	6 ug/L	NA	NA
S007	01	Manganese (Mn)	365 ug/L	1.0145	NA
		Total		2.7789	22.3092
S009	01	Barium (Ba)	382 ug/L	0.3489	NA
S009	01	Lead (Pb)	4 ug/L	NA	NA
S009	01	Manganese (Mn)	212 ug/L	0.5892	NA
		Total		0.9381	NA
S011	01	1,2-Dichloroethene (total)	2 ug/L	0.0284	NA
S011	01	Arsenic (As)	11 ug/L	2.3440	245.4012
S011	01	Barium (Ba)	1520 ug/L	1.3881	NA
S011	01	Chlorobenzene	3 ug/L	0.0432	NA
S011	01	Lead (Pb)	7 ug/L	NA	NA
S011	01	Manganese (Mn)	120 ug/L	0.3335	NA
		Total		4.1372	245.4012
S011	02	Chlorobenzene	5 ug/L	0.0720	NA
S011	02	Vinyl chloride	0.8 ug/L	NA	26.1761
S011	02	cis-1,2-Dichloroethene	2 ug/L	0.0256	NA
		Total		0.0975	26.1761
S013	01	1,2-Dichloroethene (total)	4 ug/L	0.0568	NA
S013	01	Aluminum (Al)	458 ug/L	0.0293	NA
S013	01	Arsenic (As)	4 ug/L	0.8524	89.2368
S013	01	Barium (Ba)	3790 ug/L	3.4612	NA
S013	01	Lead (Pb)	17 ug/L	NA	NA
S013	01	Manganese (Mn)	133 ug/L	0.3697	NA
		Total		4.7693	89.2368
S013	02	1,1-Dichloroethene	2 ug/L	0.0284	23.0528
S013	02	Benzene	0.4 ug/L	0.0299	0.3450
S013	02	Tetrachloroethene	7 ug/L	0.0895	5.6250
S013	02	Trichloroethene	5 ug/L	0.1065	1.2642
S013	02	Vinyl chloride	3 ug/L	NA	98.1605
S013	02	cis-1,2-Dichloroethene	28 ug/L	0.3580	NA
		Total		0.6124	128.4476

Table 10 -22
Summary Lead Model Results
Site 11
Naval Air Station Pensacola
Pensacola, Florida

Lead Model Default Inputs		Site Specific inputs (RME)		(Mean)
Air Concentration	0.1 ug Pb/m3	Soil	790 ug Pb/g	143 ug Pb/g
Paint Intake	0 ug Pb/day	House Dust	790 ug Pb/g	143 ug Pb/g
Maternal Contribution	2.5 ug Pb/dL	Drinking Water	11 ug Pb/L	10.6 ug Pb/L

Lead Model Results

RME Inputs:
Predicted Geometric Mean Blood Lead Level 9.5 ug Pb/dL (micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/dL 42.7 %

Mean Inputs:
Predicted Geometric Mean Blood Lead Level 3.6 ug Pb/dL (micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/dL 1.4 %

Table 10.3.1-23
Summary of Risk and Hazard-based Surface Soil COCs
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	Chemical	Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident Iwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Future Tresspasser Hazard Quotien	Future Tresspasser ILCR
Surface Soil	Incidental Ingestion	Aluminum	0.032	0.30	ND	0.012	ND	0.0075	ND
		Aroclor-1254	0.0022	0.020	9.9E-08	0.00077	1.[illegible]E-08	0.00050	2.9E-09
		Aroclor-1260	ND	ND	9.1E-07	ND	1.0E-07	ND	2.6E-08
		Arsenic	0.0117	0.109	6.0E-06	0.0042	6.[illegible]E-07	0.0027	1.7E-07
		Benzo(a)pyrene Equiv.	ND	ND	3.0E-05	ND	3.[illegible]E-06	ND	8.7E-07
		Cadmium	0.014	0.13	ND	0.005	ND	0.0033	ND
		Chromium	0.10	0.9	ND	0.035	ND	0.023	ND
		Lead	ND	ND	ND	ND	ND	ND	ND
	Dermal Contact	Aluminum	0.0066	0.022	ND	0.0047	ND	0.0015	ND
		Aroclor-1254	0.0018	0.0059	4.5E-08	0.0013	1.8E-08	0.00041	2.3E-09
		Aroclor-1260	ND	ND	4.1E-07	ND	1.7E-07	ND	2.2E-08
		Arsenic	0.0024	0.0079	6.7E-07	0.0017	2.7E-07	0.00055	3.5E-08
		Benzo(a)pyrene Equiv.	ND	ND	1.4E-05	ND	5.[illegible]E-06	ND	7.2E-07
		Cadmium	0.0029	0.010	ND	0.0021	ND	0.00068	ND
		Chromium	0.020	0.07	ND	0.014	ND	0.0046	ND
		Lead	ND	ND	ND	ND	ND	ND	ND
	Inhalation	Chromium	ND	ND	1.8E-06	ND	7.9E-07	ND	9.0E-08
Surface Soil Pathway Sum			0.2	2	5E-05	0.1	[illegible]E-05	0.04	2E-06

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.
5- Chemical is a COC by virtue of projected future adolescent trespasser noncarcinogenic hazard.
6- Chemical is a COC by virtue of projected future adolescent trespasser ILCR.

Table 10.3.1-24
Summary of Risk and Hazard-based Groundwater COCs
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	Chemical	Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident Iwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Identification of COCs			
Groundwater	Ingestion	Aluminum	0.36	0.84	ND	0.13	ND	1		3	
		Aldrin	0.015	0.036	4.3E-06	0.0055	1.4E-06		2		4
		Arsenic	1.8	4.3	4.5E-04	0.66	1.5E-04	1	2	3	4
		Barium	0.28	0.66	ND	0.10	ND	1		3	
		Benzene	ND	ND	1.3E-06	ND	4.2E-07		2		
		Beryllium	0.025	0.059	3.0E-04	0.0090	9.5E-05		2		4
		Cadmium	0.35	0.81	ND	0.12	ND	1		3	
		Chlorobenzene	0.0068	0.016	ND	0.0024	ND				
		Chloroform	0.0029	0.0069	9.9E-08	0.0011	3.2E-08				
		Chromium	0.90	2.1	ND	0.32	ND	1		3	
		1,1-Dichloroethene	0.030	0.071	9.0E-05	0.011	2.9E-05		2		4
		1,1-Dichloroethane	0.020	0.046	ND	0.0070	ND				
		1,2-Dichloroethane	ND	ND	1.1E-05	ND	3.5E-06		2		4
		1,2-Dichloroethene (cis)	2.7	6.2	ND	0.95	ND	1		3	
		1,2-Dichloroethene (total)	0.39	0.91	ND	0.14	ND	1		3	
		1,2-Dichloropropane	ND	ND	3.1E-06	ND	9.8E-07		2		
		Dieldrin	0.011	0.025	4.7E-06	0.0039	1.5E-06		2		4
		Ethylbenzene	0.012	0.028	ND	0.0042	ND				
		Heptachlor epoxide	0.012	0.029	8.1E-07	0.0044	2.6E-07				
		Lead	ND	ND	ND	ND	ND				
		Manganese	0.61	1.4	ND	0.22	ND	1		3	
		Naphthalene	0.025	0.058	ND	0.0089	ND				
		Nickel	0.26	0.61	ND	0.094	ND	1			
		1,1,2,2-Tetrachloroethane	ND	ND	6.0E-06	ND	1.9E-06		2		4
		Tetrachloroethene	0.022	0.052	6.3E-06	0.0079	2.0E-06		2		4
		Trichloroethene	0.052	0.12	1.9E-06	0.019	6.1E-07	1	2		
		Vanadium	0.24	0.57	ND	0.087	ND	1			
		Vinyl chloride	ND	ND	1.7E-03	ND	5.4E-04		2		4
		Xylene	0.0016	0.0038	ND	0.00058	ND				
	Inhalation	Benzene	0.048	0.11	1.3E-06	0.017	4.2E-07	1	2		
		Chlorobenzene	0.024	0.056	ND	0.0086	ND				
		Chloroform	0.0029	0.0069	1.3E-06	0.0011	4.2E-07		2		
		1,1-Dichloroethene	0.030	0.071	2.6E-05	0.011	8.4E-06		2		4
		1,1-Dichloroethane	0.014	0.032	ND	0.0049	ND				
		1,2-Dichloroethane	0.077	0.18	1.1E-05	0.028	3.5E-06	1	2		4
		1,2-Dichloroethene (cis)	2.7	6.2	ND	0.95	ND	1		3	
		1,2-Dichloroethene (total)	0.39	0.91	ND	0.14	ND	1		3	
		1,2-Dichloropropane	0.072	0.17	ND	0.026	ND	1			
		Ethylbenzene	0.0042	0.0097	ND	0.0015	ND				
		1,1,2,2-Tetrachloroethane	ND	ND	6.1E-08	ND	2.0E-08				
		Tetrachloroethene	0.022	0.052	2.5E-07	0.0079	7.9E-08				
		Trichloroethene	0.052	0.12	1.0E-06	0.019	3.3E-07	1	2		
		Vinyl chloride	ND	ND	2.7E-04	ND	8.6E-05		2		4
		Xylene	ND	ND	ND	ND	ND				
Groundwater Pathway Sum			12	27	3E-03	4	9E-04				

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.

Table 10.3.1-25
Summary of Risk and Hazard
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	HI (Adult)	HI (Child)	ILCR (LWA)	HI (Worker)	ILCR (Worker)	HI (Tresspasser)	ILCR (Tresspasser)
Surface Soil	Incidental Ingestion	0.03	1	4E-05	0.06	4E-06	0.04	1E-06
	Dermal Contact	0.03	0.1	1E-05	0.02	6E-06	0.008	8E-07
	Inhalation	ND	ND	2E-06	ND	8E-07	ND	9E-08
Groundwater	Ingestion	8	19	3E-03	3	8E-04	NA	NA
	Inhalation	3	8	3E-04	1	1E-04	NA	NA
Sum all Pathways		12	28	3E-03	4	9E-04	0.04	2E-06

Notes:
ILCR Indicates incremental lifetime cancer risk
HI Indicates hazard index
NA Not applicable or not available

Table 10.3.1-26
Remedial Goal Options for Surface Soil
Site 11
Naval Air Station, Pensacola
Pensacola, Florida

Residential-Based RGOs

Chemical	Slope Factor (mg/kg-day)-1	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Aluminum	NA	1	23654	218784	72928	7293	ND	ND	ND	3833	75000
Aroclor 1260	2	NA	0.29	ND	ND	ND	0.22	2.2	22	NA	0.9
Arsenic	1.5	0.0003	2.6	67	22	2.2	0.39	3.9	39	1.56	0.7
Benzo(a)pyrene Equiv.	7.3	NA	2.6	ND	ND	ND	0.06	0.6	6	NA	0.1
Cadmium	NA	0.001	10	210	70	7.0	ND	ND	ND	1	37
Chromium	NA	0.005	357	1094	365	36	ND	ND	ND	NA	NA

Industrial-based RGOs

Chemical	Slope Factor (mg/kg-day)-1	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Benzo(a)pyrene Equiv.	7.3	NA	2.6	ND	ND	ND	0.29	2.9	29	NA	0.5

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident for noncarcinogens

Table 10.3.1-27
Remedial Goal Options for Groundwater
Site 11
Naval Air Station Pensacola
Pensacola, Florida

Residential-Based RGOs

Chemical	Oral SF (mg/kg-day)-	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options **0.1** mg/l	**1.0** mg/l	**3** mg/l	Risk-Based Remedial Goal Options **1E-06** mg/l	**1E-05** mg/l	**1E-04** mg/l	Background Concentration mg/l	ARAR mg/l
Aluminum	NA	1	13	1.6	16	47	ND	ND	ND	3.88	0.2
Aldrin	17	3E-05	0.000017	0.000047	0.00047	0.0014	0.0000039	0.000039	0.00039	NA	5E-05
Arsenic	1.5	0.0003	0.020	0.00047	0.0047	0.014	0.000044	0.00044	0.0044	0.0028	0.05
Barium	NA	0.07	0.72	0.11	1.1	3.3	ND	ND	ND	0.0132	2
Beryllium	4.3	0.005	0.0046	0.0078	0.078	0.23	0.000015	0.00015	0.0015	0.0011	0.004
Cadmium	NA	0.0005	0.0063	0.00078	0.0078	0.023	ND	ND	ND	0.0034	0.005
Chloroform	0.0061	0.01	0.0011	0.0078	0.078	0.23	0.00077	0.0077	0.077	NA	0.006
Chromium	NA	0.005	0.16	0.0078	0.078	0.23	ND	ND	ND	0.035	0.1
1,2-Dichloroethane	0.091	NA	0.0081	0.0045	0.045	0.13	0.00036	0.0036	0.036	NA	0.003
1,2-Dichloroethene (total	NA	0.009	0.13	0.0070	0.070	0.21	ND	ND	ND	NA	0.07
Dieldrin	16	5E-05	0.000020	0.000078	0.00078	0.0023	0.0000041	0.000041	0.00041	NA	0.0001
Manganese*	NA	0.047	0.51	0.074	0.74	2.2	ND	ND	ND	0.022	0.05
Nickel	NA	0.02	0.19	0.031	0.31	0.94	ND	ND	ND	0.0399	0.1
1,1,2,2-Tetrachloroethane	0.2	NA	0.0020	ND	ND	ND	0.00033	0.0033	0.033	NA	0.0002
Tetrachloroethene	0.052	0.01	0.0081	0.0078	0.078	0.23	0.0012	0.012	0.12	NA	0.003
Trichloroethene	0.011	0.006	0.011	0.0047	0.047	0.14	0.0039	0.039	0.39	NA	0.003
Vanadium	NA	0.007	0.063	0.011	0.11	0.33	ND	ND	ND	0.0096	0.049
Vinyl chloride	1.9	NA	0.059	ND	ND	ND	0.000030	0.00030	0.0030	NA	0.001

Industrial-based RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options **0.1** mg/l	**1** mg/l	**3** mg/l	Risk-Based Remedial Goal Options **1E-06** mg/l	**1E-05** mg/l	**1E-04** mg/l	Background Concentration mg/l	ARAR mg/l
Aluminum	NA	1	13	10	102	307	ND	ND	ND	3.883	0.2
Aldrin	17	3E-05	0.000017	0.00031	0.0031	0.0092	0.000012	0.00012	0.0012	NA	5E-05
Arsenic	1.5	0.0003	0.020	0.0031	0.031	0.092	0.00014	0.0014	0.014	0.0028	0.05
Barium	NA	0.07	0.72	0.72	7.2	21	ND	ND	ND	0.0132	2
Beryllium	4.3	0.005	0.0046	0.051	0.51	1.5	0.000048	0.00048	0.0048	0.0011	0.004
Cadmium	NA	0.0005	0.0063	0.0051	0.051	0.15	ND	ND	ND	0.0034	0.005
Chromium	NA	0.005	0.16	0.051	0.51	1.5	ND	ND	ND	NA	0.1
1,2-Dichloroethane	0.091	NA	0.0081	0.029	0.29	0.88	0.0011	0.011	0.11	NA	0.003
1,2-Dichloroethene (total	NA	0.009	0.13	0.046	0.46	1.4	ND	ND	ND	NA	0.07
Dieldrin	16	5E-05	0.000020	0.00051	0.0051	0.015	0.000013	0.00013	0.0013	NA	0.0001
Manganese*	NA	0.047	0.51	0.48	4.8	14.4	ND	ND	ND	0.022	0.05
1,1,2,2-Tetrachloroethane	0.2	NA	0.0020	ND	ND	ND	0.0010	0.010	0.10	NA	0.0002
Vanadium	NA	0.007	0.063	0.072	0.72	2.1	ND	ND	ND	0.0096	0.049
Vinyl chloride	1.9	NA	0.059	ND	ND	ND	0.000094	0.00094	0.0094	NA	0.001

NOTES

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average [illegible] carcinogens and the child resident for noncarcinogens
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would [illegible] double its calculated RGOs.

10.3.2 Human Health Risk Assessment for Site 12

10.3.2.1 Site Background and Investigative Approach

Site 12 is used by the DRMO to collect, segregate, and recycle scrap metals.

As part of the RI, 15 surface soil samples were collected and analyzed for full scan TCL/TAL, gross alpha and beta radioactivity, and cyanide. Twelve groundwater samples were collected from the 12 monitoring wells screened in the shallow water-bearing zone. Groundwater was analyzed for full scan TCL/TAL parameters, including cyanide. For groundwater, TAL metals were not filtered. Table 10.3.2-1 lists the sample depths and analytical methods for the soil samples used in the Site 12 HHRA. Table 10.3.2-2 lists analytical methods used for the corresponding groundwater samples.

10.3.2.2 COPC Identification

Soil

Based on the screening comparisons presented in Table 10.3.2-3, this HHRA will focus on the following soil COPCs: aluminum, antimony, Aroclor-1254, Aroclor-1260, arsenic, BEQs, beryllium, cadmium, chromium, copper, and manganese. Ra-226 was also detected in surface soil at a maximum concentration of 1.211 million pCi/g which substantially exceeds the Department of Energy guidance of 5 pCi/g (for the upper 15 cm of soil). A formal risk assessment was not performed for exposures to Ra-226 in Site 12 soil. However, given the magnitude of the exceedance, more data should be obtained to support comprehensive risk management decisions.

Groundwater

As shown in Table 10.3.2-4, the COPCs identified in groundwater are Aroclor-1260, cadmium, chloroform, 4,4'-DDD, 1,1-DCE, dieldrin, heptachlor epoxide, and tetrachloroethene. 1,1-Dichloroethane and 1,2-DCE (cis) were detected in Site 12 groundwater at concentrations below their RBCs; however, groundwater concentrations of these chemicals exceeded their RBCs

at other OU 2 sites. As a result, 1,1-dichloroethane and 1,2-DCE (cis) were added to the list of Site 12 groundwater COPCs. No Phase II groundwater samples were collected from Site 12 monitoring wells.

10.3.2.3 Exposure Assessment

Exposure Setting

Site 12, in the eastern side of OU 2, is an active scrap metal recycling operation and will likely maintain its current use for the next five years. A perimeter fence surrounds active portions of the DRMO, limiting site access.

Potentially Exposed Populations

Potentially exposed populations are current and future site workers in addition to hypothetical future site residents, although plans do not suggest noncommercial use in the foreseeable future. Future site resident and worker exposure scenarios are addressed in this risk assessment. To assess future site risks in the event that the perimeter fence is removed, an adolescent trespasser scenario was evaluated. In the event of construction onsite, construction workers were considered to have the potential of exposure to chemicals in subsurface soil. Therefore construction worker PRGs were calculated as described in Section 10.2.12, and compared to maximum detected chemical concentrations in subsurface soil.

The hypothetical future site worker scenario assumes continuous exposure to surface soil conditions and the use of groundwater as a potable water source while on the job. The hypothetical future site worker scenario assumed continuous exposure to surface soil conditions and the use of groundwater as a potable water source. Current site workers' exposure would be less than that assumed for the hypothetical future site worker scenario because of their limited soil contact and the fact that groundwater is not currently used onsite as a source of potable or process water. The future site resident scenario assumes that existing buildings would be removed and

replaced with dwellings and that future site residents would use the onsite shallow zone of the underlying aquifers as a drinking water source. The current site trespasser is characterized as an adolescent who visits the site once a week during the summer.

Exposure Pathways

Exposure pathways for future residential use, future site workers, and adolescent trespassers are dermal contact and incidental ingestion of surface soil. Additional pathways for future residents and future site workers include ingestion of groundwater through potable use and inhalation of VOCs through domestic groundwater use. Uniform exposure is assumed for all sample locations. A potential indirect exposure pathway was identified through fate and transport analysis in Section 9. Dieldrin was identified in soil samples at concentrations exceeding the SSL, indicating it may be leaching to groundwater. Dieldrin was identified as a groundwater COPC through screening versus tap water RBC. No other indirect exposure pathways were identified through fate and transport analyses. Table 10.3.2-5 justifies exposure pathways assessed in this HHRA.

Exposure Point Concentrations

Table 10.3.2-6 summarizes the statistical data analysis for COPCs identified in surface soil. The soil EPC for aluminum, antimony, arsenic, BEQs, beryllium, chromium, and manganese was set equal to the 95% UCL. For Aroclor-1254, Aroclor-1260, cadmium, and copper, the maximum detected concentrations were used as the soil EPC since the 95% UCL exceeded these concentrations. For nondetected concentrations, one-half of the sample quantitation limits served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL for all COPCs.

Table 10.3.2-7 summarizes the statistical data analysis for COPCs identified in groundwater. For nondetected concentrations, one-half of the sample quantitation limits served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL for cadmium,

chloroform, 1,2-DCE (cis), 4,4'-DDD, and PCE. For Aroclor-1260, dieldrin, 1,1-DCA, and 1,1-DCE, one-half of their lowest detected concentrations were inserted into the data set used to calculate their 95% UCLs because the sample quantitation limits exceeded their maximum detected concentrations.

In a risk assessment, the most appropriate way to handle the uncertainty introduced through data variability is to calculate a 95% UCL. As mentioned in Section 10.2, placing monitoring wells in uncontaminated areas of the aquifer may provide a data set that causes a low bias on the 95% UCL. Region IV recently has favored the use of an arithmetic mean in the most concentrated area of the plume as an EPC. Since a high level of uncertainty is associated with defining plumes for Site 12 groundwater COPCs, the Region IV guidance for groundwater EPCs only marginally applies. As a result, the greater of the arithmetic mean of detected concentrations (to account for possible low bias caused by placing wells in uncontaminated aquifer zones) or the 95% UCL (to account for the uncertainty of highly variable data) was used as an EPC. Accordingly, the 95% UCL was used as the EPC to estimate exposure to groundwater containing tetrachloroethene. The arithmetic mean of detected concentrations was used as the EPC to estimate exposure to groundwater containing cadmium, chloroform, 1,1-DCA, 1,1-DCE, and dieldrin. The only detected concentration was used as the EPC to estimate exposure to groundwater containing Aroclor-1260, 4,4'-DDD, 1,2-DCE (cis), and heptachlor epoxide.

Exposure Quantification

Soil

CDI for ingestion and dermal contact with soil are shown in Tables 10.3.2-8 and 10.3.2-9, respectively.

Groundwater

The CDIs for groundwater ingestion are presented in Table 10.3.2-10. The CDIs for inhalation of VOCs were assumed to be approximately equal to the CDI for ingestion, as indicated in the *Technical Memorandum Guidance on Estimating Exposure to VOCs While Showering* (USEPA, 1991e).

10.3.2.4 Toxicity Assessment

Table 10.4.1-1 presents toxicological information specific to each COPC identified at Site OU 2. This information was used to quantify risk/hazard associated with soil and groundwater contaminants. Toxicological profiles for COPCs are provided in Section 10.4.

Some constituents detected in soil and groundwater at Site 12 do not have toxicity criteria available. The RBC for endosulfan was cross-assigned to endosulfan I and endosulfan sulfate. The RBC for endrin was cross-assigned to endrin aldehyde and endrin ketone. The RBC for naphthalene was cross-assigned to 2-methylnaphthalene and the RBC for acenaphthene was cross-assigned to acenaphthylene.

10.3.2.5 Risk Characterization

Surface Soil Pathways

Exposure to surface soil onsite was evaluated under residential, industrial (site worker), and trespasser scenarios. The incidental ingestion and dermal contact exposure pathways were evaluated. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.3.2-11 and 10.3.2-12 present the computed carcinogenic risks and/or HQs associated with the incidental ingestion of and dermal contact with site surface soil, respectively.

Hypothetical Site Residents

The ingestion ILCR (based on the adult and child LWA) for Site 12 surface soils is 7E-05. The dermal pathway ILCR is 3E-05. Aroclor-1260, arsenic, and BEQs were the primary contributors for the ingestion pathway with Aroclor-1260 and BEQs contributing significantly to the dermal pathway.

The computed HIs for the adult and child resident were 0.9 and 8, respectively, for the soil ingestion pathway. The computed HIs for the adult and child dermal contact pathways were 0.2 and 0.6. Cadmium was the primary contributor for both. Secondary contributors to the ingestion HI were aluminum, antimony, Aroclor-1254, chromium, and copper.

Hypothetical Site Workers

Site worker ILCR is 7E-06 for the ingestion pathway and 1E-05 for the dermal contact pathway. Aroclor-1260 and BEQs were the primary contributors for both. HIs were 0.3 for the ingestion pathway and 0.1 for the dermal pathway.

Hypothetical Adolescent Trespassers

Adolescent trespasser ILCR is 2E-06 for the ingestion pathway and 1E-06 for the dermal contact pathway. Aroclor-1260 was the primary contributor for both. HIs were 0.2 for the ingestion pathway and 0.04 for the dermal pathway.

Construction Worker

Table 10.3.2-13 presents a summary of subsurface soil with a comparison to PRGs. As shown, the maximum concentrations of chemicals reported in Site 11 subsurface soil did not exceed their respective construction worker PRGs.

Point Risk and Point Hazard Estimates for Surface Soil Pathways

Figures 10-7 and 10-8 are the risk and hazard maps for Site 12 surface soil. Table 10.3.2-14 lists the residential scenario risk and/or hazard contributed by each COPC at each sample location. As shown, two of 15 locations reported contaminant concentrations that equate with a cumulative HI of greater than unity (1). This is generally due to concentrations of cadmium. Reported concentrations of BEQs, Aroclor-1260, and arsenic in Site 12 soil samples equate with a cumulative risk between 1E-06 to 8E-05.

Groundwater Pathways

Exposure to groundwater onsite was evaluated under both residential and industrial scenarios. The groundwater exposure pathways were evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed separately for child and adult receptors. Tables 10.3.2-15 and 10.3.2-16 present the risk and hazard for the ingestion and inhalation pathways, respectively.

Hypothetical Site Residents

For the ingestion and inhalation pathways, the LWA ILCRs were computed to be 4E-05 and 4E-06, respectively. Aroclor-1260, 1,1-DCE, dieldrin, and heptachlor epoxide were the primary contributors to groundwater ingestion risk. Chloroform and 1,1-DCE were the primary contributors to inhalation risk. HIs for the adult and child resident were both under 1 for the ingestion and inhalation pathways.

Hypothetical Site Workers

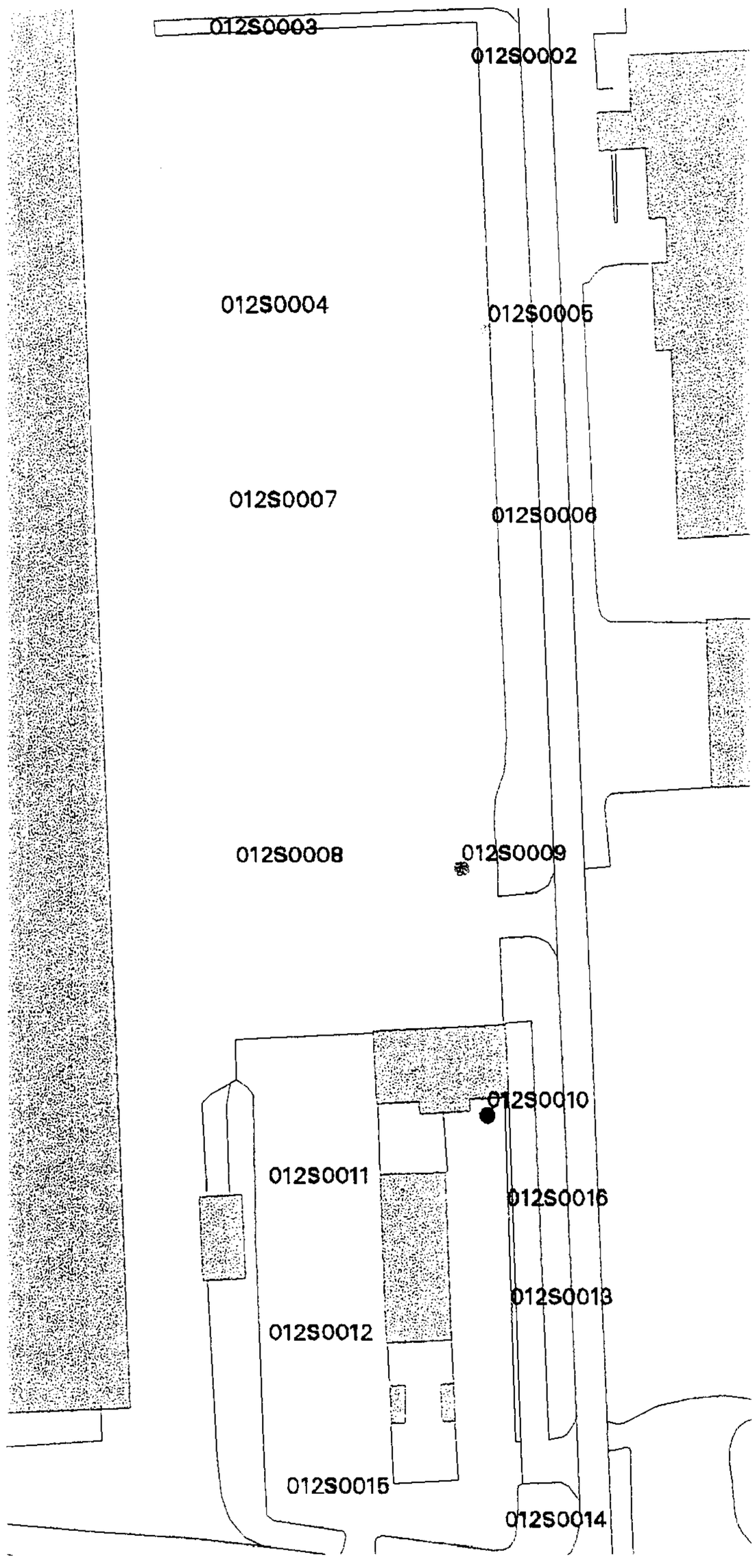
For the ingestion and inhalation pathways, the ILCRs were computed to be 1E-05 and 1E-06, respectively. 1,1-DCE and dieldrin were the primary contributors to groundwater ingestion risk. The ingestion and inhalation pathway HIs were computed to be 0.1 and 0.007, respectively.

Point Risk and Point Hazard Estimates for Groundwater Pathways

Figures 10-9 and 10-10 are the risk and hazard maps for Site 12 groundwater. Table 10.3.2-17 lists the residential scenario risk and/or hazard contributed by each COPC at all 12 monitoring well locations. As shown, one monitoring well had concentrations of cadmium that equal HQ of greater than unity (one). Reported concentrations of Aroclor-1260, chloroform, 1,1-DCE, dieldrin, heptachlor epoxide, and tetrachloroethene in Site 12 groundwater samples generally equal a cumulative risk between 1E-05 to just over 1E-04. Using maximum concentrations of COPCs in groundwater to provide estimates of risk and hazard, as prescribed by FDEP when calculating RME risk and hazard, would yield a residential groundwater pathway risk of 1E-04 and a hazard quotient of 2. This is shown on Table 10.3.1-17 as a summary of point risks and hazards associated with the maximum detected concentrations for each COPC identified in Site 12 groundwater.

Current Site Workers

Groundwater is not currently a potable water source for Site 12 or other areas of NAS Pensacola. Without an exposure pathway, no threat to human health is posed by reported groundwater contamination.



LEGEND - HAZARD VALUES

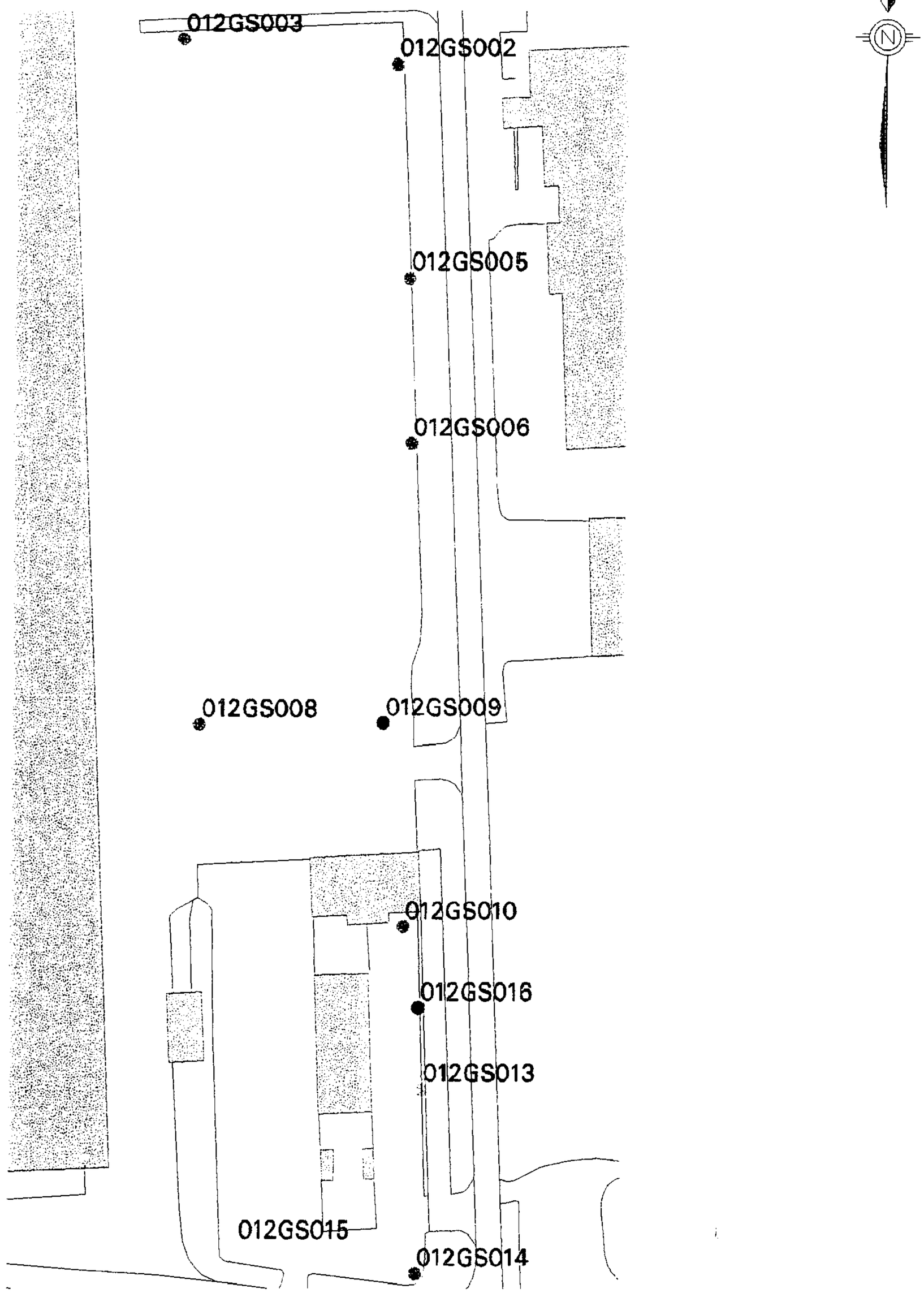
- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 250

OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-8
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 12, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/soil dir/main.aml



LEGEND - RISK VALUES

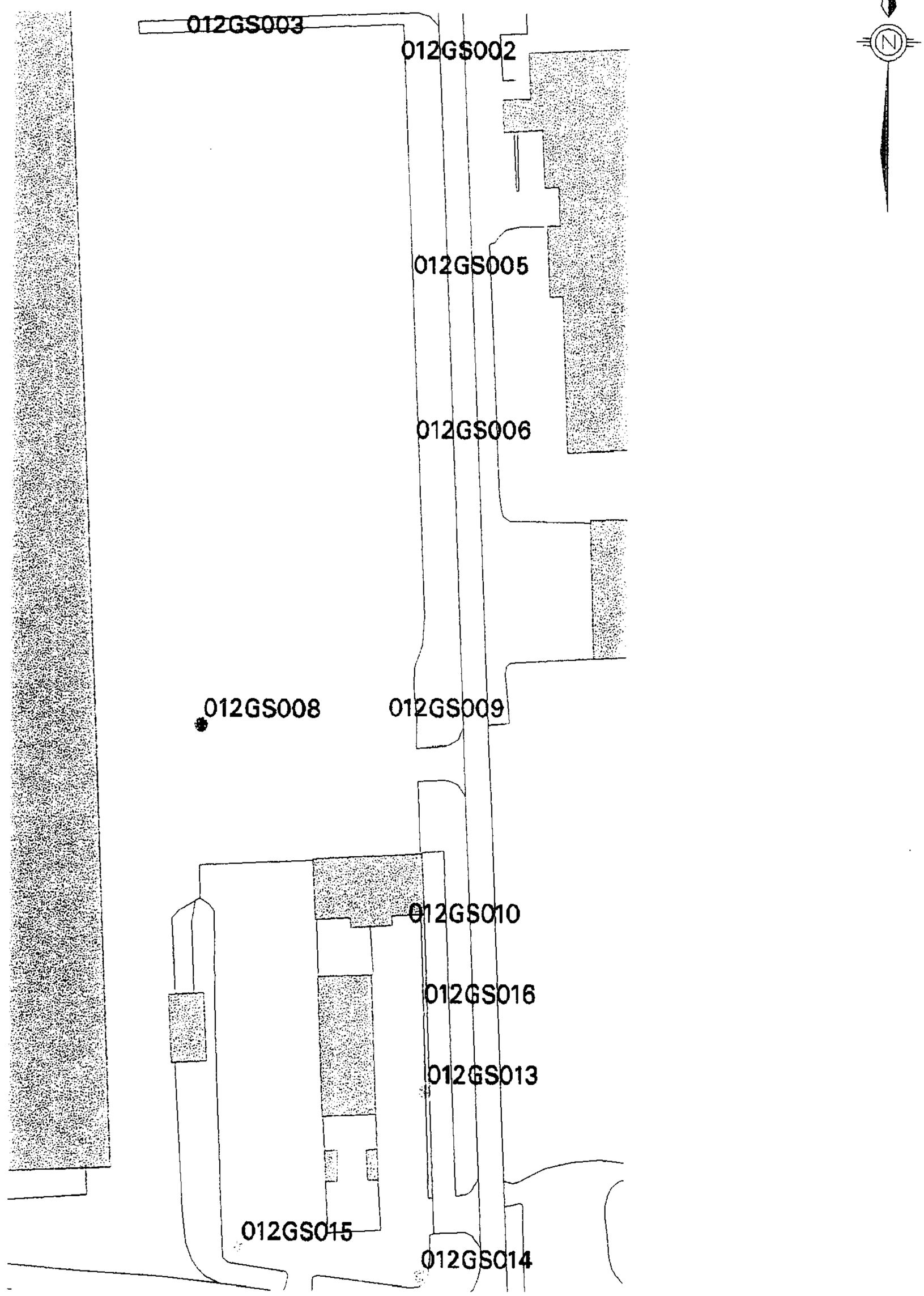
- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 250

OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-9
SAMPLE POINT ESTIMATES OF RISK
SITE 12, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/well dir/main.aml



LEGEND - HAZARD VALUES

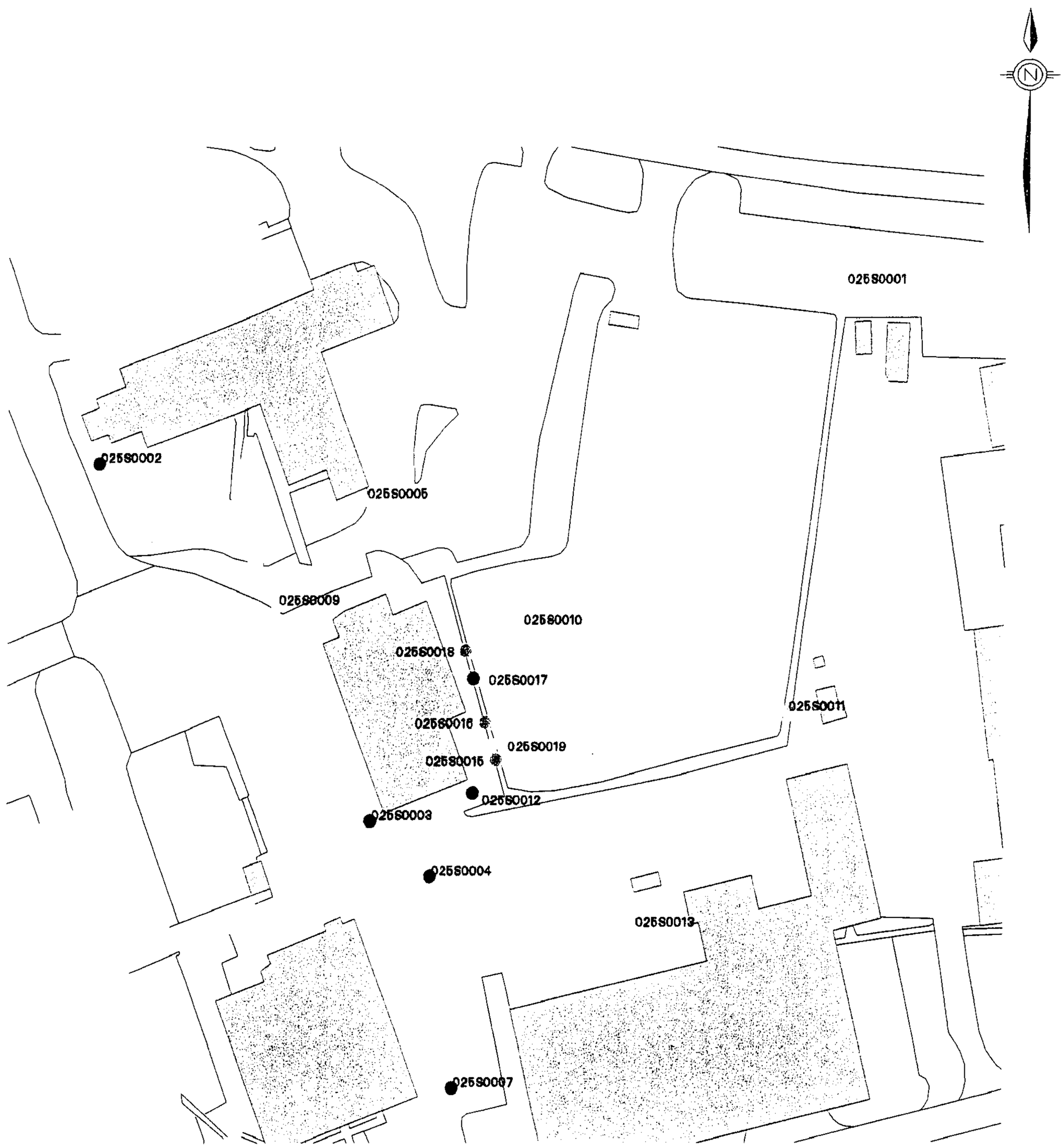
- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 250

OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-10
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 12, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/well dir/main.aml



LEGEND - RISK VALUES

- NA
- < 1E-6
- 1E-6 to 1E-5
- 1.1E-5 to 1E-4
- > 1E-4

0 feet 200

OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-11
SAMPLE POINT ESTIMATES OF RISK
SITE 25, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/soil_dir/bomain.aml

COCs Identified

COCs were identified based on cumulative (all pathway) risk and hazard projected for this site. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and HI threshold of 1 (unity). In accordance with FDEP guidance, a COC is any chemical contributing to a cumulative risk level of 1E-6 or greater, and/or a cumulative HI above 1, and has an individual ILCR that exceeds 1E-6 or has a HQ that exceeds 0.1. For carcinogens, this approach is relatively conservative because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. The COC selection method presented provides a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGO development process. Table 10.3.2-18 summarizes soil COCs and Table 10.3.2-19 summarizes groundwater COCs.

Surface Soils

Hypothetical Site Residents (Future Land Use)

Aluminum, antimony, Aroclor-1254, cadmium, chromium, and copper were identified as COCs based on their contribution to cumulative HI. Aroclor-1260, arsenic, and BEQs were identified as COCs based on their contributions to cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

Aroclor-1260 and BEQs were identified as COCs based on their contributions to cumulative ILCR.

Adolescent Trespasser (Current Land Use)

Aroclor-1260 was identified as COCs based on its contributions to cumulative ILCR.

Groundwater

Hypothetical Site Residents (Future Land Use)

Aroclor-1260, chloroform, 1,1-DCE, dieldrin, and heptachlor epoxide were identified as COCs based on their contributions to cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

1,1-DCE, and dieldrin were identified as COCs based on their contributions to cumulative ILCR.

10.3.2.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

The potential for high bias is introduced through the exposure setting and pathway selection due to the highly conservative assumptions (i.e., future residential use) recommended by USEPA Region IV and FDEP when assessing future and current exposure. The exposure assumptions in the site worker scenario are highly protective and tend to overestimate exposure. As a result, limited exposure to these maximally impacted areas is possible although the frequency and duration of direct contact events are likely to be quite low.

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Drinking water is provided from NAS Correy Station across Bayou Grande. This system will remain in operation under the current base reuse plan. As a result, groundwater would not be expected to be used under future site use scenarios. Therefore, the scenario established to project risk/hazard associated with groundwater exposure is highly conservative, and associated pathways are not expected to be completed.

Determination of Exposure Point Concentrations

A ninety-five percent UCL was applied as the EPC used to estimate risk and hazard for all soil COPCs. The use of point estimates to model exposure is limited in that actual exposure may

consist of contact with extremely high soil concentrations as well as extremely low soil concentrations throughout the course of exposure. The 95% UCL uses this variability to provide an upper bound estimate on the average soil concentration. It is impossible to forecast how redevelopment might change reported soil concentrations.

The 95% UCL, arithmetic mean of the detected concentrations, or only detected concentration was applied as the EPC for groundwater. Region IV guidance states that the average concentration of each COPC in the most concentrated area of the plume should be used as the EPC. Since a plume cannot be readily defined, this guidance applies only marginally. As in soil, groundwater data variability contributes greatly to uncertainty through spatial variability. Ninety-five percent UCLs were calculated to provide point estimates for groundwater to account for this uncertainty, thus providing an upper bound estimate for modeling exposure. For any given COPC, the placement of monitoring wells in uncontaminated areas of the aquifer could cause a low bias on the 95% UCL. As a result, the arithmetic mean of detected concentrations was compared to the 95% UCL and the greater of the two was selected as the EPC. For some COPCs, the arithmetic mean of all detected concentration would be lower than the arithmetic mean of concentrations in the most concentrated area of the plume, assuming a plume could be adequately defined using the data currently available. To address this uncertainty and to provide additional perspective, risk/hazard maps were included in the Risk Characterization Section 10.3.2.5.

Frequency of Detection and Spatial Distribution

Soil COCs were generally detected throughout Site 12. Aluminum was detected in all 15 surface soil samples and exceeded the background reference concentration in nine of 15 samples. The mean detected surface soil concentration of aluminum (5,640 mg/kg) exceeds the background reference concentration (3,833 mg/kg) and is below the residential RBC (7,800 mg/kg). Antimony was detected in seven of 15 surface soil samples and exceeded the background reference concentration only once. The mean detected surface soil concentration of antimony (3.98 mg/kg)

marginally exceeds the residential RBC (3.1 mg/kg) and is below the background (9.49 mg/kg). Arsenic was detected, exceeding the residential RBC in five of 15 surface soil samples and exceeding background in four of 15 samples. The mean detected surface soil concentration of arsenic exceeds both screening concentrations. Cadmium was detected exceeding the residential RBC in 12 of 15 surface soil samples, and exceeding background in 9 of 15 samples. The mean detected surface soil concentration of cadmium exceeded both screening concentrations. Copper was detected in 14 of 15 surface soil samples and exceeded the background reference concentration in 12 of 15. The mean detected surface soil concentration of copper (121 mg/kg) exceeds the background reference concentration (5.74 mg/kg) and is below the residential RBC (310 mg/kg). Aroclor-1260 was detected in 15 of 15 surface soil samples and exceeded the residential RBC in 12. BEQs were detected in 15 of 15 surface soil samples and exceeded the residential RBC in 11. Aroclor-1254 was detected in only one of 15 surface soil samples. As a result, risk and hazard estimates based on Aroclor-1254 should be considered highly conservative.

COCs in groundwater samples included cadmium (four of 12 samples), chloroform (five of 12 samples), Dieldrin (five of 12 samples), and tetrachloroethene (six of 12 samples). 1,1-DCE (two of 12 samples), 4,4'-DDD (one of 12 samples), Aroclor-1260 (one of 12 samples), and heptachlor epoxide (one of 12 samples) were detected infrequently in groundwater samples collected during Phase I. Generally, groundwater COCs were distributed evenly across the site. No Phase II sample data were available to confirm the Phase I sample results.

Risk/Hazard Quantification

As indicated by the discussions above, the uncertainty inherent in the risk assessment process is great. In addition, many site-specific factors have affected this assessment certainty and would bias the risk and hazard estimates. Exposure pathway-specific sources of uncertainty are discussed below.

Soil

Of the organic CPSS screened and eliminated from formal assessment, only three were reported at maximum concentrations within approximately 10% of their RBCs. Using the maximum concentration for the screening comparison minimizes the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSSs. No inorganic CPSSs were eliminated based only on comparison to their corresponding reference concentrations.

CT analysis was not formally performed for Site 12 surface soil, but a simplified approach was taken to assess the potential influences of CT assumptions. The CT assumption for residential exposure duration is nine years compared to the 30-year assumption for RME. The CT exposure frequency assumption is 234 days per year compared to 350 days per year RME. If all other exposure assumptions remain fixed, applying the CT exposure duration and frequency would result in risk projections approximately 80% below the RME. At CT, the residential surface soil pathway-related risk (incidental ingestion and dermal contact) would drop from 9E-05 to approximately 2E-5, but would still exceed the 1E-6 point of departure. CT analysis for HQ based on residential child exposure and adjustment of exposure frequency to 234 days per year would drop the HI from 9 (incidental ingestion and dermal contact) to 6.

Ninety percent of the cumulative HI (ingestion and dermal contact) is due to cadmium. This is significant since the maximum detected concentration was used as the EPC to estimate cadmium exposure. If the EPC was set equal to the average detected concentration of cadmium in surface soil, the cumulative HI would drop nearly one order of magnitude. Similarly, 90% of the cumulative risk is due to exposure to Aroclor-1260. Using the same logic, risk projections for exposure to Aroclor-1260 would decrease by a factor of 5.

Although the future land use of Site 12 is unknown, both the worker and residential exposure scenarios were assessed in this HHRA. Base redevelopment plans for NAS Pensacola are drafted

every five years. Site 12 is likely to remain part of the DRMO and maintain its current function for the foreseeable future. As previously discussed, it is likely that these scenarios would overestimate risk and/or hazard.

Groundwater

Of the organic CPSSs screened and eliminated from formal assessment, six were reported at a concentration near (within approximately 10%) the RBC. No inorganic parameters were eliminated from formal assessment based strictly upon comparison to background reference concentrations.

Aroclor-1260, dieldrin, and heptachlor epoxide exhibit the tendency to adsorb to sediment and soil particles. Their presence in groundwater, in light of the uncertainty regarding potential turbidity in Phase I groundwater samples presents some uncertainty. All three of these chemicals were detected in Site 12 surface soil and subsurface soil, which presents the possibility of groundwater concentrations that are reflective of their entrainment during the monitoring well installation.

Groundwater is not currently used as a potable water source at NAS Pensacola. Municipal water is provided from a well field at NAS Correy Station. As previously mentioned, the site is unlikely to be developed as a residential area, and a potable-use well is unlikely to installed onsite. If residences were constructed onsite and an unfiltered well were installed, the salinity and dissolved solids probably would preclude this aquifer from being an acceptable potable water source.

An informal CT analysis was performed for Site 12 groundwater using CT assumption. Residential exposure duration is nine years for CT versus 30 years for RME. The residential exposure frequency is 234 days per year for CT versus 350 days per year for RME, the ingestion rate is 1.4 liters per day for CT versus 2 liters/day for RME. At CT, the residential groundwater

pathway, related risk (incidental ingestion and dermal contact) would drop from 4E-05 to approximately 6E-6 and would still exceed the 1E-6 point of departure.

10.3.2.7 Risk Summary

The risk and hazard posed by contaminants at Site 12 were assessed for future site worker, future site resident, and future trespassers under RME assumptions. For surface soil, the incidental ingestion and dermal contact pathways were assessed. The ingestion and inhalation pathways were evaluated for groundwater. Table 10.3.2-20 presents the risk summary for each pathway/receptor group evaluated for Site 12.

10.3.2.8 Remedial Goal Options

Soil

Surface soil RGOs are presented in Table 10.3.2-21 for hypothetical site residents and hypothetical site workers. Risk-based RGOs were based on the LWA site resident and adult site worker and hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker, as noted in the table. The lowest residential-based RGO for aluminum, antimony, cadmium, chromium, copper, and iron equate with a HQ of 0.1. The lowest residential-based RGO for arsenic, Aroclor-1260, Aroclor-1254, and BEQs equate with a risk of 1E-06. All of the lowest RGOs (except for copper and iron, which do not have Florida soil cleanup goals) are lower than the Florida soil cleanup goal. The background concentration of arsenic would equal a risk between 1E-06 and 1E-05.

Groundwater

Groundwater RGOs based on site residents and site workers, shown in Table 10.3.2-22, were based on the LWA site resident and adult site worker. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker as noted in the table. Both the ingestion and inhalation (VOCs only) exposure are used to calculate groundwater RGOs. The lowest residential-based RGO for all of the Site 12 groundwater COPCs equal with a risk of 1E-06. All of the lowest RGOs are lower than the FGGC.

Table 10.3.2-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 12

Depth (feet)	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
0 to 1	0002	X	X	X	X
0 to 1	0003	X	X	X	X
0 to 1	0004	X	X	X	X
0 to 1	0005	X	X	X	X
0 to 1	0006	X	X	X	X
0 to 1	0007	X	X	X	X
0 to 1	0008	X	X	X	X
0 to 1	0009	X	X	X	X
0 to 1	0010	X	X	X	X
0 to 1	0011	X	X	X	X
0 to 1	0012	X	X	X	X
0 to 1	0013	X	X	X	X
0 to 1	0014	X	X	X	X
0 to 1	0015	X	X	X	X
0 to 1	0016	X	X	X	X

Notes:
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides, Method 8080
Volatile Organic Analysis, Method 8240
Semivolatile Organic Analysis, Method 8720

Table 10.3.2-2
Samples and Analytical Methods Used for Risk Assessment
Groundwater at Site 12

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
Shallow	GS01	1	1	1	1
Shallow	GS02	1	1	1	1
Shallow	GS03	1	1	1	1
Shallow	GS05	1	1	1	1
Shallow	GS06	1	1	1	1
Shallow	GS08	1	1	1	1
Shallow	GS09	1	1	1	1
Shallow	GS10	1	1	1	1
Shallow	GS13	1	1	1	1
Shallow	GS14	1	1	1	1
Shallow	GS15	1	1	1	1
Shallow	GS16	1	1	1	1

Notes:
1 = Sample collected during Phase I
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides, Method 8080
Volatile Organic Analysis, Method 8240
Semivolatile Organic Analysis, Method 8720

Table 10.3.2-3
Chemicals Present in Site Samples
Site 12, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC		Soil-to-air SSL		Reference	Units	Number Exceeding RBC	Ref.
Carcinogenic PAHs																
Benzo(a)pyrene Equiv.	C	15	15	6.04	2846.5	526	NA	NA	88	a	NA		NA	ug/kg	10	
Benzo(a)anthracene	C	14	15	36	1500	337	360	360	880	a	NA		NA	ug/kg	2	
Benzo(b)fluoranthene	C	15	15	55	4500	861	NA	NA	880	a	NA		NA	ug/kg	4	
Chrysene	N	13	15	44	1500	344	360	1000	88000	a	NA		NA	ug/kg		
Dibenz(a,h)anthracene	C	5	15	45	230	115	340	1000	88	a	NA		NA	ug/kg	2	
Indeno(1,2,3-cd)pyrene	C	9	15	110	1300	430	340	1000	880	a	NA		NA	ug/kg	1	
Benzo(k)fluoranthene	N	15	15	54	3300	747	NA	NA	8800	a	NA		NA	ug/kg		
Benzo(a)pyrene	C	11	15	54	1900	459	340	1000	88	a	NA		NA	ug/kg	9	
Inorganics																
Aluminum	C	15	15	324	16100	5640	NA	NA	7800	a	NA		3833.36	mg/kg	3	9
Antimony	C	7	15	0.59	12.5	3.98	0.39	1.2	3.1	a	NA		9.49	mg/kg	3	1
Arsenic	C	5	15	1.4	2.8	2.08	0.65	0.86	0.43	a	750	d	1.56	mg/kg	5	4
Barium	N	15	15	2.1	57.4	16.4	NA	NA	550	a	690000	d	4.63	mg/kg		12
Beryllium	C	1	15	0.43	0.43	0.43	0.04	0.16	0.15	a	1300	d	0.41	mg/kg	1	1
Cadmium	C	12	15	2.1	562	57	0.06	0.33	3.9	a	1800	d	1	mg/kg	18	12
Calcium	N	15	15	175	68800	26700	NA	NA	NA		NA		912.37	mg/kg		14
Chromium	C	15	15	1.1	70.8	20.7	NA	NA	39	a	270	d	6.13	mg/kg	2	12
Cobalt	N	14	15	0.15	8.8	1.34	0.13	0.13	470	a	NA		1.87	mg/kg		2
Copper	C	14	15	4	516	121	0.6	0.6	310	a	NA		5.74	mg/kg	2	12
Cyanide	N	2	15	0.78	1.1	0.94	0.51	0.67	160	a	NA		0.52	mg/kg		2
Iron	U	15	15	399	20800	5810	NA	NA	2300	a	NA		2745	mg/kg	11	9
Lead	N	15	15	6.7	341	115	NA	NA	400	b	NA		7.32	mg/kg		14
Magnesium	N	15	15	32.6	2180	472	NA	NA	NA		NA		133.33	mg/kg		13
Manganese	C	15	15	2.2	390	96	NA	NA	180	a	NA		21.36	mg/kg	3	13
Mercury	N	7	15	0.1	1.1	0.44	0.09	0.12	2.3	a	NA		0.1	mg/kg		7
Nickel	N	13	15	0.62	25.7	7.03	0.29	0.31	160	a	13000	d	6.38	mg/kg		5
Potassium	N	15	15	36.3	511	123	NA	NA	NA		NA		460.67	mg/kg		1
Sodium	N	10	15	249	998	545	160	490	NA		NA		107.85	mg/kg		10
Vanadium	N	14	15	1.5	21.9	8.16	0.44	0.44	55	a	NA		5.83	mg/kg		6
Zinc	N	15	15	4.1	680	160	NA	NA	2300	a	NA		16.87	mg/kg		13
Pesticides and PCBs																
Aroclor-1254	C	1	15	280	280	280	34	1800	83	a	NA		NA	ug/kg	1	
Aroclor-1260	C	15	15	26	15000	2750	NA	NA	83	a	NA		NA	ug/kg	12	
Aldrin	N	1	15	0.13	0.13	0.13	1.8	90	38	a	3000	d	NA	ug/kg		
alpha-BHC	N	1	15	0.1	0.1	0.1	1.8	90	100	a	800	d	NA	ug/kg		
delta-BHC	N	1	15	0.14	0.14	0.14	1.8	90	100	a	NA		NA	ug/kg		
alpha-Chlordane	N	9	15	0.11	140	25.9	1.8	90	470	a	20000	d	NA	ug/kg		
gamma-Chlordane	N	11	15	0.096	130	22.4	1.8	8.8	470	a	20000	d	NA	ug/kg		
4,4'-DDD	N	2	15	25	33	29	3.4	67	2700	a	NA		NA	ug/kg		
4,4'-DDE	N	12	15	0.53	120	24	3.5	17	1900	a	NA		NA	ug/kg		
4,4'-DDT	N	7	15	0.31	57	22.8	3.4	180	1900	a	NA		NA	ug/kg		
Dieldrin	N	8	15	0.24	20	7.56	3.5	17	40	a	1000	d	NA	ug/kg		
Endosulfan sulfate	N	4	15	0.59	2.1	1.12	3.5	180	47000	a	NA		NA	ug/kg		
Endrin aldehyde	N	9	15	0.71	140	29.2	3.4	180	2300	a	NA		NA	ug/kg		
Heptachlor	N	2	15	1.3	12	6.65	1.8	90	140	a	100	d	NA	ug/kg		
Heptachlor epoxide	N	2	15	0.18	1.8	0.99	1.8	90	70	a	5000	d	NA	ug/kg		
Methoxychlor	N	3	15	1.3	70	25.5	3.6	900	39000	a	NA		NA	ug/kg		
Semivolatile Organics																
Acenaphthene	N	1	15	56	56	56	340	1000	470000	a	NA		NA	ug/kg		
Acenaphthylene	N	7	15	57	470	178	340	1000	310000	a	NA		NA	ug/kg		
Anthracene	N	4	15	50	120	82.3	340	1000	2300000	a	NA		NA	ug/kg		
Benzo(g,h,i)perylene	N	9	15	130	1600	522	340	1000	310000	a	NA		NA	ug/kg		
bis(2-Ethylhexyl)phthalate	N	10	15	23	4800	615	340	700	46000	a	31000000	d	NA	ug/kg		
Butylbenzylphthalate	N	7	15	41	650	199	340	700	1600000	a	930000	d	NA	ug/kg		
Carbazole	N	3	15	50	140	92	340	1000	32000	a	NA		NA	ug/kg		
2-Chloronaphthalene	N	1	15	39	39	39	340	1000	630000	a	NA		NA	ug/kg		
Di-n-butylphthalate	N	4	15	30	610	221	340	1000	780000	a	2300000	d	NA	ug/kg		
2,4-Dimethylphenol	N	2	15	160	180	170	340	1000	160000	a	NA		NA	ug/kg		
Dimethyl phthalate	N	1	15	190	190	190	340	1000	78000000	a	NA		NA	ug/kg		
Fluoranthene	N	14	15	50	1900	430	360	360	310000	a	NA		NA	ug/kg		

Table 10.3.2-3
Chemicals Present in Site Samples
Site 12, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Fluorene	N	2	15	39	96	67.5	340	1000	310000	a	NA		NA	ug/kg		
2-Methylnaphthalene	N	1	15	82	82	82	340	1000	310000	a	NA		NA	ug/kg		
2-Methylphenol (o-Cresol)	N	2	15	47	160	104	340	1000	390000	a	NA		NA	ug/kg		
4-Methylphenol (p-Cresol)	N	2	15	92	290	191	340	1000	39000	a	NA		NA	ug/kg		
Phenanthrene	N	10	15	46	380	173	340	1000	310000	a	NA		NA	ug/kg		
Pyrene	N	14	15	52	1600	399	360	360	230000	a	NA		NA	ug/kg		
Volatile Organics																
Chloroform	N	1	15	1	1	1	10	11	100000	a	300	d	NA	ug/kg		
Tetrachloroethene	N	1	15	2	2	2	10	11	12000	a	11000	d	NA	ug/kg		
Miscellaneous																
Radium 226	N	6	6	0.54	1211000	328000	NA	NA	5	c	NA		NA	pci/g		
Petroleum Hydrocarbons, TPH	N	1	1	52	52	52	NA	NA	NA		NA		NA	mg/kg		

C - Selected as a COPC based on the screening process explained in Section 10.2.5
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5
U - Iron toxicity is qualitatively discussed in the uncertainty section.
PAHs - Polynuclear Aromatic Hydrocarbons
SQL - Sample Quantitation Limits
a - USEPA Region III residential risk-based concentration
b - USEPA's action level of lead in soil
c - Florida residential soil cleanup goal
d - USEPA soil to air Soil Screening Level

Table 10.3.2-4
Chemicals Present in Site Samples
Site 12, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium	N	12	12	24900	52400	38200	NA	NA	NA	NA	17560	ug/L		12
Magnesium	N	12	12	1830	4350	2810	NA	NA	NA	NA	2872.6	ug/L		4
Potassium	N	12	12	1200	3490	1730	NA	NA	NA	NA	12167	ug/L		
Sodium	N	12	12	4420	9490	6480	NA	NA	NA	NA	18345	ug/L		
Inorganics														
Aluminum	N	12	12	77.6	222	139	NA	NA	3700	RBC	3882.8	ug/L		
Antimony	R	2	12	3.3	4.8	4.05	1.9	1.9	1.5	RBC	30.2	ug/L	2	
Barium	B	12	12	3.5	35.1	14.9	NA	NA	260	RBC	13.2	ug/L		5
Cadmium	C	4	12	2.1	9.6	4.47	0.3	3.3	1.8	RBC	3.4	ug/L	4	2
Chromium	N	5	12	0.92	3	2.1	0.9	0.9	18	RBC	35	ug/L		
Cobalt	N	3	12	0.7	2.3	1.26	0.6	0.6	220	RBC	4.1	ug/L		
Copper	N	2	12	3.3	6.8	5.05	1.1	4.1	150	RBC	16.2	ug/L		
Cyanide	N	1	12	11.2	11.2	11.2	10	10	73	RBC	NA	ug/L		
Iron	N	10	12	16.4	1090	209	15.7	15.7	1100	RBC	1707.8	ug/L		
Lead	B	2	12	4	5.6	4.8	1.9	1.9	15	TTAL	1.6	ug/L		2
Manganese	B	8	12	0.77	37	9.37	0.5	1.7	84	RBC	22	ug/L		1
Nickel	N	4	12	1.5	20.5	11.7	1.4	1.4	73	RBC	39.9	ug/L		
Vanadium	N	12	12	0.4	2.3	0.896	NA	NA	26	RBC	9.6	ug/L		
Zinc	B	12	12	4	164	24.9	NA	NA	1100	RBC	153.2	ug/L		1
Pesticides and PCBs														
Aroclor-1260	C	1	12	0.42	0.42	0.42	1	1	0.0087	RBC	NA	ug/L	1	
Aldrin	N	1	12	0.002	0.002	0.002	0.05	0.05	0.004	RBC	NA	ug/L		
alpha-BHC	N	1	12	0.0033	0.0033	0.0033	0.05	0.05	0.011	RBC	NA	ug/L		
delta-BHC	N	1	12	0.002	0.002	0.002	0.05	0.05	0.011	RBC	NA	ug/L		
alpha-Chlordane	N	3	12	0.0041	0.05	0.02	0.05	0.05	0.052	RBC	NA	ug/L		
gamma-Chlordane	N	1	12	0.0031	0.0031	0.0031	0.05	0.05	0.052	RBC	NA	ug/L		
4,4'-DDD	C	1	12	0.11	0.11	0.11	0.1	0.1	0.1	FDEP	NA	ug/L	1	
4,4'-DDE	N	1	12	0.0039	0.0039	0.0039	0.1	0.1	0.1	FDEP	NA	ug/L		
4,4'-DDT	N	1	12	0.0099	0.0099	0.0099	0.1	0.1	0.1	FDEP	NA	ug/L		
Dieldrin	C	5	12	0.0073	0.3	0.104	0.1	0.1	0.0042	RBC	NA	ug/L	5	
Endosulfan I	N	1	12	0.0035	0.0035	0.0035	0.05	0.05	0.35	FDEP	NA	ug/L		
Endrin	N	1	12	0.0062	0.0062	0.0062	0.1	0.1	1.1	RBC	NA	ug/L		
Endrin aldehyde	N	1	12	0.014	0.014	0.014	0.1	0.1	0.1	FDEP	NA	ug/L		
Endrin ketone	N	4	12	0.0031	0.071	0.021	0.1	0.1	1.1	RBC	NA	ug/L		
Heptachlor	N	1	12	0.0022	0.0022	0.0022	0.05	0.05	0.0023	RBC	NA	ug/L		
Heptachlor epoxide	C	1	12	0.011	0.011	0.011	0.05	0.05	0.0012	RBC	NA	ug/L	1	
Semivolatile Organics														
Naphthalene	N	1	12	2	2	2	5	5	150	RBC	NA	ug/L		
Phenanthrene	N	1	12	0.8	0.8	0.8	5	5	10	FDEP	NA	ug/L		
Volatile Organics														
Chloroform	C	5	12	0.5	3	1.7	1	1	0.15	RBC	NA	ug/L	5	
1,1-Dichloroethane	N	4	12	0.5	12	3.43	1	1	81	RBC	NA	ug/L		
1,1-Dichloroethene	C	2	12	0.8	0.9	0.85	1	1	0.044	RBC	NA	ug/L	2	
cis-1,2-Dichloroethene	N	1	12	3	3	3	1	1	6.1	RBC	NA	ug/L		
Ethylbenzene	N	1	12	0.8	0.8	0.8	1	1	130	RBC	NA	ug/L		
Tetrachloroethene	C	6	12	0.5	2	1.13	1	1	1.1	RBC	NA	ug/L	2	
1,1,1-Trichloroethane	N	2	12	0.6	2	1.3	1	1	79	RBC	NA	ug/L		
Trichloroethene	N	2	12	0.6	1	0.8	1	1	1.6	RBC	NA	ug/L		
Miscellaneous														
Radium 226	N	4	12	0.21	0.28	0.235	0.2	0.2	5	MCL	NA	pci/L		

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B - The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
SQL - Sample Quantitation Limits
RBC - USEPA Region III residential risk-based concentration
TTAL - Treatment technique action level
FDEP - Florida risk-based groundwater guidance concentration
MCL - Maximum Contaminant Level

Table 10.3.2-5
Exposure Pathways Summary — Site 12

Medium and Exposure Pathway	Resident	Worker	Trespasser	Reason for Selection or Exclusion
Air: Inhalation of volatile contaminants emanating from soil	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Air: Inhalation of chemicals entrained in fugitive dust	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Groundwater: Ingestion of contaminants during potable or general use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Groundwater: Inhalation of volatilized contaminants during domestic use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Soil: Incidental ingestion	Yes	Yes	Yes	COPCs were identified after to risk-based and background screening comparisons.
Soil: Dermal contact	Yes	Yes	Yes	COPCs were identified after risk-based and background screening comparisons.
Wild game or domestic animals: Ingestion of tissue impacted by media contamination	No	No	No	Hunting/taking of game and/or raising livestock is prohibited at NAS Pensacola.
Fruits and vegetables: Ingestion of plant tissues grown in media	No	No	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Table 10.3.2-6
Statistical Analysis of COPCs
Surface Soils at Site 12
Naval Air Station Pensacola
Pensacola, Florida

Table 10.3.2-6
Statistical Analysis of COPCs
Surface Soils at Site 12
Naval Air Station Pensacola
Pensacola, Florida

COPC	n	Natural Log Transformed mean	SD	H-stat	UCL (mg/kg)	MAX (mg/kg)	EPC (mg/kg)	
Aluminum	15	8.15	1.10	2.91	14949	16100	14949	UCL Used
Antimony	15	-0.27	1.37	3.38	6.71	12.5	6.7	UCL Used
Aroclor-1254	15	-3.18	1.36	3.36	0.35	0.28	0.28	MAX Used
Aroclor-1260	15	-0.38	1.95	4.48	47.5	15.0	15	MAX Used
Arsenic	15	-0.48	0.88	2.56	1.67	2.8	1.7	UCL Used
Benzo(a)pyrene Equiv.	15	-0.55	0.69	2.29	1.11	2.85	1.1	UCL Used
Beryllium	15	-3.38	0.84	2.50	0.085	0.43	0.085	UCL Used
Cadmium	15	1.35	2.41	5.39	2306	562	562	MAX Used
Chromium	15	2.63	1.05	2.84	53	70.8	53	UCL Used
Copper	15	3.62	1.94	4.46	2500	516	516	MAX Used
Manganese	15	3.97	1.27	3.20	352	390	352	UCL Used

Notes:

mean	Arithmetic mean of the logtransformed data
n	Number of samples analyzed
SD	Standard deviation for a sample of data
H-stat	"H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA	Not applicable
TEF	Toxicity equivalence factor
EPC	Exposure point concentration
UCL	95 percentile upper confidence level mean
MAX	Maximum reported concentration

Table 10.3.2-7
Statistical Analysis of COPCs
Groundwater at Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Table 10.3.2-7
Statistical Analysis of COPCs
Groundwater at Site 12
Naval Air Station, Pensacola
Pensacola, Florida

COPC	Number of Detects	Number of Samples	Average ln(a)	Sample Standard Deviation sd(a)	H Statistic	Arithmetic Mean Detected Concentration (mg/L)	95% UCL (mg/L)	Maximum Detected Conc. (mg/L)	EPC (mg/L)	
Aroclor-1260	1	12	-8.41	0.20	1.843	NA	0.00025	0.00042	0.00042	Max Used
Cadmium	4	12	-7.58	1.60	4.100	0.0045	0.013	0.0096	0.0045	Mean Used
Chloroform	5	12	-7.16	0.69	2.399	0.0017	0.0016	0.0030	0.0017	Mean Used
4,4'-DDD	1	12	-9.84	0.23	1.866	NA	0.000062	0.00011	0.00011	Max Used
1,1-Dichloroethane	4	12	-7.65	1.05	3.018	0.0034	0.0022	0.012	0.0034	Mean Used
1,1-Dichloroethene	2	12	-7.70	0.29	1.922	0.00085	0.00056	0.00090	0.00085	Mean Used
1,2-Dichloroethene (cis)	1	12	-6.44	0.20	1.843	NA	0.0018	0.0030	0.0030	Max Used
Dieldrin	3	12	-11.34	1.65	4.204	0.00010	0.00027	0.00030	0.00010	Mean Used
Heptachlor epoxide	1	12	-11.90	0.15	1.810	NA	0.0000075	0.000011	0.000011	Max Used
Tetrachlorothene	6	12	-7.27	0.53	2.186	0.00113	0.00114	0.0020	0.00114	UCL Used

Notes:

ln(a)	arithmetic mean of the logtransformed data
sd(a)	standard deviation for a sample of data
H-stat	"H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA	not applicable
ND	not determined
EPC	exposure point concentration
UCL	95 percentile upper confidence level mean

Table 10.3.2-8
Chronic Daily Intakes (CDI)
Incidental Ingestion of Surface Soil
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	FI*	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	1	14949	2.05E-02	1.91E-01	2.34E-02	7.31E-03	2.61E-03	4.74E-03	6.76E-04
Antimony	1	6.7	9.19E-06	8.58E-05	1.05E-05	3.28E-06	1.17E-06	2.13E-06	3.03E-07
Aroclor-1254	1	0.28	3.84E-07	3.58E-06	4.38E-07	1.37E-07	4.89E-08	8.88E-08	1.27E-08
Aroclor-1260	1	15	2.05E-05	1.92E-04	2.35E-05	7.34E-06	2.62E-06	4.76E-06	6.78E-07
Arsenic	1	1.7	2.29E-06	2.14E-05	2.61E-06	8.17E-07	2.92E-07	5.29E-07	7.55E-08
Benzo(a)pyrene Equiv.	1	1.1	1.53E-06	1.42E-05	1.74E-06	5.45E-07	1.95E-07	3.53E-07	5.03E-08
Beryllium	1	0.085	1.16E-07	1.09E-06	1.33E-07	4.16E-08	1.49E-08	2.69E-08	3.84E-09
Cadmium	1	562	7.70E-04	7.19E-03	8.80E-04	2.75E-04	9.82E-05	1.78E-04	2.54E-05
Chromium	1	53	7.33E-05	6.84E-04	8.37E-05	2.62E-05	9.34E-06	1.70E-05	2.42E-06
Copper	1	516	7.07E-04	6.60E-03	8.08E-04	2.52E-04	9.02E-05	1.64E-04	2.33E-05
Manganese	1	352	4.83E-04	4.51E-03	5.52E-04	1.72E-04	6.16E-05	1.12E-04	1.59E-05

Notes:

TEF Toxicity equivalence factor relative to benzo(a)pyrene
lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.2-9
Chronic Daily Intakes (CDI)
Dermal Contact with Surface Soil
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/kg)	FC*	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	14949	1	0.001	8.40E-04	2.77E-03	5.25E-04	6.00E-04	2.14E-04	1.94E-04	2.77E-05
Antimony	6.7	1	0.001	3.77E-07	1.24E-06	2.36E-07	2.69E-07	9.61E-08	8.72E-08	1.24E-08
Aroclor-1254	0.28	1	0.01	1.57E-07	5.19E-07	9.84E-08	1.12E-07	4.01E-08	3.64E-08	5.18E-09
Aroclor-1260	15	1	0.01	8.42E-06	2.78E-05	5.27E-06	6.02E-06	2.15E-06	1.95E-06	2.78E-07
Arsenic	1.7	1	0.001	9.38E-08	3.10E-07	5.87E-08	6.70E-08	2.39E-08	2.17E-08	3.09E-09
Benzo(a)pyrene Equiv.	1.1	1	0.01	6.25E-07	2.06E-06	3.91E-07	4.47E-07	1.60E-07	1.45E-07	2.06E-08
Beryllium	0.085	1	0.001	4.77E-09	1.58E-08	2.99E-09	3.41E-09	1.22E-09	1.11E-09	1.57E-10
Cadmium	562	1	0.001	3.16E-05	1.04E-04	1.98E-05	2.25E-05	8.05E-06	7.31E-06	1.04E-06
Chromium	53	1	0.001	3.00E-06	9.91E-06	1.88E-06	2.15E-06	7.66E-07	6.95E-07	9.89E-08
Copper	516	1	0.001	2.90E-05	9.57E-05	1.81E-05	2.07E-05	7.39E-06	6.71E-06	9.55E-07
Manganese	352	1	0.001	1.98E-05	6.53E-05	1.24E-05	1.41E-05	5.05E-06	4.58E-06	6.52E-07

Notes:

TEF Toxicity Equivalence Factor relative to benzo(a)pyrene
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.2-10
Chronic Daily Intakes (CDI)
Ingestion of COPCs in Shallow Groundwater
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/liter)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Aroclor-1260	0.00042	1.15E-05	2.68E-05	6.33E-06	4.11E-06	2.02E-06
Cadmium	0.0045	1.23E-04	2.86E-04	6.74E-05	4.38E-05	2.15E-05
Chloroform	0.0017	4.66E-05	1.09E-04	2.56E-05	1.66E-05	8.18E-06
4,4'-DDD	0.00011	3.01E-06	7.03E-06	1.66E-06	1.08E-06	5.29E-07
1,1-Dichloroethane	0.0034	9.38E-05	2.19E-04	5.16E-05	3.35E-05	1.65E-05
1,1-Dichloroethene	0.00085	2.33E-05	5.43E-05	1.28E-05	8.32E-06	4.09E-06
1,2-Dichloroethene (cis)	0.0030	8.22E-05	1.92E-04	4.52E-05	2.94E-05	1.44E-05
Dieldrin	0.00010	2.86E-06	6.67E-06	1.57E-06	1.02E-06	5.02E-07
Heptachlor epoxide	0.000011	3.01E-07	7.03E-07	1.66E-07	1.08E-07	5.29E-08
Tetrachloroethene	0.0011	3.13E-05	7.31E-05	1.72E-05	1.12E-05	5.51E-06

Notes:
lwa Lifetime weighted average
CDI Chronic Daily Intake
H-CDI Non-carcinogenic hazard based Chronic Daily Intake
C-CDI Carcinogenic risk based Chronic Daily Intake

Table 10.3.2-11
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Surface Soil Ingestion
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD* Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	1	NA	0.020	0.19	ND	0.0073	ND	0.0047	ND
Antimony	0.0004	NA	0.023	0.21	ND	0.0082	ND	0.0053	ND
Aroclor-1254	2E-05	2	0.019	0.18	8.8E-07	0.00685	9.8E-08	0.0044	2.5E-08
Aroclor-1260	NA	2	ND	ND	4.7E-05	ND	5.2E-06	ND	1.4E-06
Arsenic	0.0003	1.5	0.0076	0.071	3.9E-06	0.0027	4.4E-07	0.0018	1.1E-07
Benzo(a)pyrene Equiv.	NA	7.3	ND	ND	1.3E-05	ND	1.4E-06	ND	3.7E-07
Beryllium	0.005	4.3	0.000023	0.00022	5.7E-07	0.00000832	6.4E-08	0.0000054	1.7E-08
Cadmium	0.001	NA	0.77	7.2	ND	0.27	ND	0.18	ND
Chromium	0.005	NA	0.015	0.14	ND	0.0052	ND	0.0034	ND
Copper	0.04	NA	0.018	0.16	ND	0.0063	ND	0.0041	ND
Manganese	0.047	NA	0.010	0.096	ND	0.0037	ND	0.0024	ND
SUM Hazard Index/ILCR			0.9	8	7E-05	0.3	7E-06	0.2	2E-06

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.2-12
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	ABS	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	0.2	0.2	NA	0.0042	0.014	ND	0.0030	ND	0.0010	ND
Antimony	0.2	8E-05	NA	0.0047	0.016	ND	0.0034	ND	0.0011	ND
Aroclor-1254	0.5	1E-05	4	0.016	0.052	3.9E-07	0.011	1.6E-07	0.0036	2.1E-08
Aroclor-1260	0.5	NA	4	ND	ND	2.1E-05	ND	8.6E-06	ND	1.1E-06
Arsenic	0.2	6E-05	7.5	0.0016	0.0052	4.4E-07	0.0011	1.8E-07	0.00036	2.3E-08
Benzo(a)pyrene Equiv.	0.5	NA	14.6	ND	ND	5.7E-06	ND	2.3E-06	ND	3.0E-07
Beryllium	0.2	0.0010	21.5	0.0000048	0.000016	6.4E-08	0.0000034	2.6E-08	0.0000011	3.4E-09
Cadmium	0.2	0.00020	NA	0.16	0.52	ND	0.11	ND	0.037	ND
Chromium	0.2	0.0010	NA	0.0030	0.010	ND	0.0021	ND	0.00070	ND
Copper	0.2	0.0080	NA	0.0036	0.012	ND	0.0026	ND	0.00084	ND
Manganese	0.2	0.0094	NA	0.0021	0.0070	ND	0.0015	ND	0.0005	ND
SUM Hazard Index/ILCR				0.2	0.6	3E-05	0.1	1E-05	0.04	1E-06

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
ABS Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.2-13
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 12
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Volatiles (μg/kg)				
1,1,2,2'-Tetrachloroethane	1/43	1.0 - 1.0	1.00	110000
Acetone	1/43	140.0 - 140.0	140.00	64000000
Chlorobenzene	1/43	3.0 - 3.0	3.00	540000
Chloroform	1/43	1.0 - 1.0	1.00	72000
Ethylbenzene	1/43	1.0 - 1.0	1.00	18000000
Xylene (Total)	2/43	1.0 - 1.0	1.00	1000000000
Semivolatiles (μg/kg)				
Acenaphthylene	2/43	43.0 - 55.0	49.00	16000000
Anthracene	1/43	79.0 - 79.0	79.00	160000000
Benzo(a)anthracene	7/43	45.0 - 700.0	177.71	100000
Benzo(a)pyrene	7/43	46.0 - 560.0	193.00	10000
Benzo(b)fluoranthene	7/43	58.0 - 1000.0	385.43	100000
Benzo(g,h,i)perylene	6/43	46.0 - 320.0	137.50	16000000
Benzo(k)fluoranthene	7/43	63.0 - 960.0	414.71	1000000
bis(2-Ethylhexyl)phthalate (BEHP)	4/43	68.0 - 170.0	108.00	5400000
Butylbenzylphthalate	1/43	82.0 - 82.0	82.00	100000000
Chrysene	7/43	46.0 - 480.0	163.14	10000000
Dibenz(a,h)anthracene	1/43	92.0 - 92.0	92.00	10000
Di-n-butylphthalate	1/43	72.0 - 72.0	72.00	54000000
Fluoranthene	7/43	53.0 - 800.0	222.57	22000000
Indeno(1,2,3-cd)pyrene	6/43	36.0 - 340.0	130.67	100000
Phenanthrene	1/43	300.0 - 300.0	300.00	16000000
Pyrene	7/43	68.0 - 700.0	206.86	22000000

Table 10.3.2-13
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 12
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Pesticides/PCBs (μg/kg)				
4,4'-DDD	2/43	3.3 - 240.0	121.65	320000
4,4'-DDE	24/43	0.16 - 22.0	2.99	220000
4,4'-DDT	23/43	0.05 - 9.6	2.29	220000
Aldrin	3/43	0.071 - 0.76	0.30	4400
alpha-BHC	3/43	0.083 - 0.11	0.09	12000
alpha-Chlordane	17/43	0.098 - 17.0	3.47	220000
Aroclor-1260	31/43	3.7 - 12000.0	746.85	38000
Dieldrin	21/43	0.072 - 3.3	0.73	4700
Endosulfan II	2/43	0.28 - 3.0	1.64	3200000
Endosulfan sulfate	4/43	0.19 - 1.4	0.51	3200000
Endrin	1/43	1.3 - 1.3	1.30	160000
Endrin aldehyde	22/43	0.19 - 28.0	4.37	160000
Endrin ketone	1/43	1.9 - 1.9	1.90	160000
gamma-Chlordane	19/43	0.086 - 19.0	3.24	220000
Heptachlor	7/43	0.07 - 2.3	0.66	15000
Heptachlor epoxide	3/43	0.075 - 0.13	0.10	8100
Methoxychlor	1/43	0.52 - 0.52	0.52	2700000
Inorganics (mg/kg)				
Aluminum (Al)	43/43	125.0 - 14800.0	1670.12	790000
Antimony (Sb)	4/43	0.39 - 11.4	3.20	310
Arsenic (As)	2/43	0.89 - 4.7	2.80	73
Barium (Ba)	38/43	0.55 - 89.1	7.62	52000
Beryllium (Be)	1/43	0.08 - 0.08	0.08	26
Cadmium (Cd)	17/43	0.78 - 243.0	24.25	780
Calcium (Ca)	40/43	62.8 - 55800.0	3874.08	NA

Table 10.3.2-13
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 12
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Inorganics (mg/kg) (Continued)				
Chromium (Cr) total	42/43	1.1 - 203.0	8.80	3800
Cobalt (Co)	24/43	0.13 - 3.7	0.48	47000
Copper (Cu)	33/43	0.32 - 515.0	30.13	1000000
Cyanide (CN)	3/43	0.67 - 3.9	2.26	16000
Iron (Fe)	43\43	130.0 - 42600.0	1909.88	NA
Lead (Pb)	38/43	0.65 - 883.0	41.34	1000
Magnesium (Mg)	17/43	48.9 - 1260.0	292.74	NA
Manganese (Mn)	43/43	1.3 - 375.0	19.97	27000
Mercury (Hg)	4/43	0.11 - 1.8	1.13	240
Nickel (Ni)	29/43	0.3 - 50.7	3.23	16000
Potassium (K)	27/43	27.60 - 277.0	68.31	NA
Silver (Ag)	2/43	0.12 - 0.53	0.33	3900
Sodium (Na)	12/43	210.0 - 746.0	287.25	NA
Vanadium (V)	33/43	0.15 - 14.7	2.14	5500
Zinc (Zn)	34/43	1.8 - 854.0	65.35	240000

Note:
* = Preliminary remediation goal based on the lesser of a hazard-based assessment using a hazard quotient of 1.0 or a risk-based assessment using a cancer risk of 1E-06.

Table 10.3.2-14
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 12, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0002	Aluminum	1310	mg/kg	0.0180	NA
0002	Antimony	12.5	mg/kg	0.4285	NA
0002	Aroclor-1260	360	ug/kg	NA	1.6333
0002	B(a)P Equiv.	101.42	ug/kg	NA	1.6795
0002	Chromium	3.5	mg/kg	0.0096	NA
0002	Copper	4	mg/kg	0.0014	NA
0002	Manganese	12.8	mg/kg	0.0037	NA
	Total			0.4611	3.3129
0003	Aluminum	4410	mg/kg	0.0605	NA
0003	Aroclor-1260	1200	ug/kg	NA	5.4445
0003	B(a)P Equiv.	31.1	ug/kg	NA	0.5150
0003	Cadmium	5.1	mg/kg	0.0701	NA
0003	Chromium	50.3	mg/kg	0.1379	NA
0003	Copper	269	mg/kg	0.0922	NA
0003	Manganese	91.9	mg/kg	0.0268	NA
	Total			0.3875	5.9595
0004	Aluminum	2440	mg/kg	0.0335	NA
0004	Aroclor-1260	4100	ug/kg	NA	18.6020
0004	B(a)P Equiv.	15.849	ug/kg	NA	0.2625
0004	Cadmium	5.1	mg/kg	0.0701	NA
0004	Chromium	9.8	mg/kg	0.0269	NA
0004	Copper	26	mg/kg	0.0089	NA
0004	Manganese	26	mg/kg	0.0076	NA
	Total			0.1469	18.8645
0005	Aluminum	1030	mg/kg	0.0141	NA
0005	Aroclor-1260	410	ug/kg	NA	1.8602
0005	B(a)P Equiv.	72.963	ug/kg	NA	1.2083
0005	Cadmium	2.2	mg/kg	0.0302	NA
0005	Chromium	4.4	mg/kg	0.0121	NA
0005	Copper	58.5	mg/kg	0.0201	NA
0005	Manganese	31.2	mg/kg	0.0091	NA
	Total			0.0855	3.0685
0006	Aluminum	1230	mg/kg	0.0169	NA
0006	Aroclor-1260	960	ug/kg	NA	4.3556
0006	B(a)P Equiv.	12.534	ug/kg	NA	0.2076
0006	Cadmium	6	mg/kg	0.0824	NA
0006	Chromium	10.9	mg/kg	0.0299	NA
0006	Copper	39.5	mg/kg	0.0135	NA
0006	Manganese	52.1	mg/kg	0.0152	NA
	Total			0.1579	4.5632
0007	Aluminum	5420	mg/kg	0.0743	NA
0007	Antimony	6.9	mg/kg	0.2365	NA
0007	Aroclor-1260	15000	ug/kg	NA	68.0561
0007	Arsenic	2.4	mg/kg	0.1097	6.2688
0007	B(a)P Equiv.	519.88	ug/kg	NA	8.6094
0007	Cadmium	11.2	mg/kg	0.1538	NA
0007	Chromium	15.1	mg/kg	0.0414	NA
0007	Copper	129	mg/kg	0.0442	NA
0007	Manganese	56	mg/kg	0.0164	NA
	Total			0.6764	82.9343

Table 10.3.2-14
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 12, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

0008	Aluminum	3930	mg/kg	0.0539	NA
0008	Antimony	1.2	mg/kg	0.0411	NA
0008	Aroclor-1260	12000	ug/kg	NA	54.4449
0008	B(a)P Equiv.	574.52	ug/kg	NA	9.5142
0008	Cadmium	17.3	mg/kg	0.2376	NA
0008	Chromium	21.3	mg/kg	0.0584	NA
0008	Copper	132	mg/kg	0.0453	NA
0008	Manganese	58.3	mg/kg	0.0170	NA
	Total			0.4533	63.9591
0009	Aluminum	4040	mg/kg	0.0554	NA
0009	Antimony	2.1	mg/kg	0.0720	NA
0009	Aroclor-1260	3900	ug/kg	NA	17.6946
0009	Arsenic	1.7	mg/kg	0.0777	4.4404
0009	B(a)P Equiv.	1696.93	ug/kg	NA	28.1017
0009	Cadmium	49.4	mg/kg	0.6786	NA
0009	Chromium	25	mg/kg	0.0686	NA
0009	Copper	370	mg/kg	0.1268	NA
0009	Manganese	182	mg/kg	0.0531	NA
	Total			1.1322	50.2367
0010	Aluminum	15100	mg/kg	0.2071	NA
0010	Antimony	3.5	mg/kg	0.1200	NA
0010	Aroclor-1260	390	ug/kg	NA	1.7695
0010	Arsenic	2.8	mg/kg	0.1280	7.3136
0010	B(a)P Equiv.	2846.5	ug/kg	NA	47.1389
0010	Cadmium	562	mg/kg	7.7200	NA
0010	Chromium	70.8	mg/kg	0.1942	NA
0010	Copper	516	mg/kg	0.1769	NA
0010	Manganese	272	mg/kg	0.0794	NA
	Total			8.6255	56.2220
0011	Aluminum	2810	mg/kg	0.0385	NA
0011	Aroclor-1260	38	ug/kg	NA	0.1724
0011	B(a)P Equiv.	257.41	ug/kg	NA	4.2628
0011	Cadmium	3.2	mg/kg	0.0440	NA
0011	Chromium	15.3	mg/kg	0.0420	NA
0011	Copper	45	mg/kg	0.0154	NA
0011	Manganese	36.2	mg/kg	0.0106	NA
	Total			0.1505	4.4352
0012	Aluminum	6020	mg/kg	0.0825	NA
0012	Aroclor-1260	26	ug/kg	NA	0.1180
0012	B(a)P Equiv.	203.38	ug/kg	NA	3.3680
0012	Cadmium	2.1	mg/kg	0.0288	NA
0012	Chromium	15.2	mg/kg	0.0417	NA
0012	Copper	5.5	mg/kg	0.0019	NA
0012	Manganese	32.9	mg/kg	0.0096	NA
	Total			0.1645	3.4860
0013	Aluminum	5190	mg/kg	0.0712	NA
0013	Antimony	0.59	mg/kg	0.0202	NA
0013	Aroclor-1260	1400	ug/kg	NA	6.3519
0013	B(a)P Equiv.	170.096	ug/kg	NA	2.8168
0013	Cadmium	15.5	mg/kg	0.2129	NA
0013	Chromium	17.7	mg/kg	0.0485	NA
0013	Copper	54.8	mg/kg	0.0188	NA
0013	Manganese	85.7	mg/kg	0.0250	NA
	Total			0.3966	9.1687
0014	Aluminum	16100	mg/kg	0.2208	NA
0014	Aroclor-1260	62	ug/kg	NA	0.2813
0014	Arsenic	2.1	mg/kg	0.0960	5.4852
0014	B(a)P Equiv.	6.04	ug/kg	NA	0.1000
0014	Chromium	18.2	mg/kg	0.0499	NA
0014	Copper	12.2	mg/kg	0.0042	NA
0014	Manganese	390	mg/kg	0.1138	NA
	Total			0.4846	5.8665

Table 10.3.2-14
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 12, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

0015	Aluminum	15300	mg/kg	0.2098	NA
0015	Antimony	1.1	mg/kg	0.0377	NA
0015	Aroclor-1260	1300	ug/kg	NA	5.8982
0015	Arsenic	1.4	mg/kg	0.0640	3.6568
0015	B(a)P Equiv.	268.3	ug/kg	NA	4.4431
0015	Beryllium	0.43	mg/kg	0.0012	3.2197
0015	Cadmium	4.5	mg/kg	0.0618	NA
0015	Chromium	32.6	mg/kg	0.0894	NA
0015	Copper	37.3	mg/kg	0.0128	NA
0015	Manganese	110	mg/kg	0.0321	NA
	Total			0.5088	17.2179
0016	Aluminum	324	mg/kg	0.0044	NA
0016	Aroclor-1254	280	ug/kg	0.2309	1.2704
0016	Aroclor-1260	150	ug/kg	NA	0.6806
0016	B(a)P Equiv.	1116.57	ug/kg	NA	18.4907
0016	Chromium	1.1	mg/kg	0.0030	NA
0016	Manganese	2.2	mg/kg	0.0006	NA
	Total			0.2390	20.4417

Table 10.3.2-15
Hazard Quotients and Incremental Lifetime Cancer Risks
Shallow Groundwater Ingestion
Site 12
val Air Station, Pensacola
.sacola, Florida

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Aroclor-1260	NA	0.4	ND	ND	2.5E-06	ND	8.1E-07
Cadmium	0.0005	NA	0.25	0.57	ND	0.09	ND
Chloroform	0.01	0.0061	0.0047	0.011	1.6E-07	0.0017	5.0E-08
4,4'-DDD	NA	0.24	ND	ND	4.0E-07	ND	1.3E-07
1,1-Dichloroethane	0.1	NA	0.00094	0.0022	ND	0.00034	ND
1,1-Dichloroethene	0.009	0.6	0.0026	0.0060	7.7E-06	0.00092	2.5E-06
1,2-Dichloroethene (cis)	0.01	NA	0.0082	0.019	ND	0.0029	ND
Dieldrin	5E-05	16	0.06	0.13	2.5E-05	0.020	8.0E-06
Heptachlor epoxide	1.3E-05	9.1	0.023	0.054	1.5E-06	0.0083	4.8E-07
Tetrachlorothene	0.01	0.052	0.0031	0.0073	9.0E-07	0.0011	2.9E-07
SUM Hazard Index/ILCR			0.3	0.8	4E-05	0.1	1E-05

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Table 10.3.2-16
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Contaminants in Shallow Groundwater due to Domestic Use
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation RfD Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Chloroform	0.01	0.0805	0.0047	0.011	2.1E-06	0.0017	6.6E-07
1,1-Dichloroethane	0.1	NA	0.00094	0.0022	ND	0.00034	ND
1,1-Dichloroethene	0.009	0.175	0.0026	0.0060	2.2E-06	0.00092	7.2E-07
1,2-Dichloroethene (cis)	0.01	NA	0.0082	0.0192	ND	0.00294	ND
Tetrachlorothene	0.01	0.00203	0.0031	0.0073	3.5E-08	0.0011	1.1E-08
SUM Hazard Index/ILCR			0.02	0.05	4E-06	0.007	1E-06

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
The oral slope factor was used as a surrogate for the inhalation slope factor

Table 10.3.2-17
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 12, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
Summary of Risk and Hazard resulting from Maximum Concentration						
GS08	01	Cadmium	9.6	ug/L	1.231	NA
GS08	01	Aroclor-1260	0.42	ug/L	NA	12.49
GS08	01	4,4'-DDD	0.11	ug/L	NA	0.39
GS03	01	Dieldrin	0.3	ug/L	0.384	71.39
GS05	01	Heptachlor epoxide	0.011	ug/L	0.108	2.98
GS14	01	Chloroform	3	ug/L	0.038	3.86
GS14	01	1,1-Dichloroethene	0.9	ug/L	0.013	10.37
GS10	01	Tetrachloroethene	2	ug/L	0.026	1.61
		Total			1.8	103
Point Estimates of Risk and Hazard						
GS01	01	Chloroform	0.5	ug/L	0.0064	0.6440
GS01	01	Dieldrin	0.0073	ug/L	0.0093	1.7371
GS01	01	Tetrachloroethene	0.6	ug/L	0.0077	0.4821
		Total			0.0234	2.8633
GS02	01	Chloroform	1	ug/L	0.0128	1.2880
GS02	01	Dieldrin	0.072	ug/L	0.0921	17.1335
GS02	01	Tetrachloroethene	0.5	ug/L	0.0064	0.4018
		Total			0.1112	18.8232
GS03	01	Dieldrin	0.3	ug/L	0.3836	71.3894
		Total			0.3836	71.3894
GS05	01	Dieldrin	0.068	ug/L	0.0869	16.1816
GS05	01	Heptachlor epoxide	0.011	ug/L	0.1082	2.9775
		Total			0.1951	19.1591
GS06	01	Chloroform	2	ug/L	0.0256	2.5760
GS06	01	Dieldrin	0.074	ug/L	0.0946	17.6094
GS06	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
		Total			0.1330	20.9889
GS08	01	4,4'-DDD	0.11	ug/L	NA	0.3926
GS08	01	Aroclor-1260	0.42	ug/L	NA	12.4932
GS08	01	Cadmium	9.6	ug/L	1.2308	NA
		Total			1.2308	12.8858
GS09	01	Cadmium	3.8	ug/L	0.4872	NA
		Total			0.4872	NA
GS10	01	1,1-Dichloroethene	0.8	ug/L	0.0114	9.2211
GS10	01	Cadmium	2.1	ug/L	0.2692	NA
GS10	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
		Total			0.3062	10.8283
GS14	01	1,1-Dichloroethene	0.9	ug/L	0.0128	10.3738
GS14	01	Chloroform	3	ug/L	0.0384	3.8640
GS14	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
		Total			0.0767	15.8449
GS15	01	Chloroform	2	ug/L	0.0256	2.5760
GS15	01	Tetrachloroethene	0.7	ug/L	0.0089	0.5625
		Total			0.0345	3.1385
GS16	01	Cadmium	2.4	ug/L	0.3077	NA
		Total			0.3077	NA

Table 10.3.2-18
Summary of Risk and Hazard-based Surface Soil COCs
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident lwa ILCR	Future Site Worker Hazard Quotient	Future Site Worker ILCR	Future Tresspasser Hazard Quotien	Future Tresspasser ILCR
Surface Soil	Incidental Ingestion	Aluminum	0.020	0.19	ND	0.0073	ND	0.0047	ND
		Antimony	0.023	0.21	ND	0.0082	ND	0.0053	ND
		Aroclor-1254	0.019	0.18	8.8E-07	0.0068	9.8E-08	0.0044	2.5E-08
		Aroclor-1260	ND	ND	4.7E-05	ND	5.2E-06	ND	1.4E-06
		Arsenic	0.0076	0.071	3.9E-06	0.0027	4.4E-07	0.0018	1.1E-07
		Benzo(a)pyrene Equiv.	ND	ND	1.3E-05	ND	1.4E-06	ND	3.7E-07
		Beryllium	0.000023	0.00022	5.7E-07	0.0000083	6.4E-08	0.0000054	1.7E-08
		Cadmium	0.77	7.2	ND	0.27	ND	0.18	ND
		Chromium	0.015	0.14	ND	0.0052	ND	0.0034	ND
		Copper	0.018	0.16	ND	0.0063	ND	0.0041	ND
		Manganese	0.010	0.096	ND	0.0037	ND	0.0024	ND
	Dermal Contact	Aluminum	0.0042	0.014	ND	0.0030	ND	0.0010	ND
		Antimony	0.0047	0.016	ND	0.0034	ND	0.0011	ND
		Aroclor-1254	0.016	0.052	3.9E-07	0.011	1.6E-07	0.0036	2.1E-08
		Aroclor-1260	ND	ND	2.1E-05	ND	8.6E-06	ND	1.1E-06
		Arsenic	0.0016	0.0052	4.4E-07	0.0011	1.8E-07	0.00036	2.3E-08
		Benzo(a)pyrene Equiv.	ND	ND	5.7E-06	ND	2.3E-06	ND	3.0E-07
		Beryllium	0.0000048	0.000016	6.4E-08	0.0000034	2.6E-08	0.0000011	3.4E-09
		Cadmium	0.16	0.52	ND	0.11	ND	0.037	ND
		Chromium	0.0030	0.010	ND	0.0021	ND	0.00070	ND
		Copper	0.0036	0.012	ND	0.0026	ND	0.00084	ND
		Manganese	0.0021	0.0070	ND	0.0015	ND	0.00049	ND
Surface Soil Pathway Sum			1	9	9E-05	0.5	2E-05	0.2	3E-06

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.
5- Chemical is a COC by virtue of projected future adolescent trespasser noncarcinogenic hazard.
6- Chemical is a COC by virtue of projected future adolescent trespasser ILCR.

Table 10.3.2-1
Summary of Risk and Hazard-based Groundwater COCs
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Future Resident Adult Hazard Quotient	Future Future Resident Child Hazard Quotient	Future Future Resident Iwa ILCR	Future Site Worker Hazard Quotient	Future Site Worker ILCR	Identification of COCs	
Groundwater	Ingestion	Aroclor-1260	ND	ND	2.5E-06	ND	8.1E-07	2	
		Cadmium	0.25	0.6	ND	0.09	ND		
		Chloroform	0.0047	0.011	1.6E-07	0.0017	5.0E-08		
		4,4'-DDD	ND	ND	4.0E-07	ND	1.3E-07		
		1,1-Dichloroethane	0.00094	0.0022	ND	0.00034	ND		
		1,1-Dichloroethene	0.0026	0.0060	7.7E-06	0.00092	2.5E-06	2	4
		1,2-Dichloroethene (cis	0.0082	0.019	ND	0.0029	ND		
		Dieldrin	0.06	0.13	2.5E-05	0.020	8.0E-06	2	4
		Heptachlor epoxide	0.023	0.054	1.5E-06	0.0083	4.8E-07	2	
		Tetrachlorothene	0.0031	0.0073	9.0E-07	0.0011	2.9E-07		
	Inhalation	Chloroform	0.0047	0.011	2.1E-06	0.0017	6.6E-07	2	
		1,1-Dichloroethane	0.00094	0.0022	ND	0.00034	ND		
		1,1-Dichloroethene	0.0026	0.0060	2.2E-06	0.00092	7.2E-07	2	
		1,2-Dichloroethene (cis	0.0082	0.019	ND	0.0029	ND		
		Tetrachlorothene	0.0031	0.0073	3.5E-08	0.0011	1.1E-08		
Groundwater Pathway Sum			0.4	0.9	4E-05	0.1	1E-05		

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.

Table 10.3.2-20
Summary of Risk and Hazard
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	HI (Adult)	HI (Child)	ILCR (LWA)	HI (Worker)	ILCR (Worker)	HI (Tresspasser)	ILCR (Tresspasser)
Surface Soil	Incidental Ingestion	0.9	8	7E-05	0.3	7E-06	0.2	2E-06
	Dermal Contact	0.2	0.6	3E-05	0.1	1E-05	0.04	1E-06
Groundwater	Ingestion	0.3	0.8	4E-05	0.1	1E-05	NA	NA
	Inhalation	0.02	0.05	4E-06	0.007	1E-06	NA	NA
Sum all Pathways		1	10	1E-04	0.6	3E-05	0.2	3E-06

Notes:
ILCR Incremental lifetime cancer risk
HI Hazard index
NA Not applicable or not available

Table 10.3.2-2.
Remedial Goal Options for Surface Soil
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Slope Factor (mg/kg-day)-1	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentratio mg/kg	FDEP Soil Cleanup Goal mg/kg
Aluminum	NA	1	14949	218781	72927	7293	ND	ND	ND	3833	75000
Antimony	NA	0.0004	6.7	88	29	2.9	ND	ND	ND	9.49	26
Aroclor-1254	2	2E-05	0.28	4	1	0.1	0.22	2.2	22	NA	0.9
Aroclor-1260	2	NA	15	ND	ND	ND	0.22	2.2	22	NA	0.9
Arsenic	1.5	0.0003	1.7	66	22	2.2	0.38	3.8	38	1.56	0.7
Benzo(a)pyrene Equiv.	7.3	NA	1.1	ND	ND	ND	0.060	0.60	6.0	NA	0.1
Cadmium	NA	0.001	562	219	73	7.3	ND	ND	ND	1	37
Chromium	NA	0.005	53	1094	365	36	ND	ND	ND	6.13	290
Copper	NA	0.04	516	8751	2917	292	ND	ND	ND	5.74	NA

Industrial RGOs

Chemical	Slope Factor (mg/kg-day)-1	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentratio mg/kg	FDEP Soil Cleanup Goal mg/kg
Aroclor 1260	2	NA	15	ND	ND	ND	1.1	11	108	NA	3.5
Benzo(a)pyrene Equiv.	7.3	NA	1.1	ND	ND	ND	0.30	3.0	30	NA	0.5

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the lifetime weighted average for carcinogens and the child resident and the worker for noncarcinogens

Table 10.3.2-22
Remedial Goal Options Shallow Groundwater
Site 12
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Oral SF (mg/kg-day)-	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options 0.1 mg/l	1.0 mg/l	3 mg/l	Risk-Based Remedial Goal Options 1E-06 mg/l	1E-05 mg/l	1E-04 mg/l	Background Concentration µg/l	ARAR mg/l
Aroclor-1260	0.4	NA	0.00042	ND	ND	ND	0.00017	0.0017	0.017	NA	0.0005
Chloroform	0.0061	0.01	0.0017	0.0078	0.078	0.23	0.00077	0.0077	0.077	NA	0.006
1,1-Dichloroethene	0.6	0.009	0.00085	0.0070	0.070	0.21	0.000086	0.00086	0.0086	NA	0.007
Dieldrin	16	5E-05	0.00010	0.000078	0.00078	0.0023	0.0000041	0.000041	0.00041	NA	0.0001
Heptachlor epoxide	9.1	1.3E-05	0.000011	0.000020	0.00020	0.00061	0.0000073	0.000073	0.00073	NA	0.0002
Tetrachloroethene	0.052	0.01	0.0011	0.0078	0.078	0.23	0.0012	0.012	0.12	NA	0.003

Industrial RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options 0.1 mg/l	1 mg/l	3 mg/l	Risk-Based Remedial Goal Options 1E-06 mg/l	1E-05 mg/l	1E-04 mg/l	Background Concentration µg/l	ARAR mg/l
Aroclor-1260	0.4	NA	0.00042	ND	ND	ND	0.00052	0.0052	0.052	NA	0.0005
1,1-Dichloroethene	0.6	0.009	0.00085	0.046	0.46	1.4	0.00027	0.0027	0.027	NA	0.007
Dieldrin	16	5E-05	0.00010	0.00051	0.0051	0.015	0.000013	0.00013	0.0013	NA	0.0001

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or the adult worker for noncarcinogens

10.3.3 Human Health Risk Assessment for Site 25

10.3.3.1 Site Background and Investigative Approach

Site 25 is a spill of approximately 10 gallons of radium paint waste immediately east of Building 780. The spill reportedly occurred in 1978. Currently, Building 780 houses the laboratory for the Joint Oils Analysis program.

As part of the RI, 16 surface soil samples were analyzed for full scan TCL/TAL, gross alpha and beta radioactivity, and cyanide. At some surface soil sampling locations, samples were collected from various intervals to a depth of 2 feet. Data for each chemical at each interval were compared and the maximum concentration of each chemical at a given sampling location was used in the risk assessment. Table 10.3.3-1 lists the analytical methods for the corresponding soil samples used in the Site 25 HHRA.

Eleven Phase I groundwater samples were collected from shallow and intermediate intervals. The use of bailers for Phase I sampling was suspected of being responsible for a high inorganic concentrations and low VOC concentrations. Eight monitoring wells were resampled for these target parameters. Phase I groundwater was analyzed for full scan TCL/TAL parameters, including cyanide, while Phase II samples were analyzed for inorganic (six monitoring wells) and VOC (six monitoring wells) parameters only. For groundwater, TAL metals were not filtered. Table 10.3.3-2 lists the analytical methods for the corresponding groundwater samples used in the HHRA. Due to incomplete and/or questionable data sets, the preliminary conclusions of this HHRA should be interpreted with caution. Supplemental, full scope (all monitoring wells) groundwater sampling and analysis should precede implementation of a remedial action.

10.3.3.2 COPC Identification

Soil

Based on the screening comparisons described in Section 10.2.5 of this RI and presented in Table 10.3.3-3, this HHRA focuses on the following COPCs: aluminum, Aroclor-1254, Aroclor-1260, arsenic, BEQs, beryllium, cadmium, chromium, dieldrin, lead, manganese, mercury, silver, and zinc. Radiological concerns are addressed in a separate technical memorandum (Appendix D).

Groundwater

As shown in Table 10.3.3-4, the COPCs identified in Phase I groundwater for this site are aluminum, antimony, arsenic, barium, beryllium, cadmium, chloroform, chromium, copper, 1,1-DCA, 1,1-DCE, heptachlor epoxide, lead, manganese, mercury, nickel, PCE, TCE, vanadium, and vinyl chloride. 1,1,1-Trichloroethane was detected in Site 25 groundwater at a concentration below the RBC. However, 1,1,1-trichloroethane was detected at other OU 2 sites exceeding the RBC and was within 10% of the RBC in Site 25 groundwater. As a result, 1,1,1-trichloroethane was added to the list of Phase I groundwater COPCs. Table 10.3.3-5 presents the screening analysis for Phase II groundwater and identifies chloroform, 1,1-DCE, mercury, PCE, and TCE as COPCs.

Table 10.3.3-6 compares both groundwater sampling phases using the list of COPCs generated with Phase I data (Phase I COPCs are inclusive of all Phase II COPCs). As shown, eight of the 11 Phase I monitoring wells were resampled during Phase II. Six of the eight Phase II wells (all screened in the shallow aquifer) were analyzed for inorganics and five of the eight Phase II wells (two screened in the intermediate aquifer and three in the shallow aquifer) were analyzed for VOCs. The intermediate interval was not resampled/reanalyzed for inorganic chemicals. Additionally, monitoring well GS004, which yielded high inorganic concentrations during Phase I, was not resampled during Phase II. The aquifer is expected to be uniform in the immediate area

of Site 25 and therefore Phase II data were sufficient to support general conclusions regarding Phase I data. Except for heptachlor epoxide (pesticide fraction), all COPCs identified using Phase I data were resampled/reanalyzed as part of Phase II.

Except for mercury the sampling technique employed during Phase I appears to have amplified inorganic concentrations because of the high turbidity of the samples. As a result, all of the inorganic COPCs identified using Phase I data were eliminated from the list based on Phase II data. The list of COPCs for Site 25 groundwater include all the VOCs identified using Phase I data, chloroform, 1,1-DCA, 1,1-DCE, PCE, 1,1,1-trichloroethane, TCE, and vinyl chloride, plus mercury and heptachlor epoxide. Point estimates of risk and hazard are provided Section 10.3.3.7, Risk Characterization, for groundwater COPCs identified in both sampling phases. Only those COPCs listed above were carried through the formal risk assessment.

10.3.3.3 Exposure Assessment

Exposure Setting

Site 25 is in the central portion of OU 2 and is currently a laboratory that tests materials. The building is surrounded by a 7-foot high fence (chain link and barb wire). Access to the building is limited to the authorized personnel. Except for a narrow strip of soil located along the west side of the building, the ground surface is generally paved or covered by the building. The area is likely to maintain its current use for the next five years.

Potentially Exposed Populations

Potentially exposed populations are current and future site workers, and future site residents. Although this area is unlikely to attract adolescent trespassers with any significant frequency because of the fence, and Site 25 is not near the base boundary, a trespasser scenario was included. Therefore, future site resident, future site worker, and adolescent trespasser exposure scenarios are addressed in this risk assessment. In the event of construction onsite, construction

workers were considered to have the potential of exposure to chemicals in subsurface soil. Therefore construction worker PRGs were calculated as described in Section 10.2.12, and compared to maximum detected chemical concentrations in subsurface soil.

The hypothetical future site worker scenario assumed continuous exposure to surface soil conditions and the use of groundwater as a potable water source. Current site workers' exposure would be less than that assumed for the hypothetical future site worker scenario because of their limited soil contact (i.e., majority of soil is under the building or pavement) and the fact that groundwater is not currently used onsite as a source of potable or process water. The future site resident scenario assumes that existing buildings would be removed and replaced with dwellings and that future site residents would use the onsite shallow zone of the underlying aquifers as a drinking water source. The current site trespasser is characterized as an adolescent who visits the site once a week during the summer.

Exposure Pathways

Exposure pathways for future residential use, future site workers, and adolescent trespassers are dermal contact and incidental ingestion of surface soil. Additional pathways for future residents and future site workers include ingestion of groundwater through potable use and inhalation of VOCs through domestic groundwater use. Uniform exposure was assumed for all sample locations. No indirect exposure pathways were identified. Table 10.3.3-7 presents the assessed exposure pathways.

Exposure Point Concentrations

Table 10.3.3-8 summarizes the statistical data analysis for COPCs identified in surface soil. For nondetected concentrations, one-half of the sample quantitation limits served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL for all COPCs. Aroclor-1260 was detected at 31 mg/kg at sample location 025S00016 which previously caused

the calculated 95% UCL to exceed the maximum detected concentration, but the soil in this location was removed and confirmation samples had a maximum detected concentration of 0.192 mg/kg. Results of the removal action are detailed in the *Project Completion Report for Remediation Work at Various Sites,* by Bechtel (September 1998). This new sample concentration was used to re-calculate the 95% UCL which did not exceed the maximum detected concentration. The soil EPC for aluminum, Aroclor-1260, arsenic, BEQs, beryllium, chromium, dieldrin, manganese, mercury, and silver was set equal to the 95% UCL. For cadmium and zinc, the maximum detected concentration was used as the soil EPC since the 95% UCL exceeded the maximum detected concentration. Exposures to lead in soil and groundwater is addressed separately in Section 10.3.3.5.

Table 10.3.3-9 summarizes the statistical data analysis for COPCs identified in Phase I groundwater. Data from both phases of groundwater sampling were combined to allow for both temporal and spatial variability to be addressed using risk assessment statistical methods (95% UCL). For nondetects, one-half of the sample quantitation limits served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL for 1,1-DCA, 1,1,1-TCA, and TCE as well as Phase II data for chloroform and 1,1-DCE. One-half of the lowest detected concentrations served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL for heptachlor epoxide, PCE, and vinyl chloride as well as Phase I data for chloroform and 1,1-DCE. This was done because the sample quantitation limits exceeded the maximum detected concentrations.

Increased method sensitivity and improved sampling techniques used in Phase II introduced groundwater data variability beyond the anticipated spatial and temporal trends. Historically, the most conservative method for providing point estimates using data with various degrees of variability was through the use of the 95% UCL statistic. As mentioned in Section 10.2, the placement of monitoring wells may provide data sets with a low bias on the 95% UCL.

Region IV guidance favors using the mean concentration from the most concentrated area of the plume as the EPC. Since a plume is difficult to define for Site 25 groundwater COPCs, the Region IV guidance for groundwater EPCs applies only marginally. As a result, the greater of the arithmetic mean of detected concentrations (to account for well placement in uncontaminated areas of the aquifer) and the 95% UCL (to account for uncertainty introduced through data variability) was used as an EPC. This decision process was straightforward for chloroform, 1,1-DCA, 1,1-DCE, mercury, PCE, and 1,1,1-TCA. Heptachlor epoxide and vinyl chloride both were detected only once. Additionally, the 95% UCL for TCE exceeded the maximum concentration. In each of these cases, the maximum (or only detected) concentration was used as an EPC. To supplement the groundwater risk assessment, risk maps have been provided in Section 10.3.3.5 Risk Characterization, which are useful in locating isolated areas of elevated risk (plumes).

Exposure Quantification

Soil

CDIs for ingestion and dermal contact with soil are shown in Tables 10.3.3-10 and 10.3.3-11, respectively.

Groundwater

The CDIs for groundwater ingestion are presented in Table 10.3.3-12. The CDIs for inhalation of VOCs are assumed to be approximately equal to the CDI is for ingestion as indicated in the *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering* (USEPA, 1991e).

10.3.3.4 Toxicity Assessment

Table 10.4.1-1 presents toxicological information specific to each COPC identified at OU 2. This information was used to quantify risk/hazard associated with soil and groundwater contaminants. Brief toxicological profiles for each COPC are provided in Section 10.4.

Some constituents detected in soil and groundwater at Site 25 do not have toxicity criteria available. The following cross-assignments were made based on structural and toxicological similarities between chemicals. The RBC for gamma-BHC was cross-assigned to delta-BHC. The RBC for endosulfan was cross-assigned to endosulfan I and endosulfan sulfate. The RBC for endrin was cross-assigned to endrin aldehyde. The RBC for naphthalene was cross-assigned to 2-methylnaphthalene.

10.3.3.5 Risk Characterization

Surface Soil Pathways

Exposure to surface soil onsite was evaluated under both residential and industrial (site worker) scenarios. For these scenarios, the incidental ingestion and dermal contact exposure pathways were evaluated. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.3.3-13 and 10.3.3-14 present the computed carcinogenic risks and/or HQs associated with the incidental ingestion of and dermal contact with site surface soil, respectively.

Hypothetical Site Residents

The ingestion ILCR (based on the adult and child LWA) for Site 25 surface soil is 3E-05. The dermal pathway ILCR is 1E-05. Arsenic, BEQs, and beryllium were the primary contributors for the ingestion pathway with BEQs contributing significantly to the dermal pathway.

The computed HIs for the adult and child resident were 0.1 and 1, respectively, for the soil ingestion pathway. The computed HIs for the adult and child dermal contact pathways were 0.04 and 0.1. Aroclor-1254, cadmium, chromium, and zinc were significant contributors for the ingestion pathway.

Hypothetical Site Workers

The site worker ILCR is 3E-06 for the ingestion pathway and 4E-06 for the dermal contact pathway. BEQs were the primary contributors for both pathways. HIs were 0.05 for the ingestion pathway and 0.03 for the dermal pathway.

Hypothetical Adolescent Trespasser

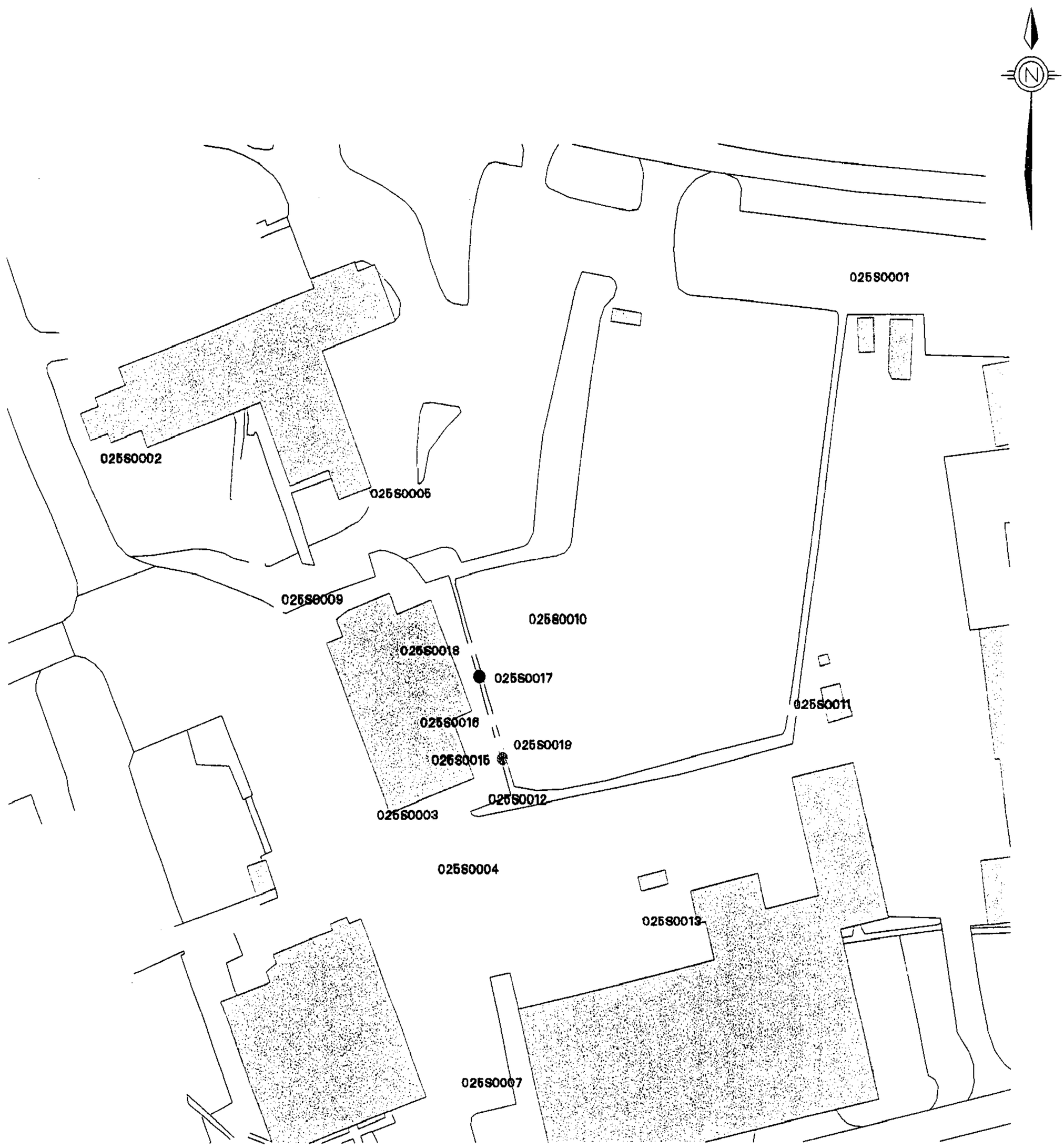
The ingestion and dermal contact ILCRs for the adolescent trespasser are 8E-07 and 5E-07, respectively. BEQs were the primary contributor for both pathways. HIs for the ingestion and dermal pathways were less than 0.1.

Construction Worker

Table 10.3.3-15 presents a summary of subsurface soil with a comparison to PRGs. As shown, the maximum concentrations of chemicals detected in Site 25 subsurface soil did not exceed their respective construction worker PRGs.

Point Risk and Point Hazard Estimates for Soil Pathways

Figures 10-11 and 10-12 are the risk and hazard maps for Site 25 soil. Table 10.3.3-16 lists the risk and/or hazard contributed by each COPC at each sample location. As shown, two of 16 locations had reported concentrations equating with a cumulative HI of greater than unity (1) due to Aroclor-1254, arsenic, cadmium, chromium, mercury, manganese, and zinc. Reported concentrations of arsenic and BEQs in Site 25 soil samples generally equate with a cumulative risk between 1E-06 to 1E-05. Reported soil concentrations of Aroclor-1254, Aroclor-1260, arsenic,



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 200

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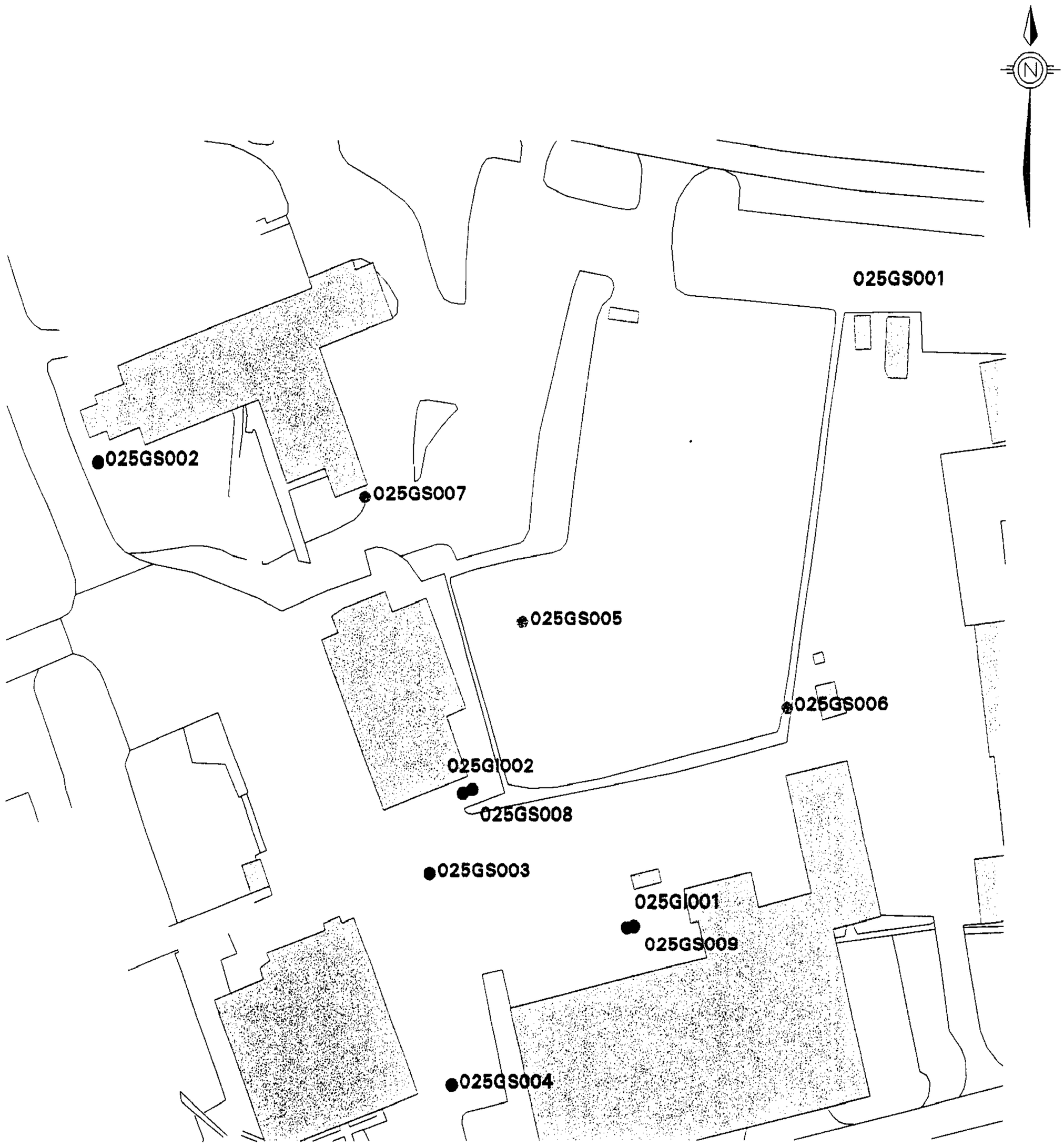
FIGURE 10-12
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 25, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/soil_dir/bomain.aml



LEGEND - RISK VALUES

- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 200

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PENSACOLA, FLORIDA

FIGURE 10-13
SAMPLE POINT ESTIMATES OF RISK
SITE 25, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/well_dir/bomain.aml

BEQs, beryllium, and dieldrin equate with a cumulative risk which had exceeded 1E-04 near locations S0016 and S0017. However, location S0016 has been removed and confirmation samples show that the Aroclor-1260 concentrations have dropped from 31 mg/kg to 0.192 mg/kg. The cumulative risk is now below 1E-04.

Groundwater Pathways

Exposure to groundwater onsite was evaluated under residential and industrial scenarios. The groundwater exposure pathways were evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed separately for child and adult receptors. Tables 10.3.3-17 and 10.3.3-18 present the risk and hazard for the ingestion and inhalation pathways, respectively.

Groundwater

Hypothetical Site Residents

For the ingestion and inhalation pathways, the LWA ILCRs were computed to be 2E-04 and 4E-05, respectively. The primary contributor to ingestion risk is vinyl chloride with secondary contributions from 1,1-DCE, PCE, and TCE. The primary contributors to inhalation risk include chloroform, 1,1-DCE, TCE, and vinyl chloride.

HIs for the adult and child resident are 0.5 and 1, respectively, for the ingestion pathway. The adult and child inhalation pathway HIs were both less than 1. The primary contributors to ingestion HI were mercury and TCE.

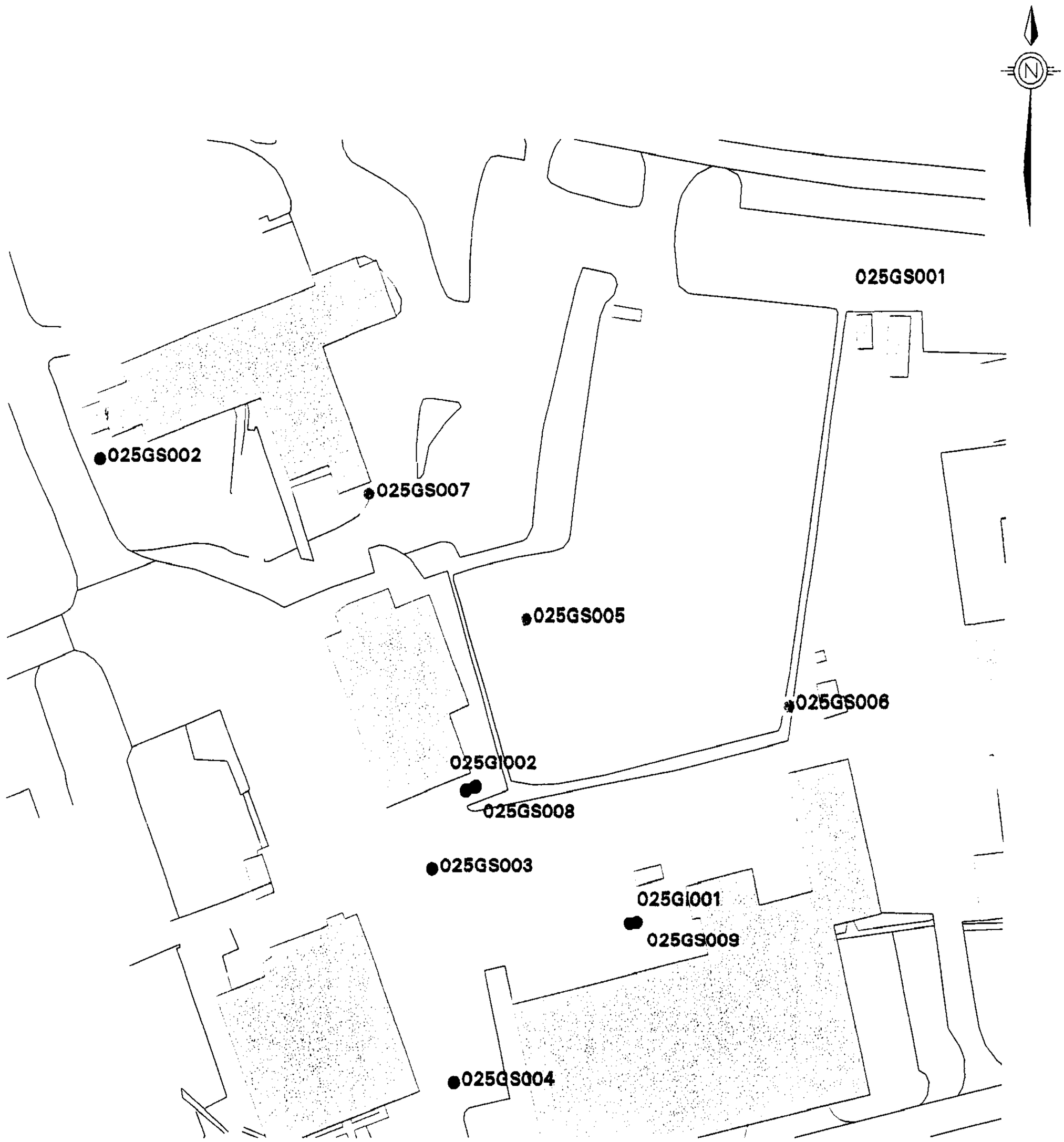
Hypothetical Site Workers

For the ingestion and inhalation pathways, the ILCRs were computed to be 7E-05 and 1E-05, respectively. The primary contributors to risk for both the ingestion and inhalation pathways are TCE and vinyl chloride.

The worker HIs were computed to be 0.2 and 0.03 for the ingestion and inhalation pathways, respectively.

Point Risk and Point Hazard Estimates for Groundwater Pathways

Figures 10-13 and 10-14 are the risk and hazard maps, respectively, for Site 25 groundwater. Table 10.3.3-19 details the contributors to risk and hazard at each monitoring well location. Phase I groundwater data have been used to generate the groundwater risk maps because not all monitoring wells were resampled during Phase II. Phase II data are used to substantiate the risk assessment conclusions. As shown, reported concentrations of COPCs in all of the Phase I monitoring wells equate with a HI above unity (1). Monitoring well locations with elevated HIs are entirely due to reported inorganic concentrations of aluminum, antimony, arsenic, cadmium, copper, chromium, and vanadium. All COPCs associated with elevated HIs in Site 25 groundwater were eliminated from the risk assessment based on comparison of Phase I and Phase II groundwater data. All monitoring wells have concentrations of COPCs that equate with cumulative risks ranging from 3E-06 to above 1E-03. Concentrations of arsenic and beryllium account for all risk projections exceeding 1E-03 (monitoring wells GI01 and GI02). Arsenic and beryllium were not at detectable concentrations in Phase II monitoring wells and were eliminated as Site 25 COPCs. Apart from the contribution of arsenic and beryllium to groundwater risk projections, the reported groundwater concentrations of chlorinated VOCs (1,1-DCE, chloroform, PCE, TCE, and vinyl chloride) result in risk projections ranging from 1E-06 to 2E-04. Using maximum concentrations of COPCs in groundwater to provide estimates of risk and hazard, as prescribed by FDEP when calculating RME risk and hazard, would yield a residential groundwater



LEGEND - RISK VALUES

- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 200

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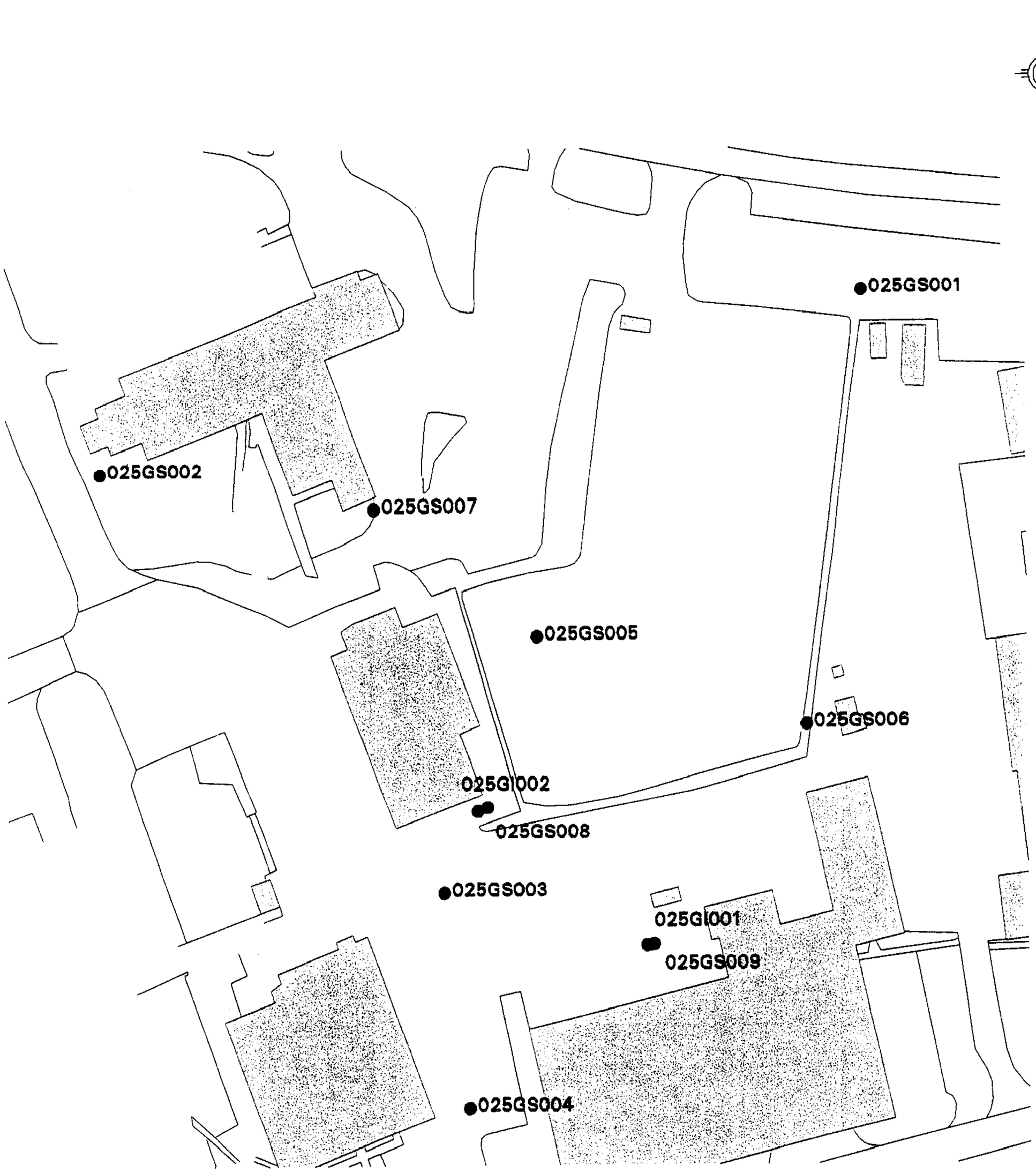
FIGURE 10-13
SAMPLE POINT ESTIMATES OF RISK
SITE 25, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/well_dir/bomain.aml



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 200

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FIGURE 10-14
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 25, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/well_dir/bomain.aml

pathway risk of 4E-03 and a hazard quotient of 284. This is shown on Table 10.3.3-19 as a summary of point risks and hazards associated with the maximum detected concentrations for each COPC identified in Site 25 groundwater.

Current Site Workers

Groundwater is not currently used as a potable water source for Site 25, or other areas of NAS Pensacola. In the absence of a completed exposure pathway, no threat to human health is posed by reported groundwater contamination.

Lead Toxicity

Background

Currently, USEPA has established neither an SF nor an RfD for lead. USEPA believes that the available studies in animals and humans do not provide sufficient quantitative information for calculation. Although lead is currently classified as a B2 carcinogen, USEPA considers the noncarcinogenic neurotoxic effects in children to be the critical toxic effect with respect to establishing health-based environmental cleanup objectives. The neurotoxic effects of chronic low-concentration lead exposure in children may occur at blood levels as low as 10 μg/dL.

In the absence of lead health criteria, USEPA Region IV's Office of Health Assessment sanctions the use of the lead model to predict mean blood lead concentrations in children based on exposure to impacted environmental media. This model was used to assess the potential health effects of elevated lead concentrations reported in surface soil at Site 25.

Lead Uptake/Biokinetics Model

Blood lead concentrations in the age group 0 to 7 can be predicted using the lead model. Such estimates can assist in risk management decisions regarding cleanup of lead at hazardous waste sites. The effects of lead exposure are complex, and the assumptions used in the lead model are

continually updated to reflect recent research findings. The results are hypothetical estimates since many of the model assumptions are subject to change.

Table 10.3.3-20 summarizes the lead model input values. Default concentrations are used for exposure to air (0.1 Pb g/m^3) and maternal blood lead level (2.5 Pb μg/dL). Data variability in the lead soil data caused the 95% UCL to exceed the maximum detected concentration. Therefore, the maximum detected concentration (1,840 mg/kg) was used for the input for soil and house dust. The mean detected soil sample was calculated to be 229 mg/kg, which may be a more accurate basis for determining lead exposure. As a conservative measure, the maximum concentration was used to model lead exposure and the mean was used to provide a possible range of lead impact due to its soil concentrations. Lead was eliminated as a COPC when Phase I and Phase II groundwater data were compared. Reported lead concentrations from Phase I monitoring wells were reported as nondetected for lead when resampled during Phase II. As a result, the model default concentration (0.004 mg/L) was input for drinking water.

The probability percentage of blood concentrations for the hypothetical child receptor. Based on this model output using the maximum soil lead concentration, the geometric mean blood level is estimated to be 16.1 μg/dL, and the probability of blood lead concentrations exceeding 10 μg/dL is 81%. USEPA generally considers media concentrations resulting in probability percentage estimates of 5% or less sufficiently protective of potential child receptors. An estimated geometric mean blood level of 4 μg/dL results when using the mean soil lead concentration. The probability of blood lead levels in excess of 10 μg/dL is 2.4%. As a result, it is possible that the highly contaminated areas of surface soil lead concentrations at Site 25 would require corrective action under this hypothetical exposure scenario. Only three of 16 surface soil samples at Site 25 exceed the action level.

COCs Identified

Table 10.3.3-21 summarizes soil COCs and Table 10.3.3-22 summarizes groundwater COCs based on contributions to cumulative ILCR or HI.

Surface Soil

Hypothetical Site Residents (Future Land Use)

Aroclor-1254, cadmium, chromium, and zinc were identified as COCs based on their contribution to cumulative HI. Arsenic, BEQs, and beryllium were identified as COCs based on their contributions to cumulative ILCRs.

Hypothetical Site Workers (Future Land Use)

BEQs were identified as COCs based on their contributions to cumulative ILCRs.

Adolescent Trespasser (Current Land Use)

There were no COCs identified for this exposure pathway.

Groundwater

Hypothetical Site Residents (Future Land Use)

Mercury and TCE were identified as groundwater COCs based on contributions to cumulative HIs. Chloroform, 1,1-DCE, PCE, TCE, and vinyl chloride were identified as COCs based on their contribution to cumulative ILCRs.

Hypothetical Site Workers (Future Land Use)

1,1-DCE and vinyl chloride were identified as groundwater COCs based their contributions to cumulative ILCRs.

10.3.3.6 Risk Uncertainty

Exposure Setting Concentration and Exposure Pathways Identification

The highly conservative assumptions (i.e., future residential use) recommended by USEPA Region IV and FDEP introduce the potential for high bias through exposure entry and pathway selection. The exposure assumptions for the site worker scenario are highly protective and tend to overestimate exposure. As a result, limited exposure to these maximally impacted areas is possible, although the frequency and duration of direct contact are likely quite low.

Site residential use is not expected, based on current site uses and the nature of surrounding buildings. Uniform exposure to current surface soil conditions would not be likely under a true future residential scenario. These factors indicate that exposure pathways assessed in this HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Therefore, the scenario established to project risk/hazard associated with groundwater exposure is highly conservative, and associated pathways are not expected to be completed in the future.

Determination of Exposure Point Concentrations

Ninety-five percent UCLs or maximum detected concentrations were applied as the EPCs to estimate risk and hazard for COPCs in soil. Using point estimates to model exposure is limited in that a receptor may contact extremely high soil concentrations as well as extremely low soil concentrations throughout the course of exposure. The 95% UCL uses this variability to provide an upper-bound estimate on the average soil concentration. It is impossible to forecast how redevelopment might change reported soil concentrations.

The 95% UCL, arithmetic mean of the detected concentrations, or the only detected concentration was applied as the EPC for groundwater COPCs. Region IV guidance states that the average concentration of each COPC in the most concentrated area of the plume should be used as the EPC. Since a plume cannot be readily defined, this guidance applies only marginally. As in soil, groundwater data variability contributes greatly to uncertainty through spatial variability. Ninety-five percent UCLs were calculated to provide point estimates for groundwater to account for this uncertainty, thus providing an upper-bound estimate for modeling exposure. For any given COPC, the placement of monitoring wells in uncontaminated aquifer areas could cause a low bias on the 95% UCL. As a result, the arithmetic mean of detected concentrations was compared to the 95% UCL and the greater of the two was selected as the EPC. For some COPCs, the arithmetic mean of all detected concentrations would be lower than that of those COPCs in the most concentrated area of the plume, assuming an arithmetic mean could be adequately defined using the data currently available. To address this uncertainty and to provide additional perspective, risk/hazard maps have been included in Section 10.3.3.5, Risk Characterization.

Frequency of Detection and Spatial Distribution

Arsenic was detected exceeding the residential RBC in seven of 16 surface soil samples and exceeded background in four of them. The mean detected surface soil concentration of arsenic (2.27 mg/kg) exceeds the RBC (0.43 mg/kg) and the background reference concentration. Beryllium was detected in one surface soil sample at a concentration of 1 mg/kg, which exceeds both the RBC (0.15 mg/kg) and the background reference concentration (0.41 mg/kg). Cadmium was detected exceeding the residential RBC in five of 16 surface soil samples and exceeded background in six. The mean of detected surface soil concentration of cadmium (16 mg/kg) exceeded both screening concentrations. Chromium exceeded the RBC in three of 16 surface soil samples and exceeded the background reference concentration in seven. The mean detected surface soil concentration of chromium (41 mg/kg) exceeds the background reference concentration (6.13 mg/kg) and is marginally above the residential RBC (39 mg/kg) for

chromium VI. Zinc exceeded the RBC in one of 16 surface soil samples and exceeded background in eight. The mean detected surface soil concentration of zinc (719 mg/kg) exceeds the background reference concentration (16 mg/kg) and is below the RBC (2,300 mg/kg). Aroclor-1254 was detected in four of 16 surface soil samples and exceeded the residential RBC in two of 16 samples. Aroclor-1260 was detected in seven of 16 surface soil samples and exceeded the residential RBC in six. BEQs were detected in seven of 16 surface soil samples and exceeded the residential RBC in six. Dieldrin was detected in eight of 16 surface soil samples and exceeded the residential RBC in one.

COCs in groundwater samples included mercury (11 of 17 samples), 1,1-DCE (10 of 16 samples), TCE (nine of 16 samples), PCE (eight of 16 samples), chloroform (three of 16 samples), and vinyl chloride (one of 16 samples). Generally, groundwater COCs were distributed evenly across all monitoring wells in both phases. However, individual plumes could not be defined with any confidence.

Risk/Hazard Quantification

The uncertainty inherent in the risk assessment process is great. In addition, many site-specific factors have affected this assessment is uncertainty and would bias the risk and hazard estimates. Exposure pathway-specific sources of uncertainty are discussed below.

Soil

Of the organic CPSSs screened and eliminated from formal assessment, only two were reported at maximum concentrations within approximately 10% of their RBCs. Maximum concentrations used for the screening comparison minimizes the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSSs. No inorganic CPSSs were eliminated based only on comparison to their corresponding background reference concentrations.

CT was not formally analyzed for Site 25 surface soil, but a simplified approach was taken to assess the potential influences of CT assumptions, as discussed previously. If all other exposure assumptions remain fixed, applying the CT exposure duration and frequency would result in risk projections approximately 80% below the RME. At CT, the residential surface soil pathway-related risk (incidental ingestion and dermal contact) would drop from 9E-05 to approximately 2E-05 but would still exceed the 1E-6 point of departure. CT analysis for HQ based on residential child exposure and adjustment of exposure frequency to 234 days per year would result in hazard projections approximately 34% below RME. The child exposure duration of six years is within the nine year CT exposure duration and is, therefore, not factored into this simplified CT analysis. This would reduce the HI from 1 (incidental ingestion and dermal contact) to 0.5.

Reported soil concentrations of chromium contribute significantly to HI projections for Site 25. Chromium exists in predominantly two valence states (trivalent and hexavalent). All chromium was assumed to be in the more toxic hexavalent chromium valence state. Hexavalent chromium was not analyzed for Site 25 soil. Due to the past uses of OU 2 sites (plating, scrap metal recycling), conservative assumptions with regard to chromium exposure are warranted.

Since the future land use of Site 25 is unknown, both the worker and residential exposure scenarios were assessed in this HHRA. Base redevelopment plans for NAS Pensacola are drafted every five years. Site 25 is likely to maintain its current function as a materials testing laboratory for the foreseeable future. As previously discussed, these scenarios likely would lead to overestimates of risk and/or hazard.

Groundwater

Of the organic CPSSs screened and eliminated from formal assessment, 1,1,1-TCA was reported at a concentration near (within approximately 10%) the RBC and was therefore included as a COPC since it was above the RBC at other OU 2 sites. No inorganic parameters were eliminated from formal assessment based strictly upon comparison to background reference concentrations.

Groundwater is not currently used as a potable water source at NAS Pensacola. If residences were constructed onsite and an unfiltered well were installed, the salinity and dissolved solids probably would preclude this aquifer from being an acceptable potable water source.

CT was not formally analyzed for Site 25 groundwater, but the previously described simplified approach was taken to assess the potential influences of CT assumptions using an ingestion rate of 1.4 liters per day (versus 2 liter per day for RME). If the remaining exposure parameters are held constant, at CT, the residential groundwater pathway-related risk (ingestion and inhalation) would drop from 3E-04 to approximately 4E-5 and would still exceed the 1E-6 point of departure.

Iron

Iron was detected in soil at a maximum concentration (27,400 mg/kg) that exceeds its RBC (23,000 mg/kg; THQ = 1). Iron was detected in groundwater (Phase I) at a maximum concentration (115 mg/L) which exceeds its RBC (11 mg/L; THQ = 1). The maximum iron concentration of iron reported in Phase II groundwater samples (1.06 mg/L) did not exceed its RBC. As a result, hazard estimates for soil and groundwater have potentially been underestimated due to the uncertainty associated with the iron reference dose.

10.3.3.7 Risk Summary

The risk and hazard posed by contaminants at Site 25 were assessed for the hypothetical site worker and the hypothetical future site resident under RME assumptions. For surface soil, the

incidental ingestion and dermal contact pathways were assessed. The ingestion and inhalation pathways were evaluated for groundwater. Table 10.3.3-23 summarizes the risk for each pathway/receptor group evaluated for Site 25.

10.3.3.8 Remedial Goal Options

Soil

Surface soil RGOs are presented in Table 10.3.3-24 for hypothetical site residents and hypothetical site workers. Risk-based RGOs were based on the LWA site resident and adult site worker and hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker, as noted in each corresponding table. The most conservative RGOs for cadmium, chromium, iron, and zinc are based on residential exposure and a target HQ of 0.1. The most conservative RGOs for arsenic, Aroclor-1260, Aroclor-1254, BEQs, and beryllium are based on residential exposure and a target risk of 1E-06. All of these RGOs are lower than the Florida soil cleanup goal. The background concentration of arsenic would equate with a risk between 1E-06 and 1E-05.

Groundwater

Groundwater RGOs based on site residents and site workers shown in Table 10.3.3-25, were based on the LWA site resident and adult site worker. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker as noted in the table. Both the ingestion and inhalation (VOCs only) exposure are used to calculate groundwater RGOs. The most conservative RGO for mercury is based on residential exposure and a target hazard index of 0.1. The most conservative RGOs for chloroform, 1,1-DCE, PCE, TCE, and vinyl chloride are based on residential exposure and a target risk of 1E-06. All of these RGOs are lower than the FGGC.

Table 10.3.3-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 25

Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
0001	1, 2	1, 2	1, 2	1, 2
0002	3	3	3	3
0003	2, 3	2, 3	2, 3	2, 3
0004	4	4	4	4
0005	4	4	4	4
0007	4	4	4	4
0009	1, 4	1, 4	1, 4	1, 4
0010	3	2,3	2,3	3
0011	2, 3	2, 3	2, 3	2, 3
0012	4	4	4	4
0013	4	4	4	4
0015	1	1	1	1
0016	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3
0017	1, 2, 3	1, 2, 3	1, 2, 3	1, 2
0018	1	1	1	1
0019	1, 2, 3	1, 2, 3	1, 2, 3	1, 2, 3

Notes:
1 = Surface soil interval (within the top 6 inches)
2 = Surface soil interval (0-1 foot)
3 = Surface soil interval (1-2 foot)
4 = Surface soil sample (0-2 foot)
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides, Method 8080
Volatile Organic Analysis, Method 8240
Semivolatile Organic Analysis, Method 8720

Table 10.3.3-2
Samples and Analytical Methods Used for Risk Assessment
Groundwater at Site 25

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
Intermediate	I001	1	1	1, 2	1
Intermediate	I002	1	1	1, 2	1
Shallow	S001	1	1	1	1, 2
Shallow	S002	1	1	1, 2	1, 2
Shallow	S003	1	1	1	1, 2
Shallow	S004	1	1	1	1
Shallow	S005	1	1	1	1
Shallow	S006	1	1	1	1
Shallow	S007	1	1	1	1, 2
Shallow	S008	1	1	1, 2	1, 2
Shallow	S009	1	1	1, 2	1, 2

Notes:
1 = Sample collected during Phase I
2 = Sample collected during Phase II
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides, Method 8080
Volatile Organic Analysis, Method 8240
Semivolatile Organic Analysis, Method 8720

Table 10.3.3-3
Chemicals Present in Site Samples
Site 25, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC		SSL		Reference	Units	Number Exceeding RBC	R
Carcinogenic PAHs																
Benzo(a)pyrene Equivalents	C	7	16	17.661	7341.4	1700	762.63	808.85	88	a	NA		NA	ug/kg	6	
Benzo(a)anthracene	C	6	16	50	3800	1310	330	350	880	a	NA		NA	ug/kg	3	
Benzo(b)fluoranthene	C	7	16	160	7700	2310	330	350	880	a	NA		NA	ug/kg	4	
Chrysene	N	7	16	61	4400	1240	330	350	88000	a	NA		NA	ug/kg		
Dibenz(a,h)anthracene	C	2	16	63	2200	1130	330	1200	88	a	NA		NA	ug/kg	1	
Indeno(1,2,3-cd)pyrene	C	5	16	70	5100	1260	330	370	880	a	NA		NA	ug/kg	1	
Benzo(k)fluoranthene	N	7	16	160	7700	2310	330	350	8800	a	NA		NA	ug/kg		
Benzo(a)pyrene	C	6	16	81	3400	1070	330	350	88	a	NA		NA	ug/kg	5	
Inorganics																
Aluminum	C	16	16	1320	15300	4340	NA	NA	7800	a	NA		3833.36	mg/kg	2	6
Arsenic	C	7	16	0.72	4.5	2.27	0.61	0.91	0.43	a	750	c	1.56	mg/kg	7	4
Barium	N	16	16	1.6	88	16.3	NA	NA	550	a	690000	c	4.63	mg/kg		9
Beryllium	C	1	16	1	1	1	0.2	0.95	0.15	a	1300	c	0.41	mg/kg	1	1
Cadmium	C	6	16	1.4	34.6	16	0.62	1.1	3.9	a	1800	c	1	mg/kg	10	6
Calcium	N	16	16	20.1	17600	3840	NA	NA	NA		NA		912.37	mg/kg		7
Chromium	C	14	16	1.7	234	41	1.6	2.1	39	a	270	c	6.13	mg/kg	3	7
Cobalt	N	3	16	2.8	12.3	8.23	1.6	2.1	470	a	NA		1.87	mg/kg		3
Copper	N	12	16	0.83	253	54	0.85	5	310	a	NA		5.74	mg/kg		5
Iron	U	16	16	1250	27400	5040	NA	NA	2300	a	NA		2745	mg/kg	6	6
Lead	C	16	16	0.89	1840	229	NA	NA	400	b	NA		7.32	mg/kg	3	8
Magnesium	N	13	16	64.6	1660	485	70.8	85.7	NA		NA		133.33	mg/kg		7
Manganese	C	12	16	3.1	359	70.5	2.8	17.7	180	a	NA		21.36	mg/kg	2	4
Mercury	C	6	16	0.23	3.7	1.01	0.1	0.11	2.3	a	NA		0.1	mg/kg	1	6
Nickel	N	4	16	10.3	46.3	28	3.5	7.9	160	a	13000	c	6.38	mg/kg		4
Potassium	N	1	16	642	642	642	261	517	NA		NA		460.67	mg/kg		1
Silver	C	4	16	0.87	45.5	18.4	0.82	2	39	a	NA		2.07	mg/kg	1	3
Sodium	N	8	16	32.1	159	80.1	25.4	143	NA		NA		107.85	mg/kg		2
Vanadium	N	14	16	2.3	21.4	7.34	3	3.1	55	a	NA		5.83	mg/kg		6
Zinc	C	12	16	3	4360	719	2	3.9	2300	a	NA		16.87	mg/kg	1	8
Pesticides and PCB																
Aroclor-1254	C	4	16	59	910	332	33	200	83	a	NA		NA	ug/kg	2	
Aroclor-1260	C	7	16	1.8	1100	224.79	34	38	83	a	NA		NA	ug/kg	6	
Aldrin	N	3	16	0.092	8.1	3.06	1.7	10	38	a	3000	c	NA	ug/kg		
alpha-BHC	N	2	16	0.093	0.28	0.19	1.7	9.6	100	a	800	c	NA	ug/kg		
delta-BHC	N	3	16	0.077	7.2	3.53	1.7	1.9	100	a	NA		NA	ug/kg		
alpha-Chlordane	N	2	16	0.29	2.4	1.35	1.7	9.6	470	a	20000	c	NA	ug/kg		
gamma-Chlordane	N	3	16	0.14	3.5	1.52	1.7	10	470	a	20000	c	NA	ug/kg		
4,4'-DDD	N	6	16	0.15	13	2.84	3.3	20	2700	a	NA		NA	ug/kg		
4,4'-DDE	N	9	16	0.16	76	9.36	3.4	20	1900	a	NA		NA	ug/kg		
4,4'-DDT	N	6	16	0.1	4.4	1.27	3.3	20	1900	a	NA		NA	ug/kg		
Dieldrin	C	8	16	0.094	71	11.8	3.4	20	40	a	1000	c	NA	ug/kg	1	
Endosulfan I	N	2	16	0.88	2.7	1.79	1.7	10	47000	a	NA		NA	ug/kg		
Endosulfan sulfate	N	2	16	0.15	3.8	1.98	3.3	20	47000	a	NA		NA	ug/kg		
Endrin aldehyde	N	4	16	6.1	1700	434	3.3	20	2300	a	NA		NA	ug/kg		
Heptachlor	N	6	16	0.068	2.1	0.51	1.7	1.9	140	a	100	c	NA	ug/kg		
Heptachlor epoxide	N	4	16	0.32	19	5.15	1.7	9.6	70	a	5000	c	NA	ug/kg		
Methoxychlor	N	4	16	0.27	66	22.8	17	100	39000	a	NA		NA	ug/kg		
Semivolatile Organics																
Acenaphthene	N	3	16	83	290	221	330	370	470000	a	NA		NA	ug/kg		
Anthracene	N	4	16	130	1200	578	330	370	2300000	a	NA		NA	ug/kg		
Benzo(g,h,i)perylene	N	4	16	75	6100	1610	330	1200	310000	a	NA		NA	ug/kg		
bis(2-Ethylhexyl)phthalate	N	1	16	2100	2100	2100	330	15000	46000	a	31000000	c	NA	ug/kg		
Butylbenzylphthalate	N	2	16	190	1900	1050	37	370	1600000	a	930000	c	NA	ug/kg		
Carbazole	N	4	16	100	1200	638	330	370	32000	a	NA		NA	ug/kg		
Dibenzofuran	N	2	16	37	160	98.5	330	1200	31000	a	NA		NA	ug/kg		
Di-n-butylphthalate	N	2	16	83	12000	6040	330	1200	780000	a	2300000	c	NA	ug/kg		
Fluoranthene	N	6	16	97	7900	2800	330	370	310000	a	NA		NA	ug/kg		
Fluorene	N	3	16	78	300	209	330	370	310000	a	NA		NA	ug/kg		
2-Methylnaphthalene	N	1	16	61	61	61	330	1200	310000	a	NA		NA	ug/kg		
Naphthalene	N	1	16	89	89	89	330	1200	310000	a	NA		NA	ug/kg		
Phenanthrene	N	6	16	56	6600	2180	330	370	310000	a	NA		NA	ug/kg		
Pyrene	N	6	16	59	4400	1670	330	370	230000	a	NA		NA	ug/kg		
Volatile Organics																
Tetrachloroethene	N	1	16	1	1	1	10	12	12000	a	11000	c	NA	ug/kg		
1,1,1-Trichloroethane	N	3	16	1	56	22.3	10	12	270000	a	1200000	c	NA	ug/kg		

C - Selected as a COPC based on the screening process explained in Section 10.2.5
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5
U - Iron toxicity is qualitatively discussed in the uncertainty section.
PAHs - Polynuclear Aromatic Hydrocarbons
SQL - Sample Quantitation Limits
a - USEPA Region III residential risk-based concentration
b - USEPA's action level of lead in soil
c - USEPA soil to air soil screening level

Table 10.3.3-4
Chemicals Present in Site Samples
Site 25, Groundwater, Phase I
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Number Exceeding RBC	Ref.
Nutrients													
Calcium	N	11	11	10300	39200	21800	NA	NA	NA	NA	17560		8
Magnesium	N	11	11	1420	13000	5640	NA	NA	NA	NA	2872.6		9
Potassium	N	11	11	1650	14400	5460	NA	NA	NA	NA	12167.6		1
Sodium	N	11	11	4340	24600	9950	NA	NA	NA	NA	18345		1
Inorganics													
Aluminum	C	11	11	4790	247000	81600	NA	NA	3700	RBC	3882.8	11	11
Antimony	C	5	11	43.7	218	88.7	35	35	1.5	RBC	30.2	5	5
Arsenic	C	8	11	4.1	142	41.5	4	4	0.045	RBC	2.8	8	8
Barium	C	11	11	12.9	354	129	NA	NA	260	RBC	13.2	1	10
Beryllium	C	5	11	1.2	3.9	2.78	1	1	0.016	RBC	1.1	5	5
Cadmium	C	6	11	4	54.4	13.7	3	7.2	1.8	RBC	3.4	6	6
Chromium	C	11	11	9.1	14700	1460	NA	NA	18	RBC	35	10	9
Cobalt	B	5	11	15.1	50.6	27.5	9	17.1	220	RBC	4.1		5
Copper	C	9	11	19.3	354	98.2	4	33.5	150	RBC	16.2	2	9
Cyanide	N	3	11	10.9	23.9	17.6	10	10	73	RBC	NA		
Iron	U	11	11	5200	115000	48700	NA	NA	1100	RBC	1707.8	11	11
Lead	C	10	11	6.4	334	88.3	2	2	15	TTAL	1.6	8	10
Manganese	C	11	11	17.5	834	247	NA	NA	84	RBC	22	8	10
Mercury	C	8	11	0.2	2.4	0.861	0.2	0.2	1.1	RBC	0.2	2	8
Nickel	C	7	11	27.9	112	62	18	18	73	RBC	39.9	2	4
Selenium	N	1	11	3	3	3	3	30	18	RBC	3.9		
Vanadium	C	10	11	12.2	284	129	66	66	26	RBC	9.6	8	10
Zinc	B	11	11	29.5	603	211	NA	NA	1100	RBC	153.2		5
Pesticides													
gamma-BHC (Lindane)	N	1	11	0.0033	0.0033	0.0033	0.05	0.05	0.052	RBC	NA		
4,4'-DDD	N	1	11	0.012	0.012	0.012	0.1	0.1	0.1	FDEP	NA		
Dieldrin	N	2	11	0.0034	0.0041	0.0038	0.1	0.1	0.0042	RBC	NA		
Endosulfan I	N	1	11	0.0016	0.0016	0.0016	0.05	0.05	0.35	FDEP	NA		
Heptachlor epoxide	C	1	11	0.0033	0.0033	0.0033	0.05	0.05	0.0012	RBC	NA	1	
Semivolatile Organics													
Naphthalene	N	1	11	4	4	4	10	10	150	RBC	NA		
Phenol	N	2	11	2	10	6	10	10	2200	RBC	NA		
Volatile Organics													
Chloroethane	N	3	11	6	44	20.7	10	10	140	FDEP	NA		
Chloroform	C	2	11	1	3	2	10	10	0.15	RBC	NA	2	
1,1-Dichloroethane	C	4	11	10	90	55.5	10	10	81	RBC	NA	1	
1,1-Dichloroethene	C	7	11	1	4	2.43	10	10	0.044	RBC	NA	7	
Ethylbenzene	N	1	11	2	2	2	10	10	130	RBC	NA		
Tetrachloroethene	C	3	11	1	5	3	10	10	1.1	RBC	NA	2	
1,1,1-Trichloroethane	N	9	11	1	20	7.56	10	10	79	RBC	NA		
Trichloroethene	C	5	11	1	14	5	10	10	1.6	RBC	NA	4	
Vinyl chloride	C	1	11	7	7	7	10	10	0.019	RBC	NA	1	
Xylene (Total)	N	1	11	5	5	5	10	10	1200	RBC	NA		

Notes:
C = Selected as a COPC based on the screening process explained in Section 10.2.5.
N = Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R = The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B = The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
U = Iron toxicity is qualitatively discussed in the uncertainty section.
SQL = Sample Quantitation Limits
RBC = USEPA Region III residential risk-based concentration
TTAL = Treatment technique action level
FDEP = Florida risk-based groundwater guidance concentration

Table 10.3.3-5
Chemicals Present in Site Samples
Site 25, Groundwater, Phase II
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Number Exceeding RBC	Ref.
Nutrients													
Calcium (Ca)	N	6	6	14300	30500	21600	NA	NA	NA	NA	17560		5
Magnesium (Mg)	N	6	6	1100	1790	1430	NA	NA	NA	NA	2872		
Potassium (K)	N	6	6	1140	2840	1830	NA	NA	NA	NA	12167		
Sodium (Na)	N	6	6	3480	6500	4810	NA	NA	NA	NA	18345		
Inorganics													
Aluminum (Al)	N	2	6	248	2300	1274	30.1	95.1	3700	RBC	3882.8		
Iron (Fe)	N	4	6	211	1060	564	10.8	36.1	1100	RBC	1707.8		
Manganese (Mn)	N	1	6	11.9	11.9	11.9	0.69	5.6	84	RBC	22		
Mercury (Hg)	C	3	6	0.06	4.7	1.62	0.06	0.07	1.1	RBC	0.2	1	1
Selenium (Se)	N	1	6	2.7	2.7	2.7	2	2	18	RBC	3.9		
Vanadium (V)	N	3	6	0.89	3	1.6	0.76	0.76	26	RBC	9.6		
Zinc (Zn)	N	1	6	68	68	68	1.4	16	1100	RBC	153.2		
Volatile Organics													
Chloroform	C	1	5	0.8	0.8	0.8	1	1	0.15	RBC	NA	1	
1,1-Dichloroethane	N	3	5	1	4	3	1	1	81	RBC	NA		
1,1-Dichloroethene	C	3	5	0.3	0.6	0.43	1	1	0.044	RBC	NA	3	
cis-1,2-Dichloroethene	N	2	5	0.2	0.5	0.35	1	1	6.1	RBC	NA		
Tetrachloroethene	C	5	5	0.4	2	1.04	NA	NA	1.1	RBC	NA	1	
1,1,1-Trichloroethane	N	4	5	0.2	1	0.625	1	1	79	RBC	NA		
Trichloroethene	C	4	5	0.2	17	6.9	1	1	1.6	RBC	NA	2	

Notes:
C = Selected as a COPC based on the screening process explained in Section 10.2.5.
N = Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
SQL = Sample Quantitation Limits
RBC = USEPA Region III residential risk-based concentration

Table 10.3.3-6
Comparison of Phase I and II Groundwater Data for COPCs
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

	Phase I Concentrations are in micrograms per liter (ug/L)											Phase II Concentrations are in micrograms per liter (ug/L)							
	GI001	GI002	GS001	GS002	GS003	GS004	GS005	GS006	GS007	GS008	GS009	GI001	GI002	GS001	GS002	GS003	GS007	GS008	GS009
Aluminum	120000	[illegible]	[illegible]	4790	83600	183000	35500	22500	[illegible]	[illegible]	[illegible]			248	55.7	102	30.1	39.4	[illegible]
Antimony	55.4	17.5	17.5	[illegible]	[illegible]	[illegible]	17.5	17.5	17.5	17.5	[illegible]			1.15	1.15	1.15	1.15	1.15	1.15
Arsenic	162	6.63	2	[illegible]	[illegible]	[illegible]	2	2	[illegible]	[illegible]	[illegible]			0.75	0.75	0.75	0.75	0.75	0.75
Barium	154	[illegible]	56.4	[illegible]	[illegible]	[illegible]	93.6	[illegible]	[illegible]	[illegible]	[illegible]			7.4	5.1	4.75	11.95	6.4	4.5
Beryllium	2.9	[illegible]	0.5	0.5	[illegible]	[illegible]	0.5	0.5	0.5	0.5	[illegible]			0.04	0.04	0.04	0.04	0.04	0.04
Cadmium	9.1	1.5	[illegible]	1.5	[illegible]	[illegible]	3.6	2.7	[illegible]	1.5	[illegible]			0.11	0.365	0.48	0.11	0.11	0.7
Chloroform	0.5	[illegible]	[illegible]	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5			[illegible]	0.5
Chromium	225	[illegible]	[illegible]	9.1	92.3	14700	43.1	39.3	[illegible]	[illegible]	[illegible]			0.32	0.32	0.55	0.32	0.49	3.4
Copper	63.9	[illegible]	[illegible]	2	[illegible]	[illegible]	97.7	[illegible]	[illegible]	16.75	[illegible]			0.32	0.32	0.6	0.8	0.32	3.75
1,1-Dichloroethane	5	5	5	5	[illegible]	[illegible]	5	5	5	[illegible]	[illegible]	[illegible]	1		0.5			0.5	[illegible]
1,1-Dichloroethene	0.5	1	0.5	2	0.5	3	3	2	0.5	[illegible]	[illegible]	[illegible]	0.6		0.5			0.5	[illegible]
Heptachlor epoxide	0.00165	0.00165	0.00165	0.00165	0.00165	0.00165	0.0023	0.00165	0.00165	0.00165	0.00165								
Lead	45.7	28.3	6.4	1	[illegible]	[illegible]	16	50	[illegible]	[illegible]	[illegible]			0.7	0.405	0.405	0.405	0.405	1.05
Manganese	283	54.7	115	17.5	[illegible]	[illegible]	126	77	[illegible]	[illegible]	[illegible]			0.9	0.43	0.345	0.6	2.8	[illegible]
Mercury	0.1	0.25	0.26	0.1	0.88	24	0.2	0.1	[illegible]	[illegible]	[illegible]			0.06	0.07	0.06	0.06	[illegible]	[illegible]
Nickel	112	27.9	9	9	53.3	69.9	9	9	[illegible]	[illegible]	[illegible]			0.44	0.37	0.37	0.55	0.37	1.25
Tetrachloroethene	0.5	1	0.5	5	0.5	0.5	0.5	0.5	0.5	0.5	[illegible]	0.9	2		0.9			[illegible]	[illegible]
1,1,1-Trichloroethane	5	2	1	19	1	10	10	3	[illegible]	[illegible]	5	0.5	0.6		1			[illegible]	[illegible]
Trichloroethene	14	5	5	[illegible]	5	5	2	5	[illegible]	5	5	[illegible]	10		0.5			[illegible]	0.5
Vanadium	282	284	25.2	12.2	98.4	199	44.2	32.7	[illegible]	33	[illegible]			0.89	0.93	0.38	0.38	0.38	[illegible]
Vinyl chloride	3.5	3.5	3.5	3.5	3.5	7	3.5	3.5	3.5	3.5	3.5	0.5	0.5		0.5			0.5	0.5

Shaded values are detected concentrations

Table 10.3.3-7
Exposure Pathways Summary — Site 25

Medium and Exposure Pathway	Resident	Worker	Trespasser	Reason for Selection or Exclusion
Air: Inhalation of volatile contaminants emanating from soil	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Air: Inhalation of chemicals entrained in fugitive dust	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Groundwater: Ingestion of contaminants during potable or general use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Groundwater: Inhalation of volatilized contaminants during domestic use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Soil: Incidental ingestion	Yes	Yes	Yes	COPCs were identified after to risk-based and background screening comparisons.
Soil: Dermal contact	Yes	Yes	Yes	COPCs were identified after risk-based and background screening comparisons.
Wild game or domestic animals: Ingestion of tissue impacted by media contamination	No	No	No	Hunting/taking of game and/or raising livestock is prohibited at NAS Pensacola.
Fruits and vegetables: Ingestion of plant tissues grown in media	No	No	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Table 10.3.3-8
Statistical Analysis of COPCs
Surface Soils at Site 25
Naval Air Station Pensacola
Pensacola, Florida

COPC	n	Natural Log Transformed mean	SD	H-stat	UCL (mg/kg)	MAX (mg/kg)	EPC (mg/kg)	
Aluminum	16	8.130	0.682	2.264	6382	15300	6382	UCL Used
Aroclor-1254	16	-3.310	1.253	3.129	0.22	0.91	0.22	UCL Used
Aroclor-1260	16	-2.883	1.959	3.794	1.08	1.1	1.08	UCL Used
Arsenic	16	-0.219	0.889	2.548	2.1	4.5	2.1	UCL Used
Benzo(a)pyrene Equiv.	16	-0.514	0.885	2.542	1.6	7.3	1.6	UCL Used
Beryllium	16	-1.347	0.777	2.390	0.57	1.0	0.57	UCL Used
Cadmium	16	0.346	1.735	3.994	38	35	35	MAX Used
Chromium	16	1.995	1.740	4.001	201	234	201	UCL Used
Dieldrin	16	-6.136	1.620	3.781	0.039	0.071	0.039	UCL Used
Lead	16	2.716	2.497	5.461	11549	1840	1840	MAX Used
Manganese	16	2.544	1.674	3.881	277	359	277	UCL Used
Mercury	16	-1.863	1.376	3.344	1.3	3.7	1.3	UCL Used
Silver	16	-0.037	1.499	3.560	12	46	12	UCL Used
Zinc	16	3.416	2.789	6.039	114960	4360	4360	MAX Used

NOTES:

mean Arithmetic mean of the logtransformed data
n Number of samples analyzed
SD Standard deviation for a sample of data
H-stat "H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA Not applicable
TEF Toxicity equivalence factor
EPC Exposure point concentration
UCL 95 percentile upper confidence level mean
MAX Maximum reported concentration

Table 10.3.3-9
Statistical Analysis of COPCs
Groundwater at Site 25
Naval Air Station, Pensacola
Pensacola, Florida

COPC	Number of Detects	Number of Samples	Average ln(a)	Sample Standard Deviation sd(a)	H Statistic	Arithmetic Mean Detected Concentration (mg/L)	95% UCL (mg/L)	Maximum Detected Conc. (mg/L)	EPC (mg/L)	
Chloroform	3	16	-0.5085	0.4737	2.029	0.0016	0.00086	0.0030	0.0016	Mean
1,1-Dichloroethane	7	16	1.6431	1.5740	3.698	0.033	0.080	0.090	0.080	UCL
1,1-Dichloroethene	10	16	-0.0704	0.8614	2.508	0.0018	0.0024	0.0040	0.0024	UCL
Heptachlor epoxide	1	11	-6.3440	0.2090	1.87	NA	0.0000020	0.0000033	0.0000033	Max
Mercury	11	17	-1.4215	1.4106	4.096	0.0011	0.0041	0.0047	0.0041	UCL
Tetrachloroethene	8	16	-0.2044	0.7445	2.346	0.0018	0.0017	0.0050	0.0018	Mean
1,1,1-Trichloroethane	13	16	0.8174	1.3751	3.343	0.0054	0.019	0.020	0.019	UCL
Trichloroethene	9	16	1.1148	1.2591	3.139	0.0059	0.019	0.017	0.017	Max
Vinyl chloride	1	16	0.6880	0.9767	2.679	NA	0.0063	0.0070	0.0070	Max

NOTES:

ln(a)	arithmetic mean of the logtransformed data
sd(a)	standard deviation for a sample of data
H-statistic	"H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA	not applicable
ND	not determined
EPC	exposure point concentration
UCL	95 percentile upper confidence level mean

Table 10.3.3-10
Chronic Daily Intakes (CDI)
Incidental Ingestion of Surface Soil
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	FI	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Current Worker adult H-CDI (mg/kg-day)	Current Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future resspasse C-CDI (mg/kg-day)
Aluminum	1	6382	8.74E-03	8.16E-02	9.99E-03	3.12E-03	1.12E-03	2.02E-03	2.88E-04
Aroclor-1254	1	0.22	3.02E-07	2.82E-06	3.45E-07	1.08E-07	3.85E-08	6.99E-08	9.96E-09
Aroclor-1260	1	0.2	2.63E-07	2.45E-06	3.01E-07	9.39E-08	3.35E-08	6.09E-08	8.68E-09
Arsenic	1	2.1	2.93E-06	2.74E-05	3.35E-06	1.05E-06	3.74E-07	6.79E-07	9.68E-08
Benzo(a)pyrene Equiv.	1	1.6	2.17E-06	2.02E-05	2.48E-06	7.74E-07	2.76E-07	5.02E-07	7.15E-08
Beryllium	1	0.57	7.78E-07	7.26E-06	8.89E-07	2.78E-07	9.92E-08	1.80E-07	2.57E-08
Cadmium	1	35	4.74E-05	4.42E-04	5.42E-05	1.69E-05	6.05E-06	1.10E-05	1.56E-06
Chromium	1	201	2.76E-04	2.58E-03	3.15E-04	9.86E-05	3.52E-05	6.39E-05	9.11E-06
Dieldrin	1	0.039	5.35E-08	4.99E-07	6.11E-08	1.91E-08	6.82E-09	1.24E-08	1.76E-09
Lead	1	1840	2.52E-03	2.35E-02	2.88E-03	9.00E-04	3.21E-04	5.83E-04	8.32E-05
Manganese	1	277	3.79E-04	3.54E-03	4.33E-04	1.35E-04	4.83E-05	8.77E-05	1.25E-05
Mercury	1	1.3	1.80E-06	1.68E-05	2.05E-06	6.42E-07	2.29E-07	4.16E-07	5.93E-08
Silver	1	12	1.61E-05	1.50E-04	1.84E-05	5.74E-06	2.05E-06	3.72E-06	5.31E-07
Zinc	1	4360	5.97E-03	5.57E-02	6.83E-03	2.13E-03	7.62E-04	1.38E-03	1.97E-04

NOTES:

TEF Toxicity equivalence factor relative to benzo(a)pyrene
lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk

Table 10.3.3-11
Chronic Daily Intakes (CDI)
Dermal Contact with Surface Soil
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/kg)	FC*	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	6382	1	0.001	3.58E-04	1.18E-03	2.24E-04	2.56E-04	9.14E-05	8.30E-05	1.18E-05
Aroclor-1254	0.22	1	0.01	1.24E-07	4.09E-07	7.75E-08	8.84E-08	3.16E-08	2.87E-08	4.08E-09
Aroclor-1260	0.2	1	0.01	1.08E-07	3.56E-07	6.75E-08	7.70E-08	2.75E-08	2.50E-08	3.55E-09
Arsenic	2.1	1	0.001	1.20E-07	3.97E-07	7.53E-08	8.59E-08	3.07E-08	2.78E-08	3.96E-09
Benzo(a)pyrene Equiv.	1.6	1	0.01	8.89E-07	2.93E-06	5.56E-07	6.35E-07	2.27E-07	2.06E-07	2.93E-08
Beryllium	0.57	1	0.001	3.19E-08	1.05E-07	2.00E-08	2.28E-08	8.14E-09	7.38E-09	1.05E-09
Cadmium	35	1	0.001	1.94E-06	6.41E-06	1.22E-06	1.39E-06	4.96E-07	4.50E-07	6.40E-08
Chromium	201	1	0.001	1.13E-05	3.73E-05	7.08E-06	8.08E-06	2.89E-06	2.62E-06	3.73E-07
Dieldrin	0.039	1	0.01	2.19E-08	7.24E-08	1.37E-08	1.57E-08	5.59E-09	5.08E-09	7.22E-10
Lead	1840	1	0.001	1.03E-04	3.41E-04	6.47E-05	7.38E-05	2.64E-05	2.39E-05	3.40E-06
Manganese	277	1	0.001	1.55E-05	5.13E-05	9.72E-06	1.11E-05	3.96E-06	3.60E-06	5.12E-07
Mercury	1.3	1	0.001	7.37E-08	2.43E-07	4.61E-08	5.26E-08	1.88E-08	1.70E-08	2.43E-09
Silver	12	1	0.001	6.59E-07	2.18E-06	4.13E-07	4.71E-07	1.68E-07	1.53E-07	2.17E-08
Zinc	4360	1	0.001	2.45E-04	8.08E-04	1.53E-04	1.75E-04	6.25E-05	5.67E-05	8.07E-06

NOTES:

TEF Toxicity Equivalence Factor relative to benzo(a)pyrene
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.3-12
Chronic Daily Intakes (CDI)
Ingestion of COPCs in Shallow Groundwater
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/liter)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Chloroform	0.0016	4.4E-05	1.0E-04	2.4E-05	1.6E-05	7.7E-06
1,1-Dichloroethane	0.080	2.2E-03	5.1E-03	1.2E-03	7.8E-04	3.9E-04
1,1-Dichloroethene	0.0024	6.5E-05	1.5E-04	3.6E-05	2.3E-05	1.1E-05
Heptachlor epoxide	0.0000033	9.0E-08	2.1E-07	5.0E-08	3.2E-08	1.6E-08
Mercury	0.0041	1.1E-04	2.6E-04	6.2E-05	4.0E-05	2.0E-05
Tetrachloroethene	0.0018	4.9E-05	1.1E-04	2.7E-05	1.7E-05	8.5E-06
1,1,1-Trichloroethane	0.019	5.2E-04	1.2E-03	2.9E-04	1.9E-04	9.2E-05
Trichloroethene	0.017	4.7E-04	1.1E-03	2.6E-04	1.7E-04	8.2E-05
Vinyl chloride	0.0070	1.9E-04	4.5E-04	1.1E-04	6.8E-05	3.4E-05

NOTES:
lwa Lifetime weighted average
CDI Chronic Daily Intake
H-CDI Non-carcinogenic hazard based Chronic Daily Intake
C-CDI Carcinogenic risk based Chronic Daily Intake

Table 10.3.3-13
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Surface Soil Ingestion
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD* Used (mg/kg-day)	Oral SF Used $(mg/kg\text{-}day)^{-1}$	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	1	NA	0.0087	0.082	ND	0.0031	ND	0.0020	ND
Aroclor-1254	2E-05	2	0.015	0.14	6.9E-07	0.0054	7.7E-08	0.0035	2.0E-08
Aroclor-1260	NA	2	ND	ND	6.0E-07	ND	6.7E-08	ND	1.7E-08
Arsenic	0.0003	1.5	0.010	0.091	5.0E-06	0.0035	5.6E-07	0.0023	1.5E-07
Benzo(a)pyrene Equiv.	NA	7.3	ND	ND	1.8E-05	ND	2.0E-06	ND	5.2E-07
Beryllium	0.005	4.3	0.00016	0.0015	3.8E-06	0.000056	4.3E-07	0.000036	1.1E-07
Cadmium	0.001	NA	0.047	0.44	ND	0.0169	ND	0.011	ND
Chromium	0.005	NA	0.055	0.52	ND	0.020	ND	0.013	ND
Dieldrin	5E-05	16	0.00107	0.0100	9.8E-07	0.00038	1.1E-07	0.00025	2.8E-08
Lead	NA	NA	ND	ND	ND	ND	ND	ND	ND
Manganese	0.047	NA	0.0081	0.075	ND	0.0029	ND	0.0019	ND
Mercury	0.0003	NA	0.0060	0.056	ND	0.0021	ND	0.0014	ND
Silver	0.005	NA	0.0032	0.030	ND	0.0011	ND	0.00074	ND
Zinc	0.3	NA	0.020	0.19	ND	0.0071	ND	0.0046	ND
SUM Hazard Index/ILCR			0.1	1	3E-05	0.05	3E-06	0.04	8E-07

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.3-14
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Dermal Adjustment	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	0.2	0.2	NA	0.0018	0.0059	ND	0.0013	ND	0.00041	ND
Aroclor-1254	0.5	1E-05	4	0.012	0.041	3.1E-07	0.0088	1.3E-07	0.0029	1.6E-08
Aroclor-1260	0.5	NA	4	ND	ND	2.7E-07	ND	1.1E-07	ND	1.4E-08
Arsenic	0.2	6E-05	7.5	0.0020	0.0066	5.6E-07	0.0014	2.3E-07	0.00046	3.0E-08
Benzo(a)pyrene Equiv.	0.5	NA	14.6	ND	ND	8.1E-06	ND	3.3E-06	ND	4.3E-07
Beryllium	0.2	0.001	21.5	0.000032	0.00011	4.3E-07	0.000023	1.7E-07	0.0000074	2.3E-08
Cadmium	0.2	0.0002	NA	0.0097	0.032	ND	0.0069	ND	0.0022	ND
Chromium	0.2	0.001	NA	0.011	0.037	ND	0.0081	ND	0.0026	ND
Dieldrin	0.5	2.5E-05	32	0.00088	0.0029	4.4E-07	0.00063	1.8E-07	0.00020	2.3E-08
Lead	0.2	NA	NA	ND	ND	ND	ND	ND	ND	ND
Manganese	0.2	0.0094	NA	0.0017	0.0055	ND	0.0012	ND	0.00038	ND
Mercury	0.2	6E-05	NA	0.0012	0.0041	ND	0.00088	ND	0.00028	ND
Silver	0.2	0.001	NA	0.00066	0.0022	ND	0.00047	ND	0.00015	ND
Zinc	0.2	0.06	NA	0.0041	0.013	ND	0.0029	ND	0.00094	ND
SUM Hazard Index/ILCR				0.04	0.1	1E-05	0.03	4E-06	0.01	5E-07

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk
\- Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.3-15
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 25 and Site 27
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Volatiles (μg/kg)				
1,1,1-Trichloroethane	3/332	1.0 - 56.0	19.67	3200000
1,2-Dichloroethene (total)	1/332	2.0 - 2.0	2.00	190000
4-Methyl-2-Pentanone (MIBK)	1/332	1.0 - 1.0	1.00	1700000
Acetone	1/332	16.0 - 16.0	16.00	64000000
Bromoform	1/332	13.0 - 13.0	13.00	4100000
Chloroform	1/332	23.0 - 23.0	23.00	31000
Tetrachloroethene	6/332	2.0 - 16.0	7.00	34000
Semivolatiles (μg/kg)				
2-Methylnaphthalene	1/331	46.0 - 46.0	46.00	22000000
4-Methylphenol (p-Cresol)	1/331	130.0 - 130.0	130.00	2700000
Acenaphthene	3/331	79.0 - 1800.0	699.67	32000000
Acenaphthylene	1/331	310.0 - 310.0	310.00	16000000
Anthracene	3/331	160.0 - 3200.0	1213.33	160000000
Benzo(a)anthracene	6/331	50.0 - 9500.0	1928.17	100000
Benzo(a)pyrene	6/331	40.0 - 5600.0	1220.00	10000
Benzo(b)fluoranthene	10/331	37.0 - 13000.0	1711.20	100000
Benzo(g,h,i)perylene	5/331	73.0 - 4400.0	990.80	16000000
Benzo(k)fluoranthene	10/331	37.0 - 13000.0	1711.20	1000000
bis(2-Ethylhexyl)phthalate (BEHP)	2/331	360.0 - 360.0	360.00	5400000
Carbazole	3/331	170.0 - 3000.0	1233.33	3800000
Chrysene	7/331	54.0 - 6400.0	1222.00	10000000
Dibenz(a,h)anthracene	3/331	41.0 - 1200.0	463.67	10000
Dibenzofuran	3/331	38.0 - 770.0	316.00	2200000
Diethylphthalate	1/331	39.0 - 39.0	39.00	430000000
Fluoranthene	7/331	40.0 - 19000.0	3492.43	22000000

Table 10.3.3-15
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 25 and Site 27
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Semivolatiles (μg/kg) (Continued)				
Fluorene	3/331	68.0 - 1500.0	582.67	22000000
Indeno(1,2,3-cd)pyrene	5/331	68.0 - 3400.0	841.60	100000
Isophorone	1/331	340.0 - 340.0	340.00	80000000
Naphthalene	4/331	36.0 - 440.0	164.00	22000000
Pentachlorophenol	2/331	47.0 - 270.0	158.50	630000
Phenanthrene	6/331	56.0 - 15000.0	3167.67	16000000
Phenol	1/331	66.0 - 66.0	66.00	320000000
Pyrene	6/331	59.0 - 14000.0	2825.50	22000000
Pesticides/PCBs (μg/kg)				
4,4'-DDD	22/333	0.11 - 11.0	1.34	320000
4,4'-DDE	27/333	0.087 - 6.1	1.05	220000
4,4'-DDT	37/333	0.1 - 12.0	1.47	220000
Aldrin	12/333	0.06 - 0.61	0.19	4400
alpha-BHC	1/333	0.036 - 0.036	0.04	12000
alpha-Chlordane	11/333	0.056 - 0.37	0.18	220000
Aroclor-1254	4/333	9.4 - 79.0	41.85	11000
Aroclor-1260	12/333	1.8 - 530.0	92.79	38000
beta-BHC	2/333	0.18 - 0.21	0.20	42000
delta-BHC	11/333	0.063 - 0.53	0.20	NA
Dieldrin	38/333	0.064 - 47.0	4.61	4700
Endosulfan I	2/333	0.11 - 0.22	0.17	3200000
Endosulfan II	5/333	0.28 - 0.92	0.55	3200000
Endosulfan sulfate	9/333	0.052 - 0.84	0.31	3200000
Endrin	13/333	0.066 - 0.43	0.14	160000
Endrin aldehyde	10/333	0.058 - 22.0	3.30	160000

Table 10.3.3-15
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 25 and Site 27
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Pesticides/PCBs (μg/kg) (Continued)				
Endrin ketone	4/333	0.11 - 1.6	0.50	160000
gamma-BHC (Lindane)	1/333	0.11 - 0.11	0.11	58000
gamma-Chlordane	15/333	0.038 - 3.5	0.48	220000
Heptachlor	28/333	0.045 - 0.27	0.12	13000
Heptachlor epoxide	12/333	0.046 - 2.2	0.70	7900
Methoxychlor	9/333	0.26 - 170.0	21.27	2700000
Inorganics (mg/kg)				
Aluminum (Al)	325/333	51.7 - 30200.0	1604.12	790000
Antimony (Sb)	2/333	9.3 - 9.5	9.40	310
Arsenic (As)	69/333	0.62 - 11.8	1.96	73
Barium (Ba)	267/333	0.44 - 29.0	2.91	52000
Beryllium (Be)	3/333	0.45 - 0.84	0.61	26
Cadmium (Cd)	16/333	1.0 - 19.9	6.47	780
Calcium (Ca)	265/333	16.2 - 92500.0	1468.01	NA
Chromium (Cr) total	189/333	1.7 - 253.0	8.58	3900
Cobalt (Co)	3/333	2.1 - 2.8	2.53	47000
Copper (Cu)	72/333	0.83 - 78.1	7.71	1000000
Cyanide (CN)	3/332	0.53 - 3.0	1.71	16000
Iron (Fe)	333/333	38.9 - 14800.0	1278.39	NA
Lead (Pb)	268/333	0.43 - 217.0	8.19	1000
Magnesium (Mg)	151/333	1.10 - 1970.0	148.55	NA
Manganese (Mn)	174/333	0.68 - 95.4	10.51	27000
Mercury (Hg)	29/333	0.1 - 10.2	0.92	240
Nickel (Ni)	25/333	4.6 - 11.6	7.42	16000
Potassium (K)	2/333	567.0 - 748.0	657.50	NA

Table 10.3.3-15
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 25 and Site 27
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Inorganics (mg/kg) (Continued)				
Selenium (Se)	3/333	0.85 - 1.5	1.07	3900
Silver (Ag)	3/333	0.87 - 156.0	53.39	3900
Sodium (Na)	111/333	27.4 - 741.0	86.68	NA
Vanadium (V)	142/333	1.3 - 41.9	4.79	5500
Zinc (Zn)	220/333	1.1 - 858.0	23.57	240000

Note:
* = Preliminary remediation goal based on the lesser of a hazard-based assessment using a hazard quotient of 1.0 or a risk-based assessment using a cancer risk of 1E-06.

Table 10.3.3-16
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 25, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0001	Aluminum	1910	mg/kg	0.0262	NA
0001	Aroclor-1260	120	ug/kg	NA	0.5444
0001	Arsenic	0.72	mg/kg	0.0329	1.8806
0001	B(a)P Equiv.	137.63	ug/kg	NA	2.2792
0001	Chromium	3.1	mg/kg	0.0085	NA
0001	Dieldrin	1.7	ug/kg	0.0006	0.0617
0001	Lead	22.7	mg/kg	NA	NA
0001	Zinc	11.8	mg/kg	0.0005	NA
	Total			0.0687	4.7660
0002	Aluminum	2150	mg/kg	0.0295	NA
0002	Lead	4.5	mg/kg	NA	NA
0002	Manganese	4.2	mg/kg	0.0025	NA
0002	Zinc	3	mg/kg	0.0001	NA
	Total			0.0321	NA
0003	Aluminum	2510	mg/kg	0.0344	NA
0003	Chromium	2.2	mg/kg	0.0060	NA
0003	Lead	1.1	mg/kg	NA	NA
0003	Zinc	14.6	mg/kg	0.0007	NA
	Total			0.0411	NA
0004	Aluminum	1320	mg/kg	0.0181	NA
0004	Lead	2.4	mg/kg	NA	NA
	Total			0.0181	NA
0005	Aluminum	5450	mg/kg	0.0747	NA
0005	Aroclor-1260	1.8	ug/kg	NA	0.0082
0005	Arsenic	1.2	mg/kg	0.0548	3.1344
0005	Chromium	4.5	mg/kg	0.0123	NA
0005	Dieldrin	0.29	ug/kg	0.0001	0.0105
0005	Lead	16.2	mg/kg	NA	NA
0005	Zinc	20.9	mg/kg	0.0010	NA
	Total			0.1430	3.1531
0007	Aluminum	1870	mg/kg	0.0256	NA
0007	Chromium	2.5	mg/kg	0.0069	NA
0007	Lead	0.89	mg/kg	NA	NA
0007	Manganese	3.1	mg/kg	0.0009	NA
	Total			0.0334	NA
0009	Aluminum	15300	mg/kg	0.2098	NA
0009	Arsenic	2.1	mg/kg	0.0960	5.4852
0009	Chromium	10.3	mg/kg	0.0282	NA
0009	Lead	2.7	mg/kg	NA	NA
0009	Manganese	20.6	mg/kg	0.0060	NA
0009	Mercury	0.23	mg/kg	0.0105	NA
0009	Zinc	6	mg/kg	0.0003	NA
	Total			0.3508	5.4852
0010	Aluminum	2260	mg/kg	0.0310	NA
0010	Chromium	1.7	mg/kg	0.0047	NA
0010	Dieldrin	0.094	ug/kg	NA	0.0034
0010	Lead	1.1	mg/kg	NA	NA
0010	Manganese	4.2	mg/kg	0.0012	NA
	Total			0.0369	0.0034
0011	Aluminum	1880	mg/kg	0.0258	NA
0011	Cadmium	9.1	mg/kg	0.2309	NA
0011	Chromium	8.9	mg/kg	0.0244	NA
0011	Dieldrin	0.3	ug/kg	0.0001	0.0109
0011	Lead	3	mg/kg	NA	NA
0011	Manganese	3.4	mg/kg	0.0010	NA
0011	Zinc	32.7	mg/kg	0.0015	NA
	Total			0.2837	0.0109
0012	Aluminum	2240	mg/kg	0.0307	NA
0012	Chromium	3.3	mg/kg	0.0091	NA
0012	Lead	3.1	mg/kg	NA	NA
0012	Manganese	3.9	mg/kg	0.0011	NA
	Total			0.0409	NA

Table 10.3.3-16
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 25, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0013	Aluminum	2690	mg/kg	0.0369	NA
0013	B(a)P Equiv.	159.569	ug/kg	NA	2.6425
0013	Chromium	3.5	mg/kg	0.0096	NA
0013	Lead	29.2	mg/kg	NA	NA
0013	Manganese	16.2	mg/kg	0.0047	NA
0013	Zinc	25.4	mg/kg	0.0012	NA
	Total			0.0523	2.6425
0015	Aluminum	9270	mg/kg	0.1271	NA
0015	Aroclor-1260	1100	ug/kg	NA	4.9908
0015	Arsenic	4.5	mg/kg	0.2057	11.7540
0015	B(a)P Equiv.	2499.2	ug/kg	NA	41.3875
0015	Cadmium	34.6	mg/kg	0.4753	NA
0015	Chromium	234	mg/kg	0.6417	NA
0015	Lead	1840	mg/kg	NA	NA
0015	Manganese	288	mg/kg	0.0840	NA
0015	Mercury	0.54	mg/kg	0.0247	NA
0015	Silver	45.5	mg/kg	0.1248	NA
0015	Zinc	2010	mg/kg	0.0919	NA
	Total			1.7752	58.1323
0016	Aluminum	4490	mg/kg	0.0616	NA
0016	Aroclor-1254	79	ug/kg	0.0651	0.3584
0016	Aroclor-1260	192	ug/kg	NA	0.8700
0016	Arsenic	2.1	mg/kg	0.0960	5.4852
0016	B(a)P Equiv.	755.65	ug/kg	NA	12.5138
0016	Cadmium	13.1	mg/kg	0.1799	NA
0016	Chromium	57.8	mg/kg	0.1585	NA
0016	Dieldrin	71	ug/kg	0.0234	2.5771
0016	Lead	717	mg/kg	NA	NA
0016	Manganese	80.7	mg/kg	0.0235	NA
0016	Mercury	0.6	mg/kg	0.0274	NA
0016	Silver	0.87	mg/kg	0.0024	NA
0016	Zinc	947	mg/kg	0.0433	NA
	Total			0.6811	21.8045
0017	Aluminum	7130	mg/kg	0.0978	NA
0017	Aroclor-1254	910	ug/kg	0.7504	4.1287
0017	Aroclor-1260	980	ug/kg	NA	4.4463
0017	Arsenic	4.1	mg/kg	0.1874	10.7092
0017	B(a)P Equiv.	7341.4	ug/kg	NA	121.5759
0017	Beryllium	1	mg/kg	0.0027	7.4877
0017	Cadmium	31.7	mg/kg	0.4354	NA
0017	Chromium	201	mg/kg	0.5512	NA
0017	Dieldrin	4.5	ug/kg	0.0015	0.1633
0017	Lead	904	mg/kg	NA	NA
0017	Manganese	359	mg/kg	0.1047	NA
0017	Mercury	3.7	mg/kg	0.1691	NA
0017	Silver	23.3	mg/kg	0.0639	NA
0017	Zinc	4360	mg/kg	0.1993	NA
	Total			2.5635	148.5112
0018	Aluminum	5400	mg/kg	0.0740	NA
0018	Aroclor-1254	280	ug/kg	0.2309	1.2704
0018	Aroclor-1260	780	ug/kg	NA	3.5389
0018	B(a)P Equiv.	959.2	ug/kg	NA	15.8847
0018	Cadmium	1.4	mg/kg	0.0192	NA
0018	Chromium	6.7	mg/kg	0.0184	NA
0018	Dieldrin	3.8	ug/kg	0.0013	0.1379
0018	Lead	20.5	mg/kg	NA	NA
0018	Manganese	14.5	mg/kg	0.0042	NA
0018	Mercury	0.41	mg/kg	0.0187	NA
0018	Zinc	261	mg/kg	0.0119	NA
	Total			0.3786	20.8319
0019	Aluminum	3600	mg/kg	0.0494	NA
0019	Aroclor-1254	59	ug/kg	0.0487	0.2677
0019	Aroclor-1260	530	ug/kg	NA	2.4046
0019	Arsenic	1.2	mg/kg	0.0548	3.1344
0019	B(a)P Equiv.	17.661	ug/kg	NA	0.2925
0019	Cadmium	6.2	mg/kg	0.0852	NA
0019	Chromium	34.7	mg/kg	0.0952	NA
0019	Dieldrin	13	ug/kg	0.0043	0.4719
0019	Lead	96.8	mg/kg	NA	NA
0019	Manganese	47.8	mg/kg	0.0139	NA

Table 10.3.3-16
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 25, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0019	Mercury	0.58	mg/kg	0.0265	NA
0019	Silver	4	mg/kg	0.0110	NA
0019	Zinc	941	mg/kg	0.0430	NA
	Total			0.4319	6.5711

Table 10.3.3-17
Hazard Quotients and Incremental Lifetime Cancer Risks
Groundwater Ingestion
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Chloroform	0.01	0.0061	0.0044	0.010	1.5E-07	0.0036	4.7E-08
1,1-Dichloroethane	0.1	NA	0.022	0.051	ND	0.0078	ND
1,1-Dichloroethene	0.009	0.6	0.007	0.017	2.1E-05	0.0026	6.8E-06
Heptachlor epoxide	1.3E-05	9.1	0.0070	0.016	4.5E-07	0.0025	1.4E-07
Mercury	0.0003	NA	0.38	0.88	ND	0.135	ND
Tetrachloroethene	0.01	0.052	0.0049	0.011	1.4E-06	0.0017	4.4E-07
1,1,1-Trichloroethane	0.035	NA	0.0150	0.035	ND	0.00534	ND
Trichloroethene	0.006	0.011	0.078	0.181	2.8E-06	0.028	9.0E-07
Vinyl chloride	NA	1.9	ND	ND	2.0E-04	ND	6.4E-05
SUM Hazard Index/ILCR			0.5	1	2E-04	0.2	7E-05

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk

Table 10.3.3-18
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Contaminants in Groundwater due to Domestic Use
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation Rf Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Chloroform	0.01	0.0805	0.0044	0.010	1.9E-06	0.0016	6.2E-07
1,1-Dichloroethane	0.143	NA	0.015	0.036	ND	0.0001[illegible]	ND
1,1-Dichloroethene	0.009	0.175	0.007	0.017	6.2E-06	0.0026	2.0E-06
Tetrachloroethene	0.01	0.00203	0.0049	0.011	5.4E-08	0.0017	1.7E-08
1,1,1-Trichloroethane	0.286	NA	0.00183	0.00427	ND	0.00065	ND
Trichloroethene	0.006	0.006	0.078	0.181	1.5E-06	0.028	4.9E-07
Vinyl chloride	NA	0.3	ND	ND	3.2E-05	ND	1.0E-05
SUM Hazard Index/ILCR			0.1	0.3	4E-05	0.03	1E-05

NOTES:
NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk
Oral RfDs have been cross-assigned as Inhalation RfDs

Table 10.3.3-19
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 25, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)

Summary of Risk and Hazard resulting from Maximum Concentration

S004	01	1,1-Dichloroethane	90	ug/L	0.098	NA
S008	01	1,1-Dichloroethene	4	ug/L	0.057	46.11
S009	01	Aluminum	247000	ug/L	15.790	NA
S004	01	Antimony	218	ug/L	34.840	NA
I001	01	Arsenic	142	ug/L	30.259	3167.91
S009	01	Barium	354	ug/L	0.323	NA
I001	01	Beryllium	3.9	ug/L	0.050	249.42
S004	01	Cadmium	54.4	ug/L	6.974	NA
S001	01	Chloroform	3	ug/L	0.038	3.86
S004	01	Chromium	14700	ug/L	187.945	NA
S004	01	Copper	354	ug/L	0.566	NA
S005	01	Heptachlor epoxide	0.0033	ug/L	0.032	0.89
S004	01	Lead	334	ug/L	NA	NA
S009	01	Manganese	834	ug/L	2.318	NA
S009	02	Mercury (Hg)	4.7	ug/L	1.002	NA
I001	01	Nickel	112	ug/L	0.358	NA
S002	01	Tetrachloroethene	5	ug/L	0.064	4.02
I001	02	Trichloroethene	17	ug/L	0.362	4.30
I002	01	Vanadium	284	ug/L	2.594	NA
S004	01	Vinyl chloride	7	ug/L	NA	229.04
		Total			284	3706

Point Estimates of Risk and Hazard

I001	01	Aluminum	120000	ug/L	7.6712	NA
I001	01	Antimony	55.4	ug/L	8.8539	NA
I001	01	Arsenic	142	ug/L	30.2588	3167.9061
I001	01	Barium	154	ug/L	0.1406	NA
I001	01	Beryllium	3.9	ug/L	0.0499	249.4168
I001	01	Cadmium	6.1	ug/L	0.7821	NA
I001	01	Chromium	225	ug/L	2.8767	NA
I001	01	Copper	65.9	ug/L	0.1053	NA
I001	01	Lead	45.7	ug/L	NA	NA
I001	01	Manganese	283	ug/L	0.7866	NA
I001	01	Nickel	112	ug/L	0.3580	NA
I001	01	Trichloroethene	14	ug/L	0.2983	3.5397
I001	01	Vanadium	282	ug/L	2.5753	NA
		Total			54.7567	3420.8626
I001	02	1,1-Dichloroethane	1	ug/L	0.0011	NA
I001	02	1,1-Dichloroethene	0.4	ug/L	0.0057	4.6106
I001	02	Tetrachloroethene	0.9	ug/L	0.0115	0.7232
I001	02	Trichloroethene	17	ug/L	0.3623	4.2982
		Total			0.3805	9.6320
I002	01	1,1-Dichloroethene	1	ug/L	0.0142	11.5264
I002	01	Aluminum	88100	ug/L	5.6320	NA
I002	01	Arsenic	64.9	ug/L	13.8295	1447.8669
I002	01	Barium	86.3	ug/L	0.0788	NA
I002	01	Beryllium	2.5	ug/L	0.0320	159.8826
I002	01	Chloroform	1	ug/L	0.0128	1.2880
I002	01	Chromium	231	ug/L	2.9534	NA
I002	01	Copper	99.4	ug/L	0.1589	NA
I002	01	Lead	28.3	ug/L	NA	NA
I002	01	Manganese	54.7	ug/L	0.1520	NA
I002	01	Mercury	0.23	ug/L	0.0490	NA
I002	01	Nickel	27.9	ug/L	0.0892	NA
I002	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
I002	01	Trichloroethene	5	ug/L	0.1065	1.2642
I002	01	Vanadium	284	ug/L	2.5936	NA
		Total			25.7147	1622.6317
I002	02	1,1-Dichloroethane	1	ug/L	0.0011	NA
I002	02	1,1-Dichloroethene	0.6	ug/L	0.0085	6.9159
I002	02	Tetrachloroethene	2	ug/L	0.0256	1.6072
I002	02	Trichloroethene	10	ug/L	0.2131	2.5284
		Total			0.2483	11.0514
S001	01	Aluminum	15800	ug/L	1.0100	NA
S001	01	Barium	56.4	ug/L	0.0515	NA

Table 10.3.3-19
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 25, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S001	01	Cadmium	4	ug/L	0.5128	NA
S001	01	Chloroform	3	ug/L	0.0384	3.8640
S001	01	Chromium	18	ug/L	0.2301	NA
S001	01	Copper	20.4	ug/L	0.0326	NA
S001	01	Lead	6.4	ug/L	NA	NA
S001	01	Manganese	115	ug/L	0.3196	NA
S001	01	Mercury	0.26	ug/L	0.0554	NA
S001	01	Vanadium	25.2	ug/L	0.2301	NA
		Total			2.4806	3.8640
S001	02	Aluminum (Al)	248	ug/L	0.0159	NA
S001	02	Vanadium (V)	0.89	ug/L	0.0081	NA
		Total			0.0240	NA
S002	01	1,1-Dichloroethene	2	ug/L	0.0284	23.0528
S002	01	Aluminum	4790	ug/L	0.3062	NA
S002	01	Antimony	61	ug/L	9.7489	NA
S002	01	Arsenic	5.4	ug/L	1.1507	120.4697
S002	01	Barium	12.9	ug/L	0.0118	NA
S002	01	Chromium	9.1	ug/L	0.1163	NA
S002	01	Manganese	17.5	ug/L	0.0486	NA
S002	01	Tetrachloroethene	5	ug/L	0.0639	4.0179
S002	01	Trichloroethene	3	ug/L	0.0639	0.7585
S002	01	Vanadium	12.2	ug/L	0.1114	NA
		Total			11.6502	148.2989
S002	02	Tetrachloroethene	0.9	ug/L	0.0115	0.7232
S002	02	Trichloroethene	0.5	ug/L	0.0107	0.1264
S002	02	Vanadium (V)	0.93	ug/L	0.0085	NA
		Total			0.0307	0.8496
S003	01	1,1-Dichloroethane	10	ug/L	0.0109	NA
S003	01	Aluminum	83600	ug/L	5.3443	NA
S003	01	Antimony	65.4	ug/L	10.4521	NA
S003	01	Arsenic	12.3	ug/L	2.6210	274.4031
S003	01	Barium	146	ug/L	0.1333	NA
S003	01	Beryllium	1.2	ug/L	0.0153	76.7436
S003	01	Cadmium	4.1	ug/L	0.5256	NA
S003	01	Chromium	92.3	ug/L	1.1801	NA
S003	01	Copper	68.8	ug/L	0.1100	NA
S003	01	Lead	28.8	ug/L	NA	NA
S003	01	Manganese	407	ug/L	1.1312	NA
S003	01	Mercury	0.88	ug/L	0.1875	NA
S003	01	Nickel	53.3	ug/L	0.1704	NA
S003	01	Vanadium	98.4	ug/L	0.8986	NA
		Total			22.7803	351.1468
S003	02	Mercury (Hg)	0.06	ug/L	0.0128	NA
		Total			0.0128	NA
S004	01	1,1-Dichloroethane	90	ug/L	0.0978	NA
S004	01	1,1-Dichloroethene	3	ug/L	0.0426	34.5793
S004	01	Aluminum	183000	ug/L	11.6986	NA
S004	01	Antimony	218	ug/L	34.8402	NA
S004	01	Arsenic	13	ug/L	2.7702	290.0196
S004	01	Barium	222	ug/L	0.2027	NA
S004	01	Beryllium	2.6	ug/L	0.0332	166.2779
S004	01	Cadmium	54.4	ug/L	6.9744	NA
S004	01	Chromium	14700	ug/L	187.9452	NA
S004	01	Copper	354	ug/L	0.5658	NA
S004	01	Lead	334	ug/L	NA	NA
S004	01	Manganese	219	ug/L	0.6087	NA
S004	01	Mercury	2.4	ug/L	0.5114	NA
S004	01	Nickel	69.9	ug/L	0.2234	NA
S004	01	Vanadium	199	ug/L	1.8174	NA
S004	01	Vinyl chloride	7	ug/L	NA	229.0411
		Total			248.3315	719.9178
S005	01	1,1-Dichloroethene	3	ug/L	0.0426	34.5793
S005	01	Aluminum	35500	ug/L	2.2694	NA
S005	01	Barium	92.6	ug/L	0.0846	NA
S005	01	Chromium	43.1	ug/L	0.5511	NA
S005	01	Copper	32.7	ug/L	0.0523	NA
S005	01	Heptachlor epoxide	0.0033	ug/L	0.0325	0.8933
S005	01	Lead	16	ug/L	NA	NA

Table 10.3.3-19
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 25, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S005	01	Manganese	128	ug/L	0.3558	NA
S005	01	Mercury	0.2	ug/L	0.0426	NA
S005	01	Trichloroethene	2	ug/L	0.0426	0.5057
S005	01	Vanadium	44.2	ug/L	0.4037	NA
		Total			3.8770	35.9782
S006	01	1,1-Dichloroethene	2	ug/L	0.0284	23.0528
S006	01	Aluminum	22500	ug/L	1.4384	NA
S006	01	Barium	51.8	ug/L	0.0473	NA
S006	01	Chromium	39.3	ug/L	0.5025	NA
S006	01	Copper	19.3	ug/L	0.0308	NA
S006	01	Lead	50	ug/L	NA	NA
S006	01	Manganese	77	ug/L	0.2140	NA
S006	01	Vanadium	32.7	ug/L	0.2986	NA
		Total			2.5600	23.0528
S007	01	Aluminum	59500	ug/L	3.8037	NA
S007	01	Arsenic	4.1	ug/L	0.8737	91.4677
S007	01	Barium	172	ug/L	0.1571	NA
S007	01	Cadmium	5.4	ug/L	0.6923	NA
S007	01	Chromium	48.2	ug/L	0.6163	NA
S007	01	Copper	29.2	ug/L	0.0467	NA
S007	01	Lead	10.2	ug/L	NA	NA
S007	01	Manganese	131	ug/L	0.3641	NA
S007	01	Mercury	0.21	ug/L	0.0447	NA
S007	01	Nickel	33.9	ug/L	0.1084	NA
S007	01	Trichloroethene	1	ug/L	0.0213	0.2528
S007	01	Vanadium	71.8	ug/L	0.6557	NA
		Total			7.3839	91.7205
S008	01	1,1-Dichloroethane	62	ug/L	0.0674	NA
S008	01	1,1-Dichloroethene	4	ug/L	0.0568	46.1057
S008	01	Aluminum	37300	ug/L	2.3845	NA
S008	01	Arsenic	4.8	ug/L	1.0228	107.0841
S008	01	Barium	72.2	ug/L	0.0659	NA
S008	01	Chromium	70.1	ug/L	0.8963	NA
S008	01	Lead	55.9	ug/L	NA	NA
S008	01	Manganese	450	ug/L	1.2507	NA
S008	01	Mercury	0.41	ug/L	0.0874	NA
S008	01	Nickel	30	ug/L	0.0959	NA
		Total			5.9277	153.1898
S008	02	Chloroform	0.8	ug/L	0.0102	1.0304
S008	02	Mercury (Hg)	0.09	ug/L	0.0192	NA
S008	02	Tetrachloroethene	1	ug/L	0.0128	0.8036
S008	02	Trichloroethene	0.2	ug/L	0.0043	0.0506
		Total			0.0465	1.8845
S009	01	1,1-Dichloroethane	60	ug/L	0.0652	NA
S009	01	1,1-Dichloroethene	2	ug/L	0.0284	23.0528
S009	01	Aluminum	247000	ug/L	15.7899	NA
S009	01	Antimony	43.7	ug/L	6.9840	NA
S009	01	Arsenic	85.7	ug/L	18.2618	1911.8982
S009	01	Barium	354	ug/L	0.3233	NA
S009	01	Beryllium	3.7	ug/L	0.0473	236.6262
S009	01	Cadmium	7.9	ug/L	1.0128	NA
S009	01	Chromium	574	ug/L	7.3388	NA
S009	01	Copper	194	ug/L	0.3100	NA
S009	01	Lead	308	ug/L	0.0000	NA
S009	01	Manganese	834	ug/L	2.3180	NA
S009	01	Mercury	2.3	ug/L	0.4901	NA
S009	01	Nickel	107	ug/L	0.3420	NA
S009	01	Tetrachloroethene	3	ug/L	0.0384	2.4107
S009	01	Vanadium	241	ug/L	2.2009	NA
		Total			55.5511	2173.9880
S009	02	1,1-Dichloroethane	4	ug/L	0.0043	NA
S009	02	1,1-Dichloroethene	0.3	ug/L	0.0043	3.4579
S009	02	Aluminum (Al)	2300	ug/L	0.1470	NA
S009	02	Manganese (Mn)	11.9	ug/L	0.0331	NA
S009	02	Mercury (Hg)	4.7	ug/L	1.0015	NA
S009	02	Tetrachloroethene	0.4	ug/L	0.0051	0.3214
S009	02	Vanadium (V)	3	ug/L	0.0274	NA
		Total			1.2227	3.7794

Table 10.3.3-20
Summary of Lead Model Results
Site 25
Naval Air Station Pensacola
Pensacola, Florida

Lead Model Default Inputs		Site Specific Inputs (RME)		(Mean)
Air Concentration	0.1 ug Pb/m3	Soil	1840 ug Pb/g	229 ug Pb/g
Paint Intake	0 ug Pb/day	House Dust	1840 ug Pb/g	229 ug Pb/g
Maternal Contribution	2.5 ug Pb/dL			
Drinking Water	4 ug Pb/L			

Lead Model Results

RME Inputs:	
Predicted Geometric Mean Blood Lead Level	16.1 ug Pb/dL (micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/dL	81 %
Mean Inputs:	
Predicted Geometric Mean Blood Lead Level	4 ug Pb/dL (micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/dL	2.4 %

Table 10.3.3-21
Summary of Risk and Hazard-based Surface Soil COCs
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident Iwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Future Tresspasser Hazard Quotien	Future Tresspasser ILCR	Identification of COCs	
Surface Soil	Incidental Ingestion	Aluminum	0.0087	0.082	ND	0.0031	ND	0.0020	ND		
		Aroclor-1254	0.015	0.14	6.9E-07	0.0054	7.7E-08	0.0035	2.0E-08	1	
		Aroclor-1260	ND	ND	6.0E-07	ND	6.7E-08	ND	1.7E-08		
		Arsenic	0.010	0.091	5.0E-06	0.0035	5.6E-07	0.0023	1.5E-07	2	
		Benzo(a)pyrene Equiv.	ND	ND	1.8E-05	ND	2.0E-06	ND	5.2E-07	2	4
		Beryllium	0.00016	0.0015	3.8E-06	0.000056	4.3E-07	0.000036	1.1E-07	2	
		Cadmium	0.047	0.44	ND	0.0169	ND	0.011	ND	1	
		Chromium	0.055	0.52	ND	0.020	ND	0.013	ND	1	
		Dieldrin	0.0011	0.0100	9.8E-07	0.00038	1.1E-07	0.00025	2.8E-08		
		Lead	ND	ND	ND	ND	ND	ND	ND		
		Manganese	0.0081	0.075	ND	0.0029	ND	0.0019	ND		
		Mercury	0.0060	0.056	ND	0.0023	ND	0.0014	ND		
		Silver	0.0032	0.030	ND	0.0013	ND	0.00074	ND		
		Zinc	0.020	0.19	ND	0.0073	ND	0.0046	ND	1	
	Dermal Contact	Aluminum	0.0018	0.0059	ND	0.0013	ND	0.00041	ND		
		Aroclor-1254	0.012	0.041	3.1E-07	0.0083	1.3E-07	0.0029	1.6E-08		
		Aroclor-1260	ND	ND	2.7E-07	ND	1.1E-07	ND	1.4E-08		
		Arsenic	0.0020	0.0066	5.6E-07	0.0014	2.3E-07	0.00046	3.0E-08		
		Benzo(a)pyrene Equiv.	ND	ND	8.1E-06	ND	3.3E-06	ND	4.3E-07	2	4
		Beryllium	0.000032	0.00011	4.3E-07	0.000023	1.7E-07	0.0000074	2.3E-08		
		Cadmium	0.0097	0.032	ND	0.0069	ND	0.0022	ND		
		Chromium	0.011	0.037	ND	0.0081	ND	0.0026	ND		
		Dieldrin	0.00088	0.0029	4.4E-07	0.00063	1.8E-07	0.00020	2.3E-08		
		Lead	ND	ND	ND	ND	ND	ND	ND		
		Manganese	0.00165	0.0055	ND	0.00113	ND	0.00038	ND		
		Mercury	0.0012	0.0041	ND	0.00083	ND	0.00028	ND		
		Silver	0.00066	0.0022	ND	0.00047	ND	0.00015	ND		
		Zinc	0.0041	0.013	ND	0.0029	ND	0.00094	ND		
Surface Soil Pathway Sum			0.2	2	4E-05	0.1	7E-06	0.05	1E-06		

Notes:
ND indicates not determined due to the lack of available risk information. 4.8E-01 1.4E-04
ILCR indicates incremental lifetime cancer risk 1.8E+00 1.8E-04
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.
5- Chemical is a COC by virtue of projected future adolescent trespasser noncarcinogenic hazard.
6- Chemical is a COC by virtue of projected future adolescent trespasser ILCR.

Table 10.3.3-22
Summary of Risk and Hazard-based Groundwater COCs
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident lwa ILCR	Site Worker Hazard Quotien	Site Worker ILCR	Identification of COCs	
Groundwater	Ingestion	Chloroform	0.0044	0.010	1.5E-07	0.0016	4.7E-08		
		1,1-Dichloroethane	0.022	0.051	ND	0.0078	ND		
		1,1-Dichloroethene	0.0072	0.017	2.1E-05	0.0026	6.8E-06	2	4
		Heptachlor epoxide	0.0070	0.016	4.5E-07	0.0025	1.4E-07		
		Mercury	0.38	0.88	ND	0.13	ND	1	
		Tetrachloroethene	0.0049	0.011	1.4E-06	0.0017	4.4E-07	2	
		1,1,1-Trichloroethane	0.015	0.035	ND	0.0053	ND		
		Trichloroethene	0.078	0.18	2.8E-06	0.028	9.0E-07	1 2	
		Vinyl chloride	ND	ND	2.0E-04	ND	6.4E-05	2	4
	Inhalation	Chloroform	0.0044	0.010	1.9E-06	0.0016	6.2E-07	2	
		1,1-Dichloroethane	0.015	0.036	ND	0.00011	ND		
		1,1-Dichloroethene	0.0072	0.017	6.2E-06	0.0026	2.0E-06	2	4
		Tetrachloroethene	0.0049	0.011	5.4E-08	0.0017	1.7E-08		
		1,1,1-Trichloroethane	0.0018	0.0043	ND	0.00065	ND		
		Trichloroethene	0.078	0.18	1.5E-06	0.028	4.9E-07	1 2	
		Vinyl chloride	ND	ND	3.2E-05	ND	1.0E-05	2	4
Groundwater Pathway Sum			0.6	1	3E-04	0.2	9E-05		

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.

Table 10.3.3-23
Summary of Risk and Hazard
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	HI (Adult)	HI (Child)	ILCR (LWA)	HI (Worker)	ILCR (Worker)	HI (Tresspasser)	ILCR (Tresspasser)
Surface Soil	Incidental Ingestion	0.1	1	3E-05	0.05	3E-06	0.05	8E-07
	Dermal Contact	0.04	0.1	1E-05	0.03	4E-06	0.01	5E-07
Groundwater	Ingestion	0.5	1	2E-04	0.2	7E-05	NA	NA
	Inhalation	0.1	0.3	4E-05	0.03	1E-05	NA	NA
Sum all Pathways		0.8	3	3E-04	0.3	9E-05	0.06	1E-06

Notes:
ILCR Indicates incremental lifetime cancer risk
HI Indicates hazard index
NA Not applicable or not available

Table 10.3.3-24
Remedial Goal Options Surface Soil
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Slope Factor (mg/kg-day)$^{-1}$	Reference Dose (mg/kg-day)	FI/FC	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Aroclor-1254	2	2E-05	1	0.22	4	1.2	0.12	0.22	2.2	22	NA	0.9
Aroclor-1260	2	NA	1	1.08	ND	ND	ND	1.24	12.4	124	NA	0.9
Arsenic	1.5	0.0003	1	2.1	66	22	2.2	0.38	3.8	38	1.56	0.7
Benzo(a)pyrene Equiv.	7.3	NA	1	1.6	ND	ND	ND	0.06	0.6	6	NA	0.1
Beryllium	4.3	0.005	1	0.6	1094	365	36.5	0.13	1.3	13	0.41	0.2
Cadmium	NA	0.001	1	35	219	73	7.3	ND	ND	ND	1	37
Chromium	NA	0.005	1	201	1094	365	36	ND	ND	ND	6.13	290
Zinc	NA	0.3	1	4360	65634	21878	2188	ND	ND	ND	16.87	23000

Industrial RGOs

Chemical	Slope Factor (mg/kg-day)$^{-1}$	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Aroclor 1254	2	2E-05	0.22	46	15	1.5	1.1	11	108	NA	3.5
Aroclor 1260	2	NA	1.08	ND	ND	ND	6.1	61	610	NA	3.5
Benzo(a)pyrene Equiv.	7.3	NA	1.6	ND	ND	ND	0.30	3.0	30	NA	0.5

NOTES:
EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinogens

Table 10.3.3-25
Remedial Goal Options Groundwater
Site 25
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options **0.1** mg/l	**1.0** mg/l	**3** mg/l	Risk-Based Remedial Goal Options **1E-06** mg/l	**1E-05** mg/l	**1E-04** mg/l	Background Concentration mg/l	ARAR mg/l
Chloroform	0.0061	0.01	0.0016	0.0078	0.078	0.23	0.00077	0.0077	0.077	NA	0.006
1,1-Dichloroethene	0.6	0.009	0.0024	0.0070	0.070	0.21	0.000086	0.00086	0.0086	NA	0.007
Mercury	NA	0.0003	0.0041	0.00047	0.0047	0.014	ND	ND	ND	0.0002	0.002
Tetrachloroethene	0.052	0.01	0.0018	0.0078	0.078	0.23	0.0012	0.012	0.12	NA	0.003
Trichloroethene	0.011	0.006	0.0170	0.0047	0.047	0.14	0.0039	0.039	0.39	NA	0.003
Vinyl chloride	1.9	NA	0.0070	ND	ND	ND	0.000030	0.00030	0.0030	NA	0.001

Industrial RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options **0.1** mg/l	**1** mg/l	**3** mg/l	Risk-Based Remedial Goal Options **1E-06** mg/l	**1E-05** mg/l	**1E-04** mg/l	Background Concentration mg/l	ARAR mg/l
1,1-Dichloroethene	0.6	0.009	0.0024	0.046	0.46	1.4	0.00027	0.0027	0.027	NA	0.007
Vinyl chloride	1.9	NA	0.0070	ND	ND	ND	0.000094	0.00094	0.0094	NA	0.001

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinogens

10.3.4 Human Health Risk Assessment for Site 26

10.3.4.1 Site Background and Investigative Approach

Site 26, northwest of Chevalier Field, is a 50-foot by 100-foot, open-sided, chemical storage shed. Before 1964, NAS Pensacola Supply Department used Site 26 for outside storage of industrial chemicals such as paint strippers and acids. Containers were placed on a grated steel matting which allowed leaks to penetrate through to the soil.

As part of the RI, six surface soil samples were collected for TCL/TAL, and gross alpha and beta radioactivity analyses. Table 10.3.4-1 lists the analytical methods for the soil samples used in the Site 26 HHRA. Four groundwater samples were collected from the shallow water-bearing zone. Groundwater was analyzed for full scan TCL/TAL parameters, including cyanide. For groundwater, TAL metals were not filtered. Table 10.3.4-2 lists the analytical methods for the groundwater samples used in the HHRA. No Site 26 monitoring wells were resampled during Phase II.

10.3.4.2 COPC Identification

Soil

Based on the screening comparisons described in Section 10.2.5 of this RI and presented in Table 10.3.4-3, this HHRA will focus on BEQs.

Groundwater

As shown in Table 10.3.4-4, the COPCs identified in this site's groundwater for this site are arsenic, cadmium, dieldrin, heptachlor epoxide, PCE, and vinyl chloride.

10.3.4.3 Exposure Assessment

Exposure Setting

Site 26 is a chemical storage area on the eastern side of OU 2. The area will likely remain a storage area for the next five years.

Potentially Exposed Populations

Potentially exposed populations are current and future site workers, and future site residents. Although this area is unlikely to attract adolescent trespassers with any significant frequency and, although Site 26 is not near the base boundary so as to allow convenient access to trespassers, an adolescent trespasser scenario was included. Therefore, future site resident, future site worker, and adolescent trespasser exposure scenarios are addressed in this risk assessment. In the event of construction onsite, construction workers were considered to have the potential of exposure to chemicals in subsurface soil. Therefore construction worker PRGs were calculated as described in Section 10.2.12, and compared to maximum detected chemical concentrations in subsurface soil.

The hypothetical future site worker scenario assumed continuous exposure to surface soil conditions and the use of groundwater as a potable water source. Current site workers' exposure would be less than that assumed for the hypothetical future site worker scenario because of their limited soil contact and the fact that groundwater is not currently used onsite as a source of potable or process water. The future site resident scenario assumes that existing buildings would be removed and replaced with dwellings and that future site residents would use the onsite shallow zone of the underlying aquifers as a drinking water source. The current site trespasser is characterized as an adolescent who visits the site once a week during the summer.

Exposure Pathways

Exposure pathways for future residential use, future site workers, and adolescent trespassers are dermal contact and incidental ingestion of surface soil. Additional pathways for future residents and future site workers include ingestion of groundwater through potable use and inhalation of VOCs through domestic groundwater use. Uniform exposure is assumed for all sample locations. Table 10.3.4-5 justifies exposure pathways assessed in this HHRA.

Exposure Point Concentrations

The maximum detected concentration was used as the soil EPC for BEQs since less than ten data points were available to determine a 95% UCL. Table 10.3.4-6 presents the data for all seven of the carcinogenic PAHs used to calculate the BEQ values for the five surface soil samples collected for Site 26. Maximum concentrations were used as EPCs for groundwater COPCs (arsenic, cadmium, dieldrin, heptachlor epoxide, tetrachloroethene, and vinyl chloride) because there were too few data points to determine a 95% UCL. Maximum concentration for groundwater COPCs can be found on Table 10.3.4-4.

Exposure Quantification

Soil

CDIs for ingestion and dermal contact with soil are shown in Tables 10.3.4-7 and 10.3.4-8, respectively.

Groundwater

The CDIs for groundwater ingestion are presented in Table 10.3.4-9. The CDIs for inhalation of VOCs were assumed to be approximately equal to that for ingestion as indicated in the *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering* (USEPA, 1991e).

10.3.4.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 10.2.8 of this report. Table 10.4.1-1 presents toxicological information specific to each COPC identified at OU 2. This information was used to quantify risk/hazard associated with soil and groundwater contaminants. Toxicological profiles for COPCs are provided in Section 10.4.

Some constituents detected in soil at Site 26 do not have toxicity criteria available. The following cross-assignments were made based on structural and toxicological similarities between chemicals. The RBC for gamma-BHC was cross-assigned to delta-BHC. The RBC for endrin was cross-assigned to endrin ketone.

10.3.4.5 Risk Characterization

Surface Soil Pathways

Incidental ingestion and dermal contact exposure to surface soil onsite were evaluated under both residential and industrial (site worker) scenarios. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.3.4-10 and 10.3.4-11 present the computed carcinogenic risks and/or HQs associated with incidental ingestion of and dermal contact with site surface soil, respectively.

Hypothetical Site Residents

The ingestion ILCR (based on the adult and child LWA) for Site 26 surface soil is 2E-06. The dermal pathway ILCR is 1E-06.

Hypothetical Site Workers

Site worker ILCRs are 3E-07 for the ingestion pathway and 4E-07 for the dermal contact pathway.

Hypothetical Adolescent Trespasser

The ingestion and dermal contact ILCRs for the adolescent trespasser are 7E-08 and 6E-08, respectively.

Construction Worker

Table 10.3.4-12 presents a summary of Site 26 subsurface soil data with a comparison to PRGs. As shown, the maximum concentrations of chemicals reported in Site 26 subsurface soil did not exceed their respective construction worker PRGs.

Point Risk and Point Hazard Estimates for Soil Pathways

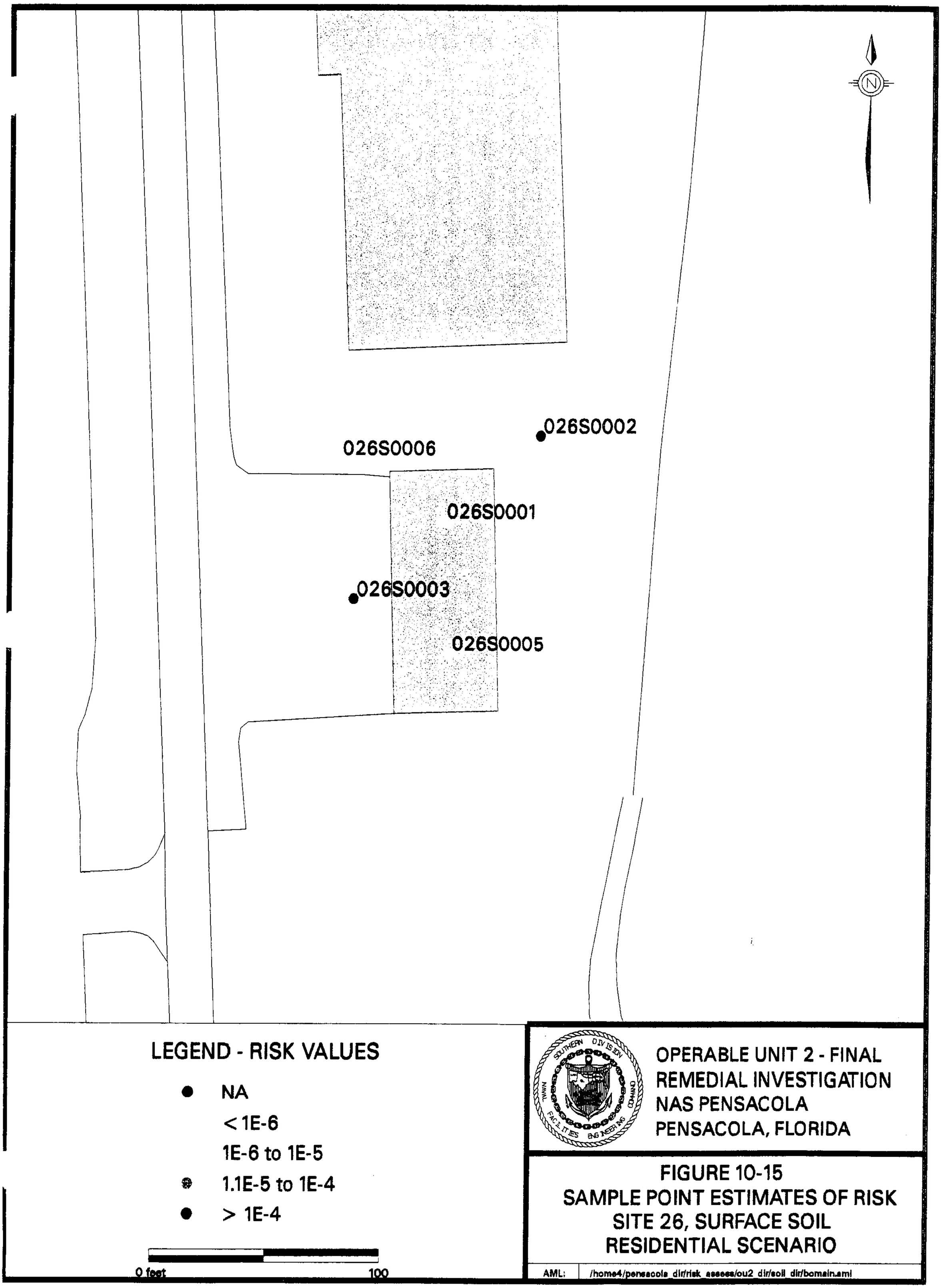
Figures 10-15 and 10-16 are the risk and hazard maps for Site 26 soil. Table 10.3.4-13 provides the risk and/or hazard contributed by each COPC at each sample location. As shown, reported concentrations of BEQs in Site 26 soil samples generally equate with a risk of approximately 3E-06.

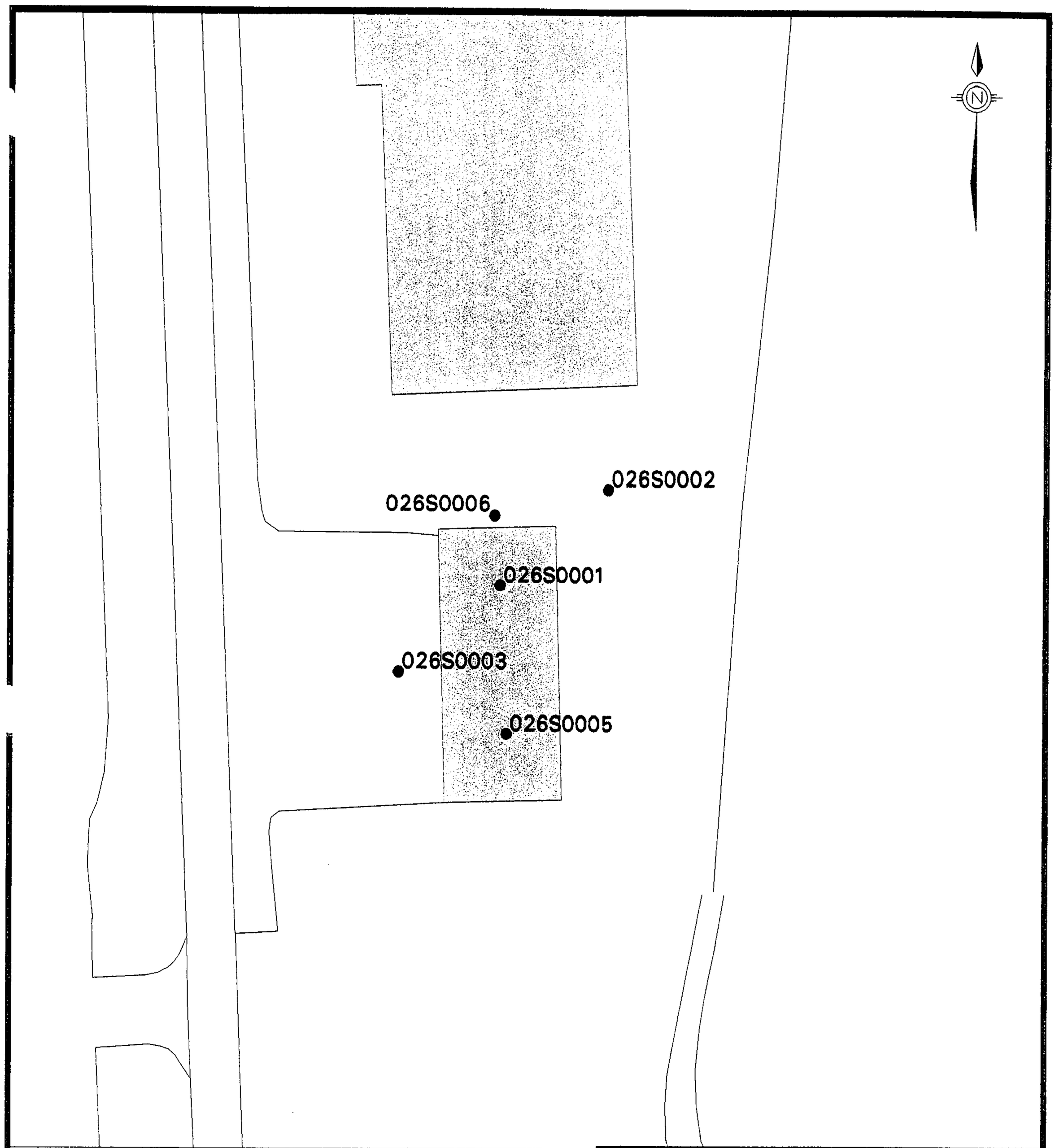
Groundwater Pathways

The groundwater exposure pathways for residential and industrial scenarios were evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed separately for child and adult receptors. Tables 10.3.4-14 and 10.3.4-15 present the risk and hazard for the groundwater pathways.

Hypothetical Site Residents

For the ingestion and inhalation pathways, the LWA ILCRs were computed to be 1E-04 and 3E-06, respectively. The primary contributors to the ingestion pathway include arsenic, dieldrin, PCE, and vinyl chloride. The primary contributor to the inhalation pathway is vinyl chloride.


N
026S0002
026S0006
026S0001
026S0003
026S0005
LEGEND - RISK VALUES
NA
< 1E-6
1E-6 to 1E-5
1.1E-5 to 1E-4
> 1E-4
0 feet
100
SOUTHERN DIVISION NAVAL FACILITIES ENGINEERING COMMAND
OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 10-15
SAMPLE POINT ESTIMATES OF RISK
SITE 26, SURFACE SOIL
RESIDENTIAL SCENARIO
AML: /home4/pensacola_dir/risk_assess/ou2_dir/soil_dir/bomain.aml



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 100

OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-16
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 26, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/soil dir/bomain.aml

HIs for adult and child residents are 1 and 3 for the ingestion pathway. For the inhalation pathway, both the adult and child HIs are below 0.1. The primary contributors to ingestion HI are arsenic and cadmium.

Hypothetical Site Workers

For the ingestion and inhalation pathway, the ILCRs were computed to be 4E-05 and 9E-07, respectively. The primary contributors to the ingestion pathway include arsenic, dieldrin, and vinyl chloride. The ingestion and inhalation pathway HIs were computed to be 0.4 and 0.003, respectively.

Point Risk and Point Hazard Estimates for Groundwater Pathways

Figures 10-17 and 10-18 are the risk and hazard maps for Site 26 groundwater. Table 10.3.4-16 lists the risk and/or hazard contributed by each COPC at each monitoring well location. As shown, two of four monitoring wells had concentrations of arsenic and cadmium that combine to equate with a cumulative hazard quotient of greater than unity (one). Reported concentrations of arsenic, beryllium, dieldrin, and tetrachloroethene in Site 26 groundwater samples generally equate with a cumulative risk between 1E-05 to 1E-04.

Current Site Workers

Groundwater is not currently used as a potable water source for Site 26, or other areas of NAS Pensacola. Without an exposure pathway, no threat to human health is posed by reported groundwater contamination.

COCs Identified

COCs were identified based on cumulative (all pathway) risk and hazard projected for this site. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and a HI threshold of 1.0 (unity). In this HHRA, a COC was considered to be any chemical contributing

to a cumulative risk level of 1E-6 or greater and/or a cumulative HI above 1.0, and has an individual ILCR that exceeds 1E-6 or has a hazard quotient that exceeds 0.1. For carcinogens, this approach is relatively conservative because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. The COC selection method presented was used in order to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGOs development process. Table 10.3.4-17 summarizes COCs identified in each medium based on contribution to cumulative ILCR or HI.

Surface Soils

Hypothetical Site Residents (Future Land Use)

BEQs were identified as COCs based on their contributions to the cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

No COCs were identified for the hypothetical future site worker.

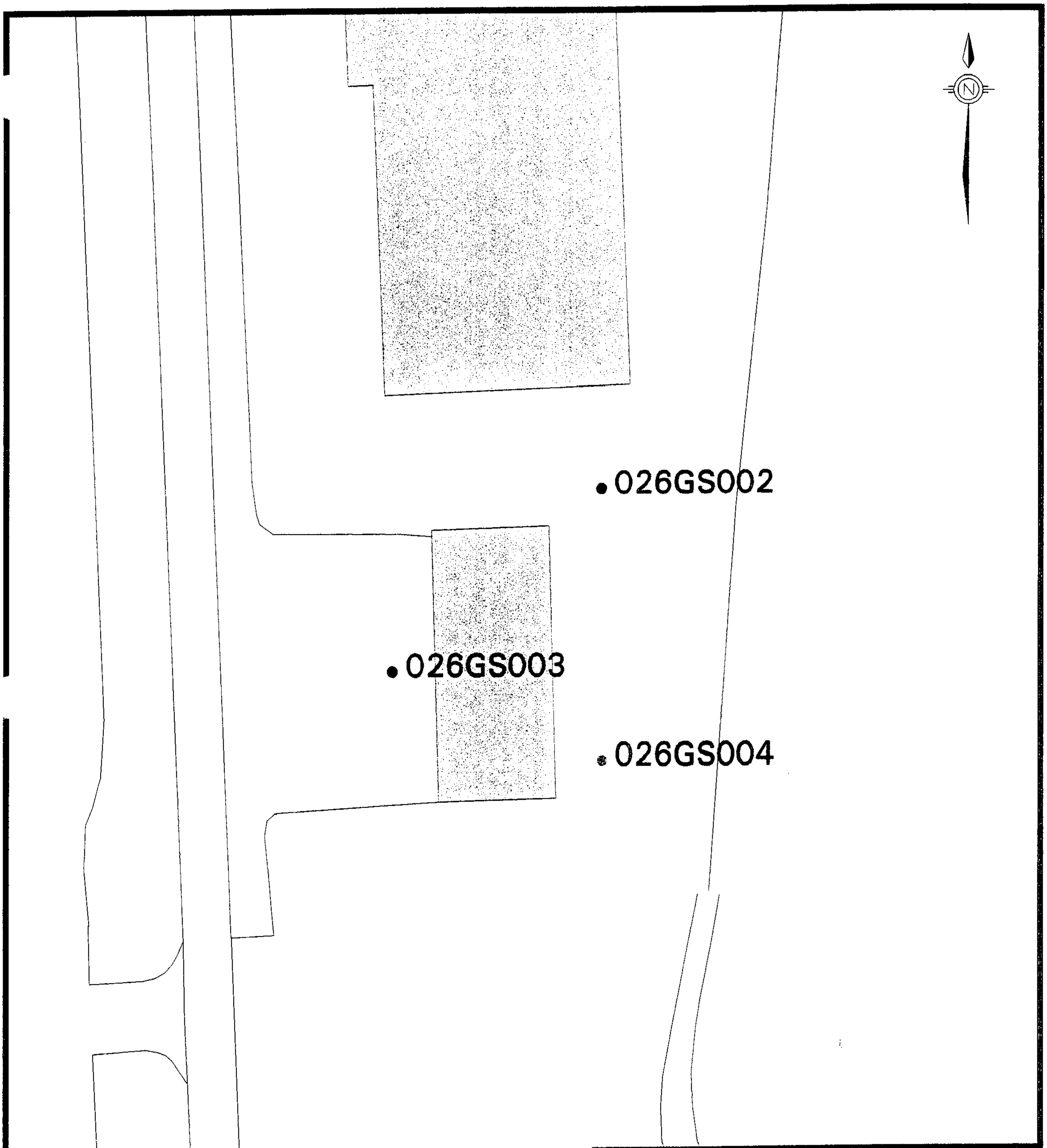
Adolescent Trespasser (Current Land Use)

No COCs were identified for the trespasser scenario.

Groundwater

Hypothetical Site Residents (Future Land Use)

Arsenic and cadmium were identified as a groundwater COCs based on contributions to cumulative HI. Arsenic, dieldrin, tetrachloroethene, and vinyl chloride were identified as COCs based on their contributions to the cumulative ILCR.



LEGEND - RISK VALUES

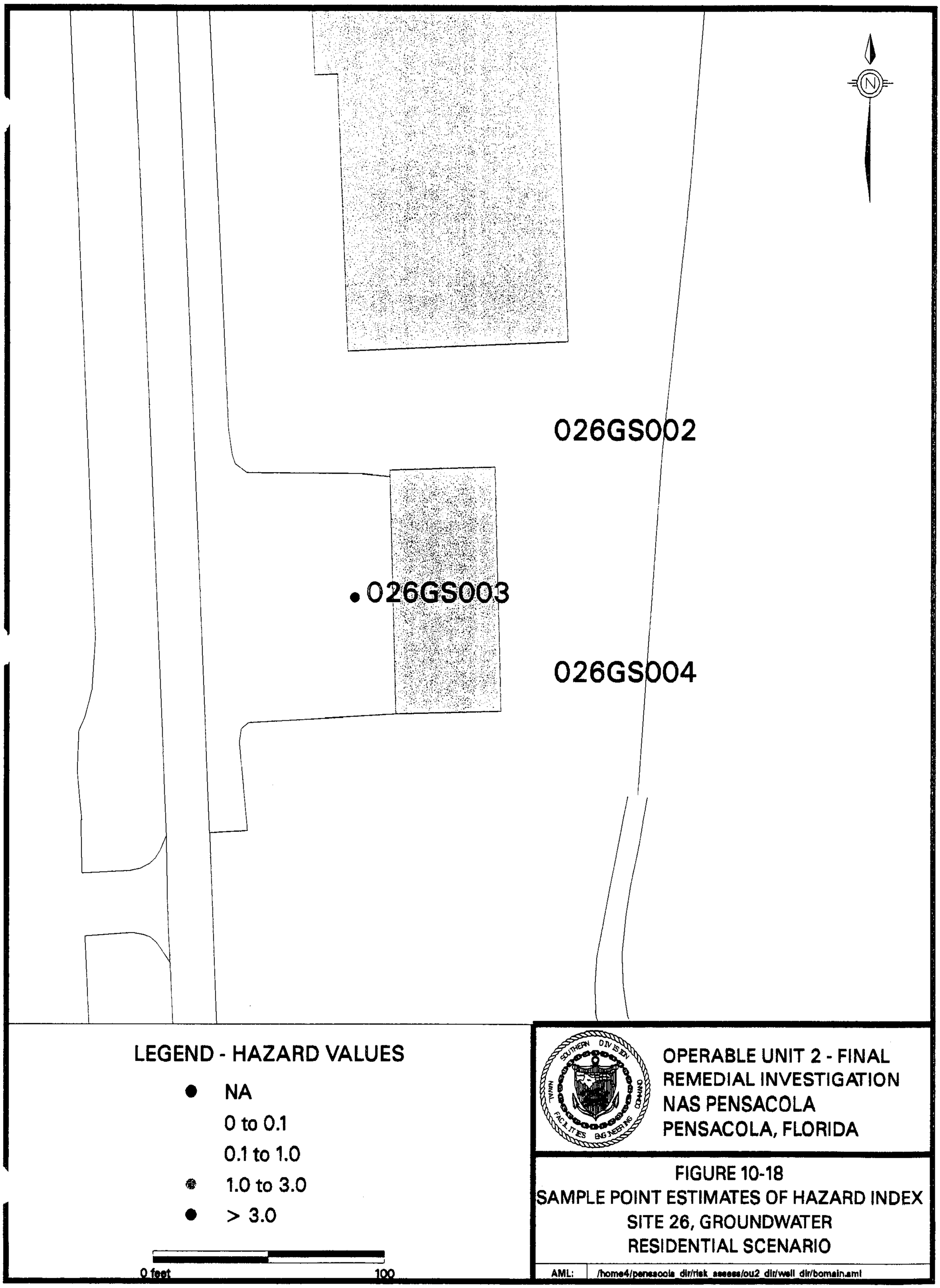
- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 100

OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-17
SAMPLE POINT ESTIMATES OF RISK
SITE 26, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/well_dir/bomain.aml


N
026GS002
026GS003
026GS004
LEGEND - HAZARD VALUES
NA
0 to 0.1
0.1 to 1.0
1.0 to 3.0
> 3.0
0 feet
100
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA
FIGURE 10-18
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 26, GROUNDWATER
RESIDENTIAL SCENARIO
AML:
/home4/pensacola_dir/risk_assess/ou2_dir/well_dir/bomain.aml

Hypothetical Site Workers (Future Land Use)

Arsenic, dieldrin and vinyl chloride were identified as COCs based on their contributions to cumulative ILCR.

10.3.4.6 Risk Uncertainty

Exposure Setting Characterization and Exposure Pathways Identification

The highly conservative assumptions (i.e., future residential use), recommended by USEPA Region IV and FDEP, introduce this potential for high bias through exposure setting and pathway selection when assessing future and current exposure. The exposure assumptions in the site worker scenario are highly protective and would tend to overestimate exposure. As a result, limited exposure to these maximally impacted areas is possible although the frequency and duration of direct contact events are likely quite low.

Residential site use is not expected, based on current site uses and the nature of surrounding buildings. If this area were to be used as a residential site, the buildings would be demolished, asphalt surface removed, and the surface soil conditions would likely change dramatically as the area could be covered with landscaping soil and/or a house. Consequently, uniform exposure to current surface soil conditions would not be likely under a true future residential scenario.

These factors indicate that exposure pathways assessed in this HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Therefore, the scenario established to project risk/hazard associated with groundwater exposure is highly conservative, and associated pathways are not expected to be completed in the future.

Determination of Exposure Point Concentrations

Maximum detected concentrations were applied as the EPCs used to estimate risk and hazard for COPCs in soil and groundwater because there were too few data to determine a 95% UCL. As a result, risk projections based on EPC selection are considered overestimates.

Frequency of Detection and Spatial Distribution

COCs in Phase I groundwater samples were cadmium (two of four samples), dieldrin (three of four samples), and tetrachloroethene (two of four samples). Arsenic, heptachlor epoxide, and vinyl chloride were detected infrequently (one of four samples) in Phase I groundwater samples. Generally, Phase I sampling indicated groundwater COCs were distributed evenly across the site.

Risk/Hazard Quantification

As indicated by the discussions above, the uncertainty inherent in the risk assessment process is great. In addition, many site-specific factors have affected this assessment is certainty and would bias the risk and hazard estimates. Exposure pathway-specific sources of uncertainty are discussed below.

Soil

Of the organic CPSSs screened and eliminated from formal assessment, only three were reported at a maximum concentrations within approximately 10% of their RBCs. The use of maximum concentration for the screening comparison minimizes the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSSs. No inorganic CPSSs were eliminated based only on comparison to their corresponding reference concentrations.

Although the future land use of Site 26 is unknown, both the worker and residential exposure scenarios were assessed in this HHRA. Base redevelopment plans for NAS Pensacola are drafted every five years. Site 26 is likely to remain a chemical storage shed for the next five years. As

previously discussed, it is likely that these scenarios would lead to overestimates of risk and/or hazard.

Groundwater

Of the organic CPSSs screened and eliminated from formal assessment, one was reported at a concentration near (within approximately 10%) the RBC. No inorganic parameters were eliminated from formal assessment based strictly upon comparison to background reference concentrations.

Groundwater is not currently a potable water source at NAS Pensacola. If residences were constructed onsite and an unfiltered well was installed, the salinity and dissolved solids would preclude this aquifer from being an acceptable potable water source.

Arsenic accounts for 80% of the risk projections due to exposure to Site 26 groundwater; however, arsenic was not detected in Site 26 groundwater at concentrations exceeding the MCL.

CT was analyzed for Site 26 groundwater using previously described CT assumptions. At CT, the residential groundwater pathway-related risk (incidental ingestion and inhalation) would drop from 1E-04 to approximately 2E-5 but would still exceed the 1E-6 point of departure. CT analysis for HQs based on residential child exposure, using an exposure frequency of 234 days per year, would reduce the hazard estimate approximately 35%. This would drop the HI from 3 (incidental ingestion and dermal contact) to 2.

10.3.4.7 Risk Summary

The risk and hazard posed by contaminants at Site 26 were assessed for the hypothetical site worker and the hypothetical future site resident under RME assumptions. The surface soil, incidental ingestion and dermal contact pathways were assessed. The ingestion and inhalation

pathways were evaluated for groundwater. Table 10.3.4-18 summarizes the risk for each pathway/receptor group evaluated for Site 26.

10.3.4.8 Remedial Goal Options

Soil

Surface soil RGOs for carcinogens presented in Table 10.3.4-19 were based on the LWA site resident. Both ingestion and dermal exposure are used to calculate soil-based RGOs. The most conservative RGOs for BEQs based on a target risk of 1E-06 is lower than the Florida soil cleanup goal.

Groundwater

Groundwater RGOs, based on site resident and site worker exposures and shown in Table 10.3.4-20, were based on the LWA site resident and adult site worker. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker as noted in the table. Both ingestion and inhalation (VOCs only) exposures are used to calculate groundwater RGOs. The most conservative RGO for cadmium is based on residential exposure and a target HQ of 0.1. The most conservative RGOs for arsenic, dieldrin, tetrachloroethene, and vinyl chloride are based on residential exposure and a target risk of 1E-06. All of these RGOs are lower than the FGGC.

Table 10.3.4-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 26

Depth (feet)	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
0 to 1	0001	X	X	X	X
0 to 1	0002	X	X	X	X
0 to 1	0003	X	X	X	X
0 to 1	0004	X	X	X	X
0 to 1	0005	X	X	X	X
0 to 1	0006	X	X	X	X

Notes:
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides: Method 8080
Volatile Organic Analysis: Method 8240
Semivolatile Organic Analysis: Method 8720

Table 10.3.4-2
Samples and Analytical Methods Used for Risk Assessment
Groundwater at Site 26

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
Shallow	GS15	1	1	1	1
Shallow	GS02	1	1	1	1
Shallow	GS03	1	1	1	1
Shallow	GS04	1	1	1	1

Notes:
1 = Sample collected during Phase I
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides: Method 8080
Volatile Organic Analysis: Method 8240
Semivolatile Organic Analysis: Method 8720

Table 10.3.4-3
Chemicals Present in Site Samples
Site 26, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC		SSL		Reference	Units	Number Exceeding RBC	Ref.
Carcinogenic PAHs																
Benzo(apyrene Equivalents	C	3	5	5.157	137.82	89.7	785.74	785.74	88	a	NA		NA	ug/kg	2	
Benzo(a)anthracene	N	3	5	51	140	104	340	340	880	a	NA		NA	ug/kg		
Benzo(b)fluoranthene	N	2	5	220	240	230	340	340	880	a	NA		NA	ug/kg		
Chrysene	N	3	5	57	140	106	340	340	88000	a	NA		NA	ug/kg		
Benzo(k)fluoranthene	N	2	5	170	200	185	340	340	8800	a	NA		NA	ug/kg		
Benzo(a)pyrene	C	2	5	88	100	94	340	340	88	a	NA		NA	ug/kg	2	
Inorganics																
Aluminum	N	6	6	988	1750	1340	NA	NA	7800	a	NA		3833.36	mg/kg		
Barium	N	6	6	1.2	18	5.05	NA	NA	550	a	690000	c	4.63	mg/kg		1
Calcium	N	6	6	43.6	416	158	NA	NA	NA		NA		912.37	mg/kg		
Chromium	N	6	6	1.9	2.8	2.13	NA	NA	39	a	270	c	6.13	mg/kg		
Cobalt	N	4	6	0.16	13.7	3.58	0.12	0.13	470	a	NA		1.87	mg/kg		1
Copper	N	6	6	0.99	7.3	3.07	NA	NA	310	a	NA		5.74	mg/kg		1
Iron	N	6	6	657	1660	1130	NA	NA	2300	a	NA		2745	mg/kg		
Lead	N	6	6	1.5	16.7	5.97	NA	NA	400	b	NA		7.32	mg/kg		1
Magnesium	N	4	6	26.4	62.9	42.9	20.7	22.1	NA		NA		133.33	mg/kg		
Manganese	N	6	6	7.3	95.8	32.7	NA	NA	180	a	NA		21.36	mg/kg		3
Nickel	N	5	6	0.29	0.68	0.47	0.29	0.29	160	a	13000	c	6.38	mg/kg		
Potassium	N	6	6	28.9	65.8	47.8	NA	NA	NA		NA		460.67	mg/kg		
Sodium	N	3	6	138	247	210	184	196	NA		NA		107.85	mg/kg		3
Vanadium	N	6	6	1.6	3.2	2.32	NA	NA	55	a	NA		5.83	mg/kg		
Zinc	N	6	6	3.1	16.4	8.7	NA	NA	2300	a	NA		16.87	mg/kg		
Pesticides and PCBs																
Aroclor-1260	N	1	6	11	11	11	34	36	83	a	NA		NA	ug/kg		
Aldrin	N	5	6	0.033	0.47	0.22	3.5	3.5	38	a	3000	c	NA	ug/kg		
delta-BHC	N	1	6	0.18	0.18	0.18	1.8	3.5	100	a	NA		NA	ug/kg		
alpha-Chlordane	N	1	6	2.3	2.3	2.3	1.7	1.9	470	a	20000	c	NA	ug/kg		
gamma-Chlordane	N	3	6	0.21	3.4	1.9	1.8	1.8	470	a	20000	c	NA	ug/kg		
4,4'-DDD	N	6	6	0.17	51	9.96	NA	NA	2700	a	NA		NA	ug/kg		
4,4'-DDE	N	6	6	0.22	5.5	1.71	NA	NA	1900	a	NA		NA	ug/kg		
4,4'-DDT	N	4	6	1.3	6.2	3.83	3.4	6.8	1900	a	NA		NA	ug/kg		
Dieldrin	N	5	6	0.054	1.3	0.49	6.8	6.8	40	a	1000	c	NA	ug/kg		
Endrin	N	3	6	0.13	0.5	0.32	3.4	6.8	2300	a	NA		NA	ug/kg		
Endrin ketone	N	2	6	0.25	0.34	0.3	3.4	6.8	2300	a	NA		NA	ug/kg		
Heptachlor	N	1	6	0.12	0.12	0.12	1.8	3.5	140	a	100	c	NA	ug/kg		
Heptachlor epoxide	N	1	6	0.28	0.28	0.28	1.8	3.5	70	a	5000	c	NA	ug/kg		
Methoxychlor	N	3	6	0.51	3.4	1.55	18	35	39000	a	NA		NA	ug/kg		
Semivolatile Organics																
Anthracene	N	1	5	38	38	38	340	360	2300000	a	NA		NA	ug/kg		
bis(2-Ethylhexyl)phthalate	N	1	5	40	40	40	340	360	46000	a	3.1E+07	c	NA	ug/kg		
Butylbenzylphthalate	N	1	5	60	60	60	340	360	1600000	a	930000	c	NA	ug/kg		
Di-n-butylphthalate	N	1	5	66	66	66	40	360	780000	a	2300000	c	NA	ug/kg		
Fluoranthene	N	2	5	200	250	225	340	340	310000	a	NA		NA	ug/kg		
Phenanthrene	N	2	5	150	240	195	340	340	310000	a	NA		NA	ug/kg		
Pyrene	N	2	5	150	230	190	340	340	230000	a	NA		NA	ug/kg		

C - Selected as a COPC based on the screening process explained in Section 10.2.5
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5
PAHs - Polynuclear Aromatic Hydrocarbons
SQL - Sample Quantitation Limits
a - USEPA Region III residential risk-based concentration
b - USEPA's action level of lead in soil

Table 10.3.4-4
Chemicals Present in Site Samples
Site 26, Groundwater, Phase I
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	UTL	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium	N	4	4	2440	64000	40100	NA	NA	NA	NA	17560	ug/L		3
Magnesium	N	4	4	313	5010	3150	NA	NA	NA	NA	2872	ug/L		2
Potassium	N	4	4	1630	3610	2560	NA	NA	NA	NA	12167.6	ug/L		
Sodium	N	4	4	2270	9110	6090	NA	NA	NA	NA	18345	ug/L		
Aluminum	N	2	4	387	789	588	84.8	101	3700	RBC	3882.8	ug/L		
Antimony	R	2	4	3	20.2	11.6	1.9	1.9	1.5	RBC	30.2	ug/L	2	
Arsenic	C	1	4	4.7	4.7	4.7	3.2	3.2	0.045	RBC	2.8	ug/L	1	1
Barium	B	4	4	3.4	56.8	36.3	NA	NA	260	RBC	13.2	ug/L		3
Beryllium	R	1	4	0.29	0.29	0.29	0.24	0.34	0.016	RBC	1.1	ug/L	1	
Cadmium	C	2	4	6.2	13.9	10.1	0.3	0.77	1.8	RBC	3.4	ug/L	2	2
Chromium	N	4	4	0.91	3.4	2.05	NA	NA	18	RBC	35	ug/L		
Cobalt	N	1	4	0.62	0.62	0.62	0.6	0.6	220	RBC	4.1	ug/L		
Iron	N	2	4	22.8	214	118	15.7	15.7	1100	RBC	1707.8	ug/L		
Manganese	N	3	4	5.7	13.7	10.9	4	4	84	RBC	22	ug/L		
Zinc	N	4	4	2.5	140	57.5	NA	NA	1100	RBC	153.2	ug/L		
Pesticides														
4,4'-DDD	N	1	4	0.012	0.012	0.012	0.1	0.1	0.1	FDEP	NA	ug/L		
4,4'-DDT	N	2	4	0.0026	0.0067	0.00465	0.1	0.1	0.1	FDEP	NA	ug/L		
Dieldrin	C	3	4	0.0045	0.026	0.013	0.1	0.1	0.0042	RBC	NA	ug/L	3	
Heptachlor epoxide	C	1	4	0.003	0.003	0.003	0.05	0.05	0.0012	RBC	NA	ug/L	1	
Volatile Organics														
Tetrachloroethene	C	2	4	0.9	2	1.45	1	1	1.1	RBC	NA	ug/L	1	
Trichloroethene	N	1	4	0.5	0.5	0.5	1	1	1.6	RBC	NA	ug/L		
Vinyl chloride	C	1	4	0.6	0.6	0.6	1	1	0.019	RBC	NA	ug/L	1	
Miscellaneous														
Radium 226	N	2	4	0.21	0.31	0.26	0.2	0.2	5	MCL	NA	ug/L		

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B - The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
SQL - Sample Quantitation Limits
RBC - USEPA Region III residential risk-based concentration
FDEP - Florida risk-based groundwater guidance concentration

Table 10.3.4-5
Exposure Pathways Summary — Site 26

Medium and Exposure Pathway	Resident	Worker	Trespasser	Reason for Selection or Exclusion
Air: Inhalation of volatile contaminants emanating from soil	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Air: Inhalation of chemicals entrained in fugitive dust	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Groundwater: Ingestion of contaminants during potable or general use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Groundwater: Inhalation of volatilized contaminants during domestic use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Soil: Incidental ingestion	Yes	Yes	Yes	COPCs were identified after to risk-based and background screening comparisons.
Soil: Dermal contact	Yes	Yes	Yes	COPCs were identified after risk-based and background screening comparisons.
Wild game or domestic animals: Ingestion of tissue impacted by media contamination	No	No	No	Hunting/taking of game and/or raising livestock is prohibited at NAS Pensacola.
Fruits and vegetables: Ingestion of plant tissues grown in media	No	No	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Table 10.3.4-6
Carcinogenic PAH Data used to Calculate EPC
Surface Soils at Site 26
NAS Pensacola OU2
Pensacola, Florida

COPC	TEF	026S001	026S002	026S003	026S005	026S006	MAX (mg/kg)	EPC (mg/kg)
Benzo(a)pyrene Equiv.	NA	0.20	ND	ND	0.17	ND	0.20	0.20 MAX Used
Benzo(a)pyrene	1	0.1	ND	ND	0.088	ND		
Benzo(a)anthracene	0.1	0.12	ND	ND	0.14	ND		
Benzo(b)fluoranthene	0.1	0.24	ND	ND	0.22	ND		
Benzo(k)fluoranthene	0.01	0.17	ND	ND	0.2	ND		
Chrysene	0.001	0.12	ND	ND	0.14	ND		
Dibenzo(a,h)anthracene	1	**0.06**	ND	ND	**0.044**	ND		
Indeno(1,2,3-cd)pyrene	0.1	**0.06**	ND	ND	**0.044**	ND		

NOTES:

TEF Toxicity equivalence factor
EPC Exposure point concentration
MAX Maximum reported concentration
Shaded values represent nondetects that have been substituted with one-half of the lowest reported concentration of the seven carcinogenic PAHs the sample.

Table 10.3.4-7
Chronic Daily Intakes (CDI)
Incidental Ingestion of Surface Soil
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	FI*	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Benzo(a)pyrene Equiv.	1	0.20	2.8E-07	2.6E-06	3.2E-07	1.0E-07	3.6E-08	6.46E-08	9.21E-09

NOTES:

lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.4-8
Chronic Daily Intakes (CDI)
Dermal Contact with Surface Soil
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/kg)	FC*	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Benzo(a)pyrene Equiv.	0.20	1	0.01	1.14E-07	3.78E-07	7.16E-08	8.18E-08	2.92E-08	2.65E-08	3.77E-09

NOTES:

TEF Toxicity Equivalence Factor relative to benzo(a)pyrene
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.4-9
Chronic Daily Intakes (CDI)
Ingestion of COPCs in Groundwater
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/liter)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Arsenic	0.0047	1.3E-04	3.0E-04	7.1E-05	4.6E-05	2.3E-05
Cadmium	0.014	3.8E-04	8.9E-04	2.1E-04	1.4E-04	6.7E-05
Dieldrin	0.000026	7.1E-07	1.7E-06	3.9E-07	2.5E-07	1.3E-07
Heptachlor epoxide	0.0000030	8.2E-08	1.9E-07	4.5E-08	2.9E-08	1.4E-08
Tetrachloroethene	0.0020	5.5E-05	1.3E-04	3.0E-05	2.0E-05	9.6E-06
Trichloroethene	0.00050	1.4E-05	3.2E-05	7.5E-06	4.9E-06	2.4E-06
Vinyl chloride	0.00060	1.6E-05	3.8E-05	9.0E-06	5.9E-06	2.9E-06

NOTES:

lwa Lifetime weighted average
CDI Chronic Daily Intake
H-CDI Noncarcinogenic hazard based Chronic Daily Intake
C-CDI Carcinogenic risk based Chronic Daily Intake

Table 10.3.4-10
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Surface Soil Ingestion
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD Used (mg/kg-day	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotien	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Benzo(a)pyrene Equiv.	NA	7.3	ND	ND	2E-06	ND	3E-07	ND	7E-08

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Table 10.3.4-11
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	ABS	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Benzo(a)pyrene Equiv	0.5	NA	14.6	ND	ND	1E-06	ND	4E-07	ND	6E-08

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
ABS Dermal to absorbed dose adjustment factor is applied to adjust Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)

Table 10.3.4-12
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 26
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Semivolatiles (μg/kg)				
Nitrobenzene	1/7	350.0 - 350.0	350.00	130000
Phenanthrene	1/7	36.0 - 36.0	36.00	16000000
Pesticides/PCBs (μg/kg)				
4,4'-DDD	8/15	0.14 - 5.4	1.57	320000
4,4'-DDE	4/15	0.07 - 1.2	0.48	220000
4,4'-DDT	5/15	0.19 - 2.4	1.23	220000
Aroclor-1260	2/15	7.5 - 14	10.75	38000
Dieldrin	1/15	0.09 - 0.09	0.09	4700
Endosulfan I	1/15	0.2 - 0.2	0.20	3200000
Endosulfan II	1/15	0.04 - 0.04	0.04	3200000
Endosulfan sulfate	1/15	0.25 - 0.25	0.25	3200000
gamma-Chlordane	2/15	0.16 - 1.1	0.63	220000
Heptachlor	1/15	0.07 - 0.07	0.07	13000
Inorganics (mg/kg)				
Aluminum (Al)	15/15	72.1 - 1240.0	411.58	760000
Barium (Ba)	6/15	0.59 - 2.5	1.32	52000
Calcium (Ca)	8/15	31.1 - 119.0	55.40	NA
Chromium (Cr) total	15/15	0.64 - 1.9	1.14	3800
Cobalt (Co)	3/15	0.15 - 2.9	1.07	47000
Copper (Cu)	12/15	0.3 - 2.1	0.78	1000000
Iron (Fe)	15/15	96.6 - 1020.0	356.37	NA
Lead (Pb)	11/15	0.4 - 2.6	1.01	1000
Magnesium (Mg)	4/15	29.5 - 64.2	39.55	NA
Manganese (Mn)	15/15	0.86 - 9.9	3.18	27000
Nickel (Ni)	4/15	0.30 - 1.5	0.63	16000

Table 10.3.4-12
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 26
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Inorganics (mg/kg) (Continued)				
Potassium (K)	7/15	26.3 - 45.9	37.47	NA
Selenium (Se)	1/15	1.1 - 1.1	1.1	3900
Sodium (Na)	4/15	239.0 - 253.0	245.20	NA
Vanadium (V)	5/15	0.93 - 2.0	1.37	5500
Zinc (Zn)	15/15	1.3 - 7.5	3.12	230000

Note:
* = Preliminary remediation goal based on the lesser of a hazard-based assessment using a hazard quotient of 1.0 or a risk-based assessment using a cancer risk of 1E-06.

Table 10.3.4-13
Sample Point Estimates of Risk and Hazard
Site 26, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0001	Benzo(a)pyrene Equivalents	203.8	ug/kg	NA	3.3750
0002	No COPCs Detected			NA	NA
0003	No COPCs Detected			NA	NA
0005	Benzo(a)pyrene Equivalents	174.5	ug/kg	NA	2.8900
0006	No COPCs Detected			NA	NA

Table 10.3.4-14
Hazard Quotients and Incremental Lifetime Cancer Risks
Shallow Groundwater Ingestion
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Arsenic	0.0003	1.5	0.43	1.0	1.1E-04	0.15	3.4E-05
Cadmium	0.0005	NA	0.76	1.8	ND	0.27	ND
Dieldrin	5E-05	16	0.014	0.033	6.3E-06	0.0051	2.0E-06
Heptachlor epoxide	1.3E-05	9.1	0.0063	0.015	4.1E-07	0.0023	1.3E-07
Tetrachloroethene	0.01	0.052	0.0055	0.013	1.6E-06	0.0020	5.0E-07
Trichloroethene	0.006	0.011	0.0023	0.0053	8.3E-08	0.00082	2.6E-08
Vinyl chloride	NA	1.9	ND	ND	1.7E-05	ND	5.5E-06
SUM Hazard Index/ILCR			1	3	1E-04	0.4	4E-05

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Table 10.3.4-15
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Contaminants in Shallow Groundwater due to Domestic Use
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation Rf Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Tetrachloroethene	0.01	0.00203	0.0055	0.013	6.1E-08	0.0020	2.0E-08
Trichloroethene	0.006	0.006	0.0023	0.0053	4.5E-08	0.00082	1.4E-08
Vinyl chloride	NA	0.3	ND	ND	2.7E-06	ND	8.7E-07
SUM Hazard Index/ILCR			0.008	0.02	3E-06	0.003	9E-07

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
Oral RfD cross-assigned as inhalation RfD

Table 10.3.4-16
Sample Point Estimates of Risk and Hazard
Site 26, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
Summary of Risk and Hazard resulting from Maximum Concentration						
GS03	01	Arsenic	4.7	ug/L	1.002	104.85
GGS15	01	Cadmium	13.9	ug/L	1.7772	NA
GS03	01	Dieldrin	0.026	ug/L	0.033	6.19
GS03	01	Heptachlor epoxide	0.003	ug/L	0.030	0.81
GS03	01	Tetrachloroethene	2	ug/L	0.026	1.61
		Total			2.9	113
Point Estimates of Risk and Hazard						
GS02	01	No COPCs Detected			NA	NA
GS03	01	Arsenic	4.7	ug/L	1.0015	104.8532
GS03	01	Cadmium	6.2	ug/L	0.7949	NA
GS03	01	Dieldrin	0.026	ug/L	0.0332	6.1871
GS03	01	Heptachlor epoxide	0.003	ug/L	0.0295	0.8121
GS03	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
		Total			1.8847	113.4595
GS04	01	Dieldrin	0.0073	ug/L	0.0093	1.7371
GS04	01	Tetrachloroethene	0.9	ug/L	0.0115	0.7232
GS04	01	Vinyl chloride	0.6	ug/L	NA	19.6321
		Total			0.0208	22.0925
GGS15	01	Cadmium	13.9	ug/L	1.7772	NA
GGS15	01	Dieldrin	0.0045	ug/L	0.0058	1.0708
		Total			1.7829	1.0708

Table 10.3.4-17
Summary of Risk and Hazard-based COCs
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident Iwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Future Tresspasser Hazard Quotien	Future Tresspasser ILCR	Identification of COCs		
Surface Soil	Incidental Ingestion	Benzo(a)pyrene Equiv.	ND	ND	2.3E-06	ND	2.6E-07	ND	5E-08	2		
	Dermal Contact Contact	Benzo(a)pyrene Equiv.	ND	ND	1.0E-06	ND	4.3E-07	ND	4E-08	2		
Surface Soil Pathway Sum			ND	ND	3E-06	ND	7E-07	ND	8E-08			
Groundwater	Ingestion	Arsenic	0.43	1.0	1.1E-04	0.15	3.4E-05	NA	NA	1	2	4
		Cadmium	0.76	1.8	ND	0.27	ND	NA	NA	1		
		Dieldrin	0.01	0.033	6.3E-06	0.0051	2.0E-06	NA	NA		2	4
		Heptachlor epoxide	0.0063	0.015	4.1E-07	0.0023	1.3E-07	NA	NA			
		Tetrachloroethene	0.0055	0.013	1.6E-06	0.0020	5.0E-07	NA	NA		2	
		Trichloroethene	0.0023	0.0053	8.3E-08	0.00082	2.6E-08	NA	NA			
		Vinyl chloride	ND	ND	1.7E-05	ND	5.5E-06	NA	NA		2	4
	Inhalation	Tetrachloroethene	0.0055	0.013	6.1E-08	0.0020	2.0E-08	NA	NA			
		Trichloroethene	0.0023	0.0053	4.5E-08	0.00082	1.4E-08	NA	NA			
		Vinyl chloride	ND	ND	2.7E-06	ND	8.7E-07	NA	NA	2		
Groundwater Pathway Sum			1	3	1E-04	0.4	4E-05	NA	NA			
Sum of All Pathways			1	3	1E-04	0.4	4E-05	ND	8E-08			

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.
5- Chemical is a COC by virtue of projected future adolescent trespasser noncarcinogenic hazard.
6- Chemical is a COC by virtue of projected future adolescent trespasser ILCR.

Table 10.3.4-18
Summary of Risk and Hazard
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	HI (Adult)	HI (Child)	ILCR (LWA)	HI (Worker)	ILCR (Worker)	HI (Tresspasser)	ILCR (Tresspasser)
Surface Soil	Incidental Ingestion	ND	ND	2E-06	ND	3E-07	ND	7E-08
	Dermal Contact	ND	ND	1E-06	ND	4E-07	ND	6E-08
Groundwater	Ingestion	1	3	1E-04	0.4	4E-05	NA	NA
	Inhalation	0.008	0.02	3E-06	0.003	9E-07	NA	NA
Sum of All Pathways		1	3	1E-04	0.4	4E-05	ND	1E-07

Notes:
ILCR Indicates incremental lifetime cancer risk
HI Indicates hazard index

Table 10.3.4-19
Residential-Based Remedial Goal Options Surface Soil
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Slope Factor (mg/kg-day)-1	Reference Dose (mg/kg-day)	FI/FC Factor	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Benzo(a)pyrene equivalents	7.3	NA	1	0.2	ND	ND	ND	0.060	0.60	6.0	NA	0.1

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident for noncarcinogens

Table 10.3.4-20
Remedial Goal Options Groundwater
Site 26
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Oral SF (mg/kg-day)-	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options 0.1 mg/L	1.0 mg/L	3 mg/L	Risk-Based Remedial Goal Options 1E-06 mg/L	1E-05 mg/L	1E-04 mg/L	Background Concentration mg/L	ARAR mg/L
Arsenic	1.5	0.0003	0.0047	0.00047	0.0047	0.014	0.000044	0.00044	0.0044	0.0028	0.05
Cadmium	NA	0.0005	0.014	0.00078	0.0078	0.023	ND	ND	ND	0.0034	0.005
Dieldrin	16	5E-05	0.000026	0.000078	0.00078	0.0023	0.0000041	0.000041	0.00041	NA	0.0001
Tetrachloroethene	0.052	0.01	0.0020	0.0078	0.078	0.23	0.0012	0.012	0.12	NA	0.003
Vinyl chloride	1.9	NA	0.00060	ND	ND	ND	0.000035	0.00035	0.0035	NA	0.001

Industrial RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options 0.1 mg/L	1 mg/L	3 mg/L	Risk-Based Remedial Goal Options 1E-06 mg/L	1E-05 mg/L	1E-04 mg/L	Background Concentration mg/L	ARAR mg/L
Arsenic	1.5	0.0003	0.0047	0.0031	0.031	0.092	0.00014	0.0014	0.014	0.0028	0.05
Dieldrin	16	5E-05	0.000026	0.00051	0.005	0.015	0.000013	0.00013	0.0013	NA	0.0001
Vinyl chloride	1.9	NA	0.00060	ND	ND	ND	0.000094	0.00094	0.0094	NA	0.001

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
\- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinogens

10.3.5 Human Health Risk Assessment for Site 27

10.3.5.1 Site Background and Investigative Approach

Site 27 consists of the area formerly occupied by Building 790 which housed an electric shop, metal plating shop, parts-cleaning room, radium paint room, and a radium dial shop. The building was demolished approximately 10 years ago and the concrete pad that once served as its footing is now a parking lot.

As part of the RI, 43 surface soil locations were sampled and analyzed for full scan TCL/TAL, gross alpha and beta radioactivity, and cyanide. At some surface soil sampling locations, samples were taken at various intervals, from ground surface to 2 feet deep. To provide one concentration for each sample location, data were compared for surface soil samples collected at various depths. The maximum concentration of each parameter at a given sampling location was used to assess risk. Table 10.3.5-1 lists the analytical methods used for soil samples in the Site 27 HHRA.

Twenty-five Phase I groundwater samples were collected from shallow and intermediate interval monitoring wells. Phase I groundwater samples were analyzed for full scan TCL/TAL parameters, including cyanide. Questions were raised about the use of bailers for Phase I sampling because this technique may have caused a high bias for inorganic compounds and a low bias for VOCs. As a result, 16 monitoring wells were resampled using quiescent methods. Phase II samples were analyzed for inorganic, VOC, and SVOC parameters only. Groundwater samples were not filtered prior to analysis. Table 10.3.5-2 provides the analytical methods employed for the corresponding groundwater samples used in the HHRA. Due to incomplete and/or questionable data sets; preliminary conclusions of this HHRA should be interpreted with caution. Supplemental, full scope (all monitoring wells) groundwater sampling and analysis are recommended in advance of any formal remedial design.

10.3.5.2 COPC Identification

Soil

Based on the screening comparisons described in Section 10.2.5 of this RI and presented in Table 10.3.5-3, this HHRA will focus on the COPCs aluminum, arsenic, BEQs, beryllium, cadmium, chromium, dieldrin, lead, manganese, mercury, and silver. Radiological concerns are addressed in a separate technical memorandum (Appendix D).

Groundwater

As shown in Table 10.3.5-4, the COPCs identified in Phase I groundwater for this site are aldrin, aluminum, antimony, arsenic, alpha-BHC, benzene, beryllium, cadmium, chlorobenzene, chloroethane, chloroform, chloromethane, chromium, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,1-DCA, 1,2-DCE (total), 1,1-DCE, dieldrin, heptachlor, heptachlor epoxide, lead, manganese, mercury, 4-methylphenol, nickel, pentachlorophenol, PCE, 1,1,1-TCA, TCE, vanadium, and vinyl chloride. Table 10.3.5-5 presents the screening analysis for Phase II groundwater and identifies chloroform, chromium, 1,4-dichlorobenzene, 1,1-DCA, 1,2-DCA, 1,1-DCE, 1,2-DCE (cis), bis(2-ethylhexyl)phthalate, iron, manganese, pentachlorophenol, PCE, and TCE as COPCs. Ethylbenzene, naphthalene, toluene, and xylene were detected at concentrations within 10% of their RBCs, and were therefore added to the list of Site 27 groundwater COPCs since they were detected in groundwater at other OU 2 sites in excess of the RBC.

Table 10.3.5-6 compares the data of each groundwater sampling phase using the combined list of COPCs. As shown, 16 of the 25 Phase I monitoring wells were resampled in Phase II. Eight of the 16 Phase II wells were analyzed for inorganics, seven were analyzed for VOCs, and six were analyzed for SVOCs. The aquifer is expected to be uniform in the immediate area of Site 27. Phase II data were sufficient to support general conclusions from Phase I. Except for the pesticide fraction, all COPCs identified using Phase I data were also analyzed as part of Phase II.

Sampling techniques used in Phase I apparently amplified inorganic concentrations. As a result, the Phase II groundwater data were used to determine inorganic COPCs. The following were not determined to be COPCs for Site 27: aluminum, antimony, arsenic, beryllium, cadmium, lead, mercury, nickel, and vanadium. Benzene, chlorobenzene, and chloromethane were detected in only one monitoring well each (GI002, benzene and chlorobenzene; GI005, chloromethane) during Phase I and were not detected when the same wells were resampled in Phase II. As a result, these VOCs were eliminated from the COPC list for Site 27 HHRA.

10.3.5.3 Exposure Assessment

Exposure Setting

Site 27 is a three-quarter acre site in the central portion of OU 2, an area that will likely maintain its current use for the next five years. Most of the site is covered with a concrete pad formerly used as a building footing. Surface and near-surface soil sampled during the RI are essentially entombed by the former footing and parking lot pad, precluding receptor exposure to the underlying soil.

Potentially Exposed Populations

Potentially exposed populations are current and future site workers and future site residents. A trespasser scenario was included, although this area is unlikely to attract adolescent trespassers with any significant frequency, and Site 27 is not near the base boundary so as to allow convenient access. In the event of onsite construction, construction workers could be potentially exposed to chemicals in subsurface soil. Therefore construction worker PRGs were calculated as described in Section 10.2.12, and compared with maximum detected chemical concentrations in subsurface soil. The hypothetical future site worker scenario assumed continuous exposure to surface soil and use of groundwater as a source of process and potable water. Current site worker exposure is expected to be less than that assumed for the hypothetical future site worker scenario, because groundwater is not currently a source of potable or process water. The current site trespasser is

characterized as an adolescent who visits the site once a week during the summer. The future site resident scenario assumes that existing buildings would be removed and replaced with dwellings. and that future site residents would use the onsite shallow zone of the underlying aquifers as a drinking water source.

Exposure Pathways

Exposure pathways for the site workers, future resident, and current trespasser are dermal contact and incidental ingestion of surface soil. Additional pathways for future site residents and workers include ingestion of groundwater and inhalation of VOCs through domestic/process use of groundwater. The maximum detected concentration of chromium in surface soil exceeded its soil-to-air SSL, and thus exposure to chromium via dust inhalation was added and evaluated in the formal risk assessment. Uniform exposure was assumed for all sample locations. Table 10.3.5-7 presents the exposure pathways assessed in this HHRA.

Exposure Point Concentrations

Table 10.3.5-8 summarizes the statistical data analysis for COPCs in surface soil. For nondetects, one-half the sample quantitation limits served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL. The EPC for all soil COPCs was set equal to the 95% UCL.

Table 10.3.5-9 summarizes the statistical analysis of the data for COPCs in groundwater. Data from both phases of groundwater sampling were combined to account for the temporal and spatial variance from the statistical methods used for risk assessment. For nondetects, one-half the sample quantitation limits served as proxy concentrations for all COPCs except aldrin, alpha-BHC, heptachlor, and heptachlor epoxide. Nondetects for these pesticides were substituted with one-half the lowest detected concentration, since their SQLs were greater than their maximum detected

concentrations. Table 10.3.5-6 provides the amended data set for groundwater COPCs used to calculate the 95% UCL.

Increased method sensitivity and improved Phase II sampling techniques introduce groundwater data variability beyond the anticipated spatial and temporal trends. Historically, the most conservative method of providing point estimates using data with different degrees of variability was by using the 95% UCL statistic. As mentioned in Section 10.2, the placement of monitoring wells may provide data sets that cause a low bias on the 95% UCL. Additionally, since a plume is difficult to define for most Site 27 groundwater COPCs, the Region IV guidance for groundwater EPCs applies only marginally. As a result, the larger number — either the arithmetic mean of detected concentrations or the 95% UCL — was used as the EPC.

In some cases there were too few data to determine a 95% UCL. When this occurs, maximum concentrations are used the EPCs. The 95% UCL was used as the EPC to estimate exposure to groundwater containing these COPCs: chloroethane, chromium, 1,1-DCA, 1,1-DCE, dieldrin, manganese, toluene, and 1,1,1-TCA. Arithmetic means of detected concentrations were used as EPCs to estimate exposure to groundwater containing aldrin, alpha-BHC, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-DCE (cis), 1,2-DCE (total), ethylbenzene, bis(2-ethylhexyl)phthalate, heptachlor, heptachlor epoxide, 4-methylphenol, naphthalene, pentachlorophenol, PCE, TCE, and xylene. The only detected concentrations of 1,2-DCA and vinyl chloride were used as their EPCs. Because of the poorly defined plume(s) at Site 27, it was determined that a geographical depiction of groundwater risk would assist in interpretation. Groundwater risk maps are presented in Section 10.3.5.5, Risk Characterization.

Quantification of Exposure

Soil

CDIs for ingestion, dermal contact, and inhalation pathways are shown in Tables 10.3.5-10, 10.3.5-11, and 10.3.5-12, respectively.

Groundwater

The CDIs for groundwater ingestion are presented in Table 10.3.5-13. The CDIs for VOC inhalation are assumed to be approximately equal to those for ingestion, as indicated in the *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering* (USEPA, 1991e).

10.3.5.4 Toxicity Assessment

Toxicity assessment terms and methods are discussed in Section 10.2.8 of this report. Table 10.4.1-1 presents toxicological information specific to each COPC identified at Site 27. This information was used to quantify the risk/hazard associated with soil and groundwater contaminants. Brief toxicological profiles for each COPC are provided in Section 10.4.

Toxicity criteria are not available for some of the constituents detected in Site 27 soil and groundwater. The following cross-assignments are based on structural and toxicological similarities between chemicals. Thus, the RBC for gamma-BHC was cross-assigned to delta-BHC; endosulfan was cross-assigned to endosulfan I, endosufan II, and endosulfan sulfate; endrin was cross-assigned to endrin aldehyde and endrin ketone; acenaphthene was cross-assigned to acenaphthylene; and naphthalene was cross-assigned to 2-methylnaphthalene.

10.3.5.5 Risk Characterization

Surface Soil Pathways

Exposure to site surface soil was evaluated under residential, industrial (site worker), and trespasser scenarios for incidental ingestion, dermal contact, and dust inhalation pathways. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.3.5-14, 10.3.5-15, and 10.3.5-16 present the computed carcinogenic risks and/or HQs associated with the incidental ingestion, dermal contact, and inhalation exposure pathways, respectively.

Hypothetical Site Residents

The ingestion, dermal contact, and inhalation ILCR (based on the adult and child residents' LWA) for Site 27 surface soil are 2E-05, 5E-06, and 3E-07, respectively. Arsenic, BEQs, and beryllium were the primary contributors to the ingestion pathway, with BEQs and dieldrin contributing to the dermal pathway. The computed HIs for the adult and child resident were 0.05 and 0.5, respectively, for the soil ingestion pathway. The computed HIs for the adult and child dermal contact pathways were 0.01 and 0.04.

Hypothetical Site Workers

The ingestion, dermal contact, and inhalation ILCRs for the site worker are 2E-06, 2E-06, and 2E-07, respectively. Arsenic, BEQs, and beryllium were the primary contributors for the ingestion and dermal contact pathways. HIs were 0.02 for the ingestion pathway and 0.008 for the dermal pathway.

Hypothetical Adolescent Trespasser

The ingestion, dermal contact, and inhalation ILCRs for the adolescent trespasser are 5E-07, 2E-07, and 2E-08, respectively. HIs for the ingestion and dermal pathways were less than 0.1.

Construction Worker

Table 10.3.3-17 (Section 10.3.3.5) presents a combined summary of Sites 25 and 27 subsurface soil with a comparison to PRGs. As shown, the maximum chemical concentrations reported in Site 27 subsurface soil did not exceed construction worker PRGs.

Point Risk and Point Hazard Estimates for Soil Pathways

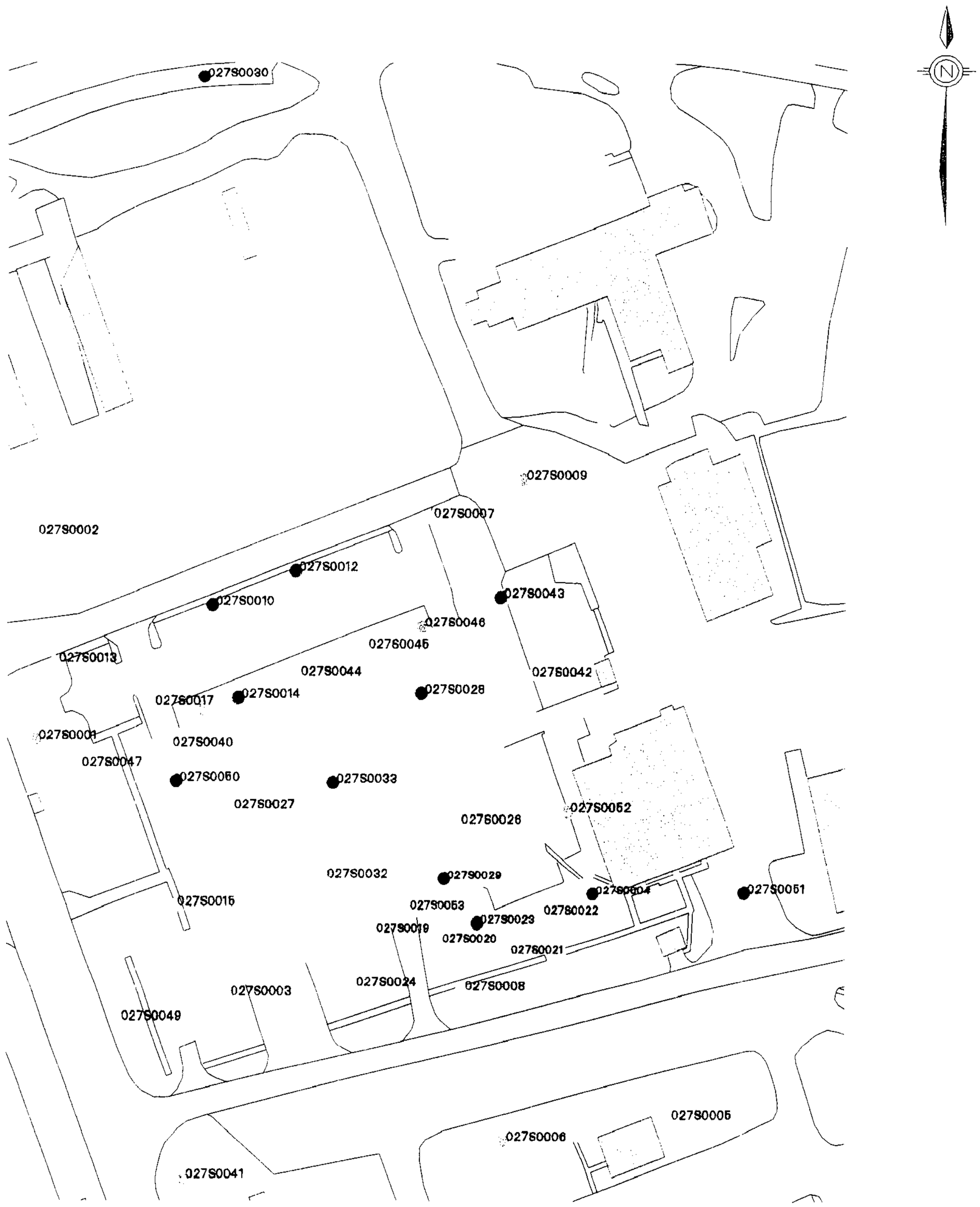
Figures 10-19 and 10-20 are the risk and hazard maps for Site 27 soil. Table 10.3.5-17 details the contributors to risk and hazard at each sampling location. As shown, three of 40 soil locations had reported concentrations equivalent to a cumulative HI greater than unity (1). Primary contributors to the HI were HQs of aluminum, arsenic, cadmium, chromium, and mercury.

Reported concentrations of COPCs in Site 27 soil samples generally equate to a cumulative risk between 1E-06 and 1E-05. Sample location GS004 reported COPC concentrations equivalent to a cumulative risk of 2E-04, almost entirely from BEQs.

Arsenic, the most widespread soil COPC, was detected at soil concentrations equivalent to a risk above 1E-06 in 25 of the 40 samples. Dieldrin is associated with elevated risk at only one location and marginally elevated risk at three others.

Groundwater Pathways

Exposure to site groundwater was evaluated under both residential and industrial scenarios. Exposure pathways were evaluated assuming that site groundwater will be used for potable and/or domestic purposes, and that an unfiltered well will be installed which draws from the corresponding water-bearing zone. For noncarcinogenic contaminants relative to future site residents, hazard was computed separately for child and adult receptors. Tables 10.3.5-18 and 10.3.5-19 present risk and hazard for the ingestion and inhalation pathways, respectively.



LEGEND - RISK VALUES

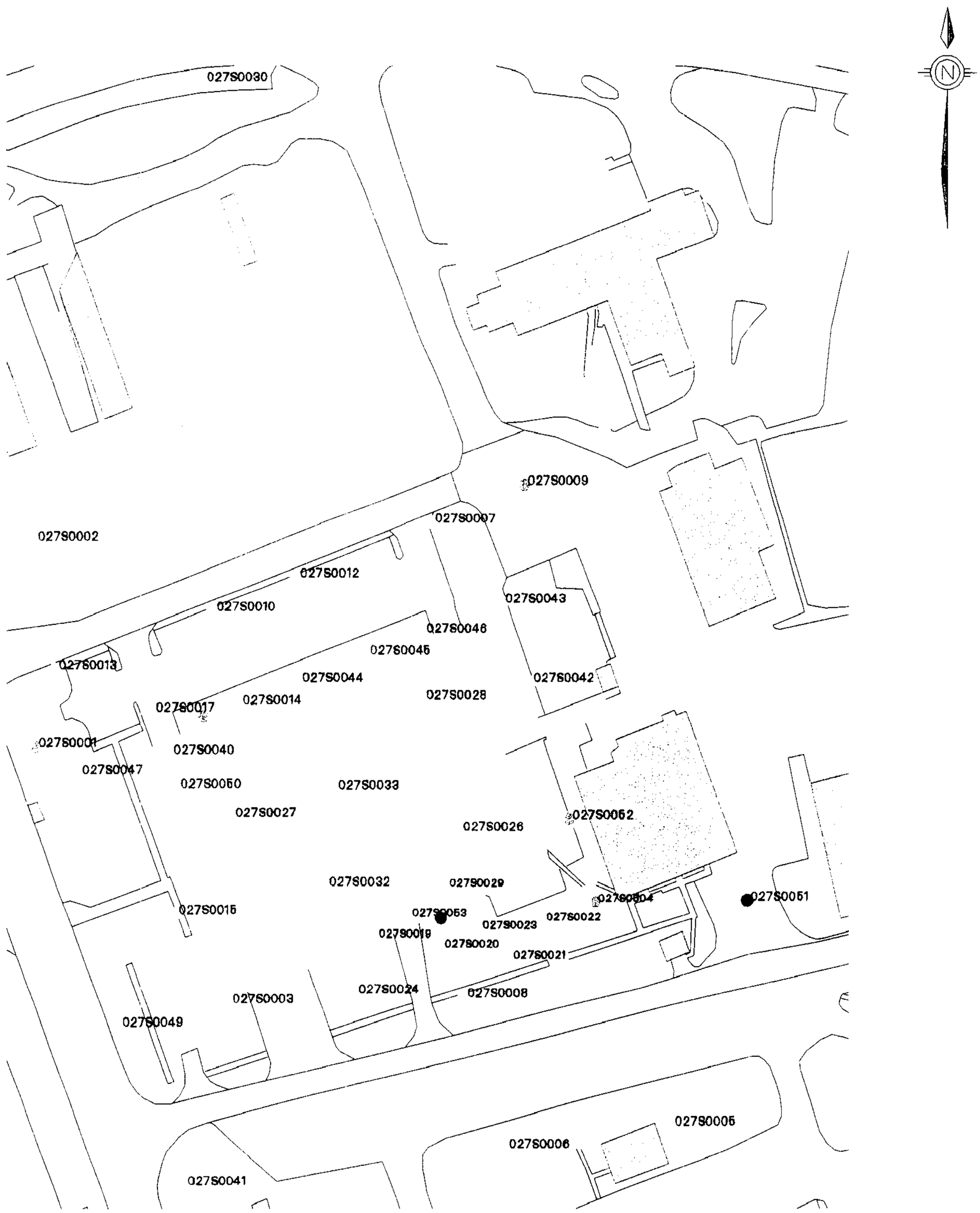
- NA
- < 1E-6
- 1E-6 to 1E-5
- 1.1E-5 to 1E-4
- > 1E-4

0 feet 250

OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-19
SAMPLE POINT ESTIMATES OF RISK
SITE 27, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/soil dir/bomain.aml



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 250

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REMEDIAL INVESTIGATION
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PENSACOLA, FLORIDA

FIGURE 10-20
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 27, SURFACE SOIL
RESIDENTIAL SCENARIO

AML: /home4/pensacola_dir/risk_assess/ou2_dir/soil_dir/bomain.aml

Hypothetical Site Residents

For the ingestion and inhalation pathways, the lifetime weighted average ILCRs for future residents were computed to be 5E-04 and 2E-04, respectively. For the ingestion pathway 1,2-dichloroethane, 1,1-DCE, tetrachloroethene, and vinyl chloride were the primary contributors to risk, with secondary contributions from 1,4-dichlorobenzene, dieldrin, pentachlorophenol, and TCE. For the inhalation pathway, 1,2-DCA, 1,1-DCE, and vinyl chloride were the primary contributors to risk, with secondary contributions from chloroform, 1,4-dichlorobenzene, and TCE. HIs for the adult and child resident were 12 and 28 for the ingestion pathway and 0.8 and 2 for the inhalation pathway, respectively. The primary contributors to ingestion HIs were chromium and manganese, with secondary contributions from 1,1-DCA, 1,1-DCE, 1,2-DCE (total), 4-methylphenol, 1,1,1-TCA, and TCE. The primary contributors to inhalation HIs were 1,2-DCA, 1,1-DCE, 1,2-DCE (total), and TCE.

Hypothetical Site Workers

For the ingestion and inhalation pathways, the ILCRs for future workers were computed to be 2E-04 and 1E-04, respectively. 1,1-DCE, PCE, and vinyl chloride were the primary contributors to ingestion risk. 1,4-Dichlorobenzene, 1,2-DCA, and 1,1-DCE were the primary contributors to inhalation risk. The worker HIs were computed to be 4 and 0.3 for the ingestion and inhalation pathways, respectively. Chromium and manganese were the primary contributors to HI.

Point Risk and Point Hazard Estimates for Groundwater Pathways

Figures 10-21 and 10-22 are the risk and hazard maps for Site 27 groundwater. Table 10.3.5-20 details the contributors to risk and hazard at each monitoring well location. Phase I groundwater data have been used to generate the groundwater risk maps because not all monitoring wells were resampled during Phase II. Phase II data are included in Table 10.3.5-20. Based on Phase I data, 22 of 26 monitoring well locations have concentrations equivalent to a hazard index above unity (1). Much of the cumulative hazard index above one at each location is due to inorganic

COPCs that were eliminated from the risk assessment based on Phase II groundwater data (benzene, chlorobenzene, aluminum, antimony, arsenic, cadmium, and vanadium). Other contributors to elevated HI are chromium, 1,1-DCE, 1,2-DCA, 1,2-DCE (total), manganese, 4-methylphenol, and TCE. Nearly all of the monitoring wells have COPC concentrations equivalent to a cumulative risk above 1E-04. Concentrations of arsenic and beryllium account for almost all of the elevated risk in eight monitoring wells (27GI01, 27GI03, 27GI05, 27GI06, 27GS01, 27GS02, 27GS03, and 27GS06). Arsenic and beryllium were not detected in Phase II monitoring wells and were eliminated as a Site 27 COPC. Apart from these arsenic/beryllium contributions to groundwater risk projections, the reported groundwater concentrations of chlorinated VOCs, including 1,4-dichlorobenzene, 1,1-DCE, 1,2-DCA, dieldrin, chloroform, PCE, and TCE, are associated with risk projections ranging from 1E-06 to 6E-04.

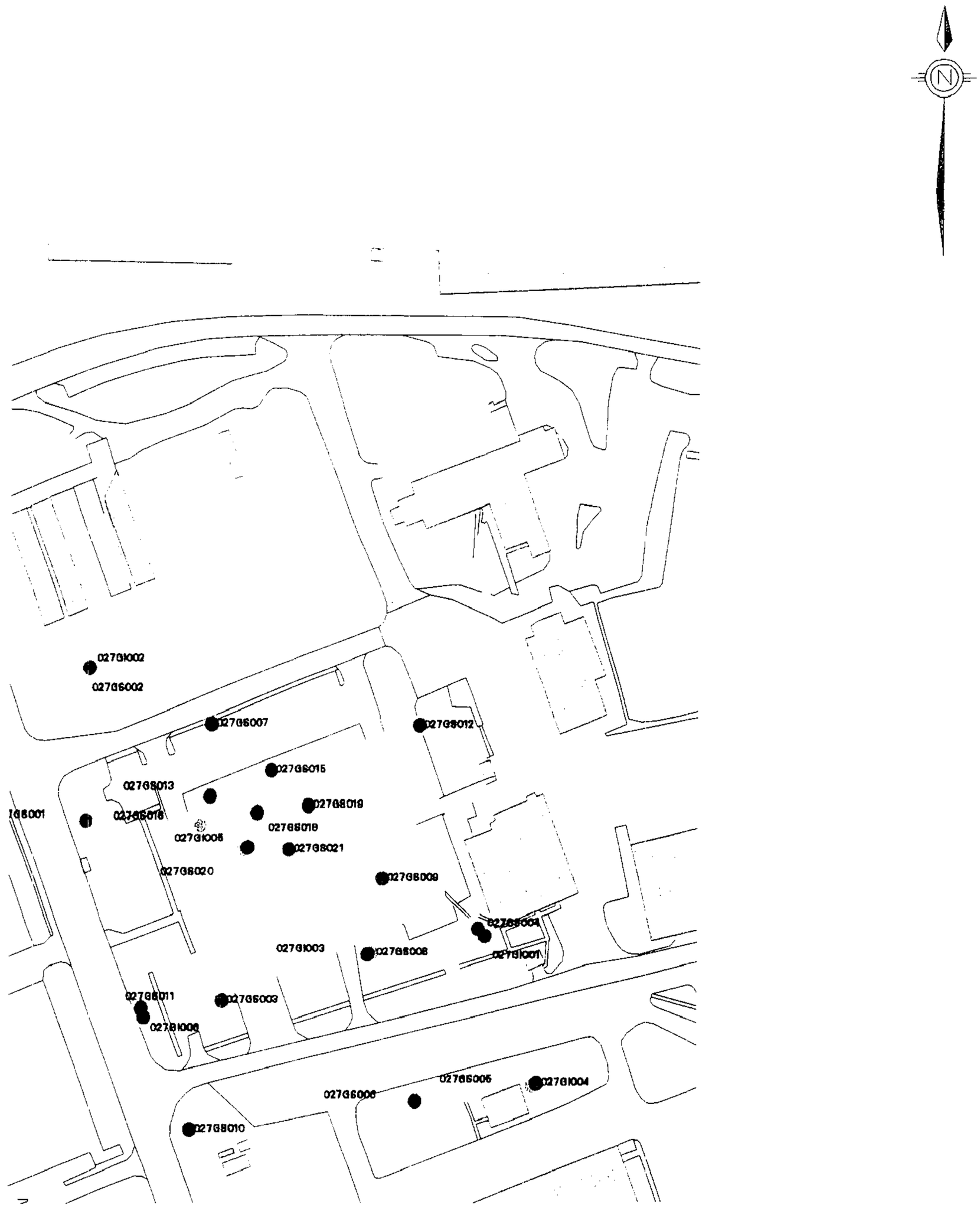
Using maximum concentrations of COPCs in groundwater to provide risk and hazard estimates, as prescribed by FDEP when calculating RME risk and hazard, would yield a residential groundwater pathway risk of 4E-03 and a hazard quotient of 139. This is shown on Table 10.3.5-20 as a summary of point risks and hazards associated with the maximum detected concentrations for each Site 27 groundwater COPC.

Current Site Workers

Groundwater is not currently used as a potable water source at NAS Pensacola. In the absence of a completed exposure pathway, no threat to human health is posed by reported groundwater contamination.

Lead Toxicity

The lead model described earlier was used to assess potential health effects of elevated lead concentrations reported in Site 27 surface soil. Table 10.3.5-21 summarizes the lead model inputs. Default concentrations are used for air (0.1 μg Pb/m^3) and drinking water (4 μg/L)



LEGEND - RISK VALUES

- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 400

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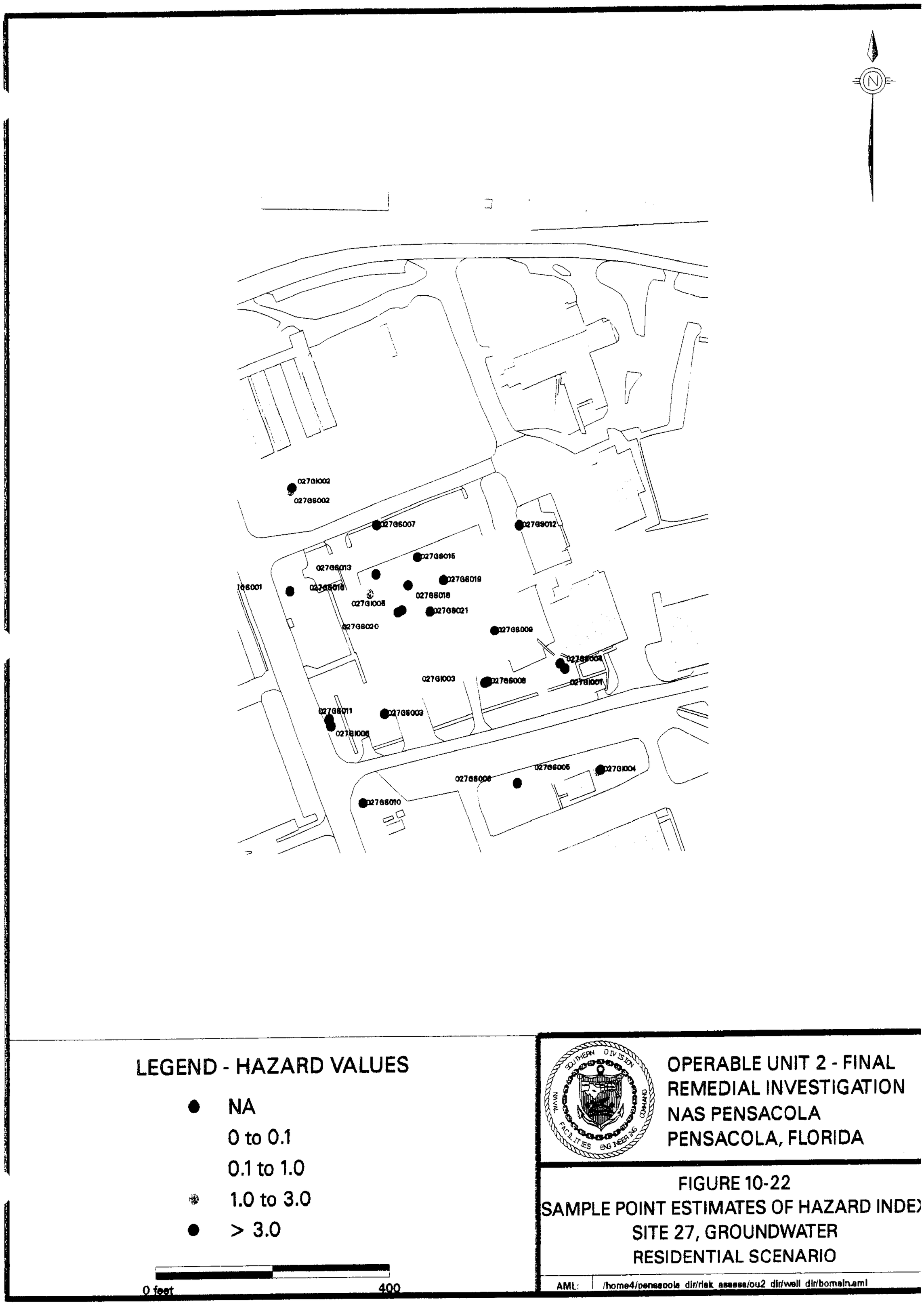
PENSACOLA, FLORIDA

FIGURE 10-21
SAMPLE POINT ESTIMATES OF RISK
SITE 27, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/well dir/bomain.aml



OPERABLE UNIT 2 - FINAL
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-22
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 27, GROUNDWATER
RESIDENTIAL SCENARIO

AML: /home4/pensacola dir/risk assess/ou2 dir/well dir/bomain.aml

exposures, and maternal blood lead level (2.5 μg Pb/dL). The 95% UCL (438 mg/kg) was used as the value for soil and house dust.

Based on this model output, the geometric mean blood concentration is estimated to be 5.7 μg/dL, and the probability of blood lead levels exceeding 10 μg/dL is 10.6% for the hypothetical child receptor. USEPA generally considers media concentrations that result in probability estimates of 5% or less sufficiently protective of potential child receptors. Using the arithmetic mean of detected concentrations for soil (90 mg/kg) produces a geometric mean blood lead level of 2.5 μg/dL with a 0.16% probability of blood lead exceeding 10 μg/dL. Lead concentrations exceed the action level in only two of 40 surface soil samples, so the mean of detected lead concentrations does not exceed the action level. As a result, soil lead concentrations at Site 27 would not require action under this hypothetical exposure scenario.

Lead concentrations in Site 27 Phase I groundwater exceed the action level in 12 of 25 samples; however, lead was not detected in any Phase II groundwater samples. Phase I lead concentrations have been attributed to sediment introduced into the samples by the sampling technique.

COCs Identified

COCs were identified based on cumulative (all pathway) risk and hazard projected for this site. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and HI threshold of 1 (unity). In accordance with FDEP guidance, a COC is any chemical contributing to a cumulative risk level of 1E-6 or greater, and/or a cumulative HI above 1, with an individual ILCR that exceeds 1E-6 or an HQ that exceeds 0.1. For carcinogens, this approach is relatively conservative because a cumulative risk level of 1E-4 (and individual ILCR of 1E-6) is recommended by USEPA Region IV as the trigger for establishing COCs. This COC selection method provides a more comprehensive evaluation of chemicals contributing to carcinogenic risk

or noncarcinogenic hazard during the RGO development process. Table 10.3.5-22 summarizes soil-based COCs and Table 10.3.5-23 summarizes groundwater-based COCs.

Surface Soil

Hypothetical Site Residents (Future Land Use)

Arsenic, BEQs, and beryllium were identified as COCs based on their contributions to the cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

BEQs were identified as COCs based on their contribution to the cumulative ILCR.

Adolescent Trespasser (Current Land Use)

No COCs were identified for the trespasser scenario.

Groundwater

Hypothetical Site Residents (Future Land Use)

Chromium, 1,1-DCA, 1,2-DCA, 1,1-DCE, 1,2-DCE (total), manganese, 4-methylphenol, 1,1,1-TCA, and TCE were identified as groundwater COCs based on contributions to the cumulative HIs. Chloroform, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-DCE, dieldrin, pentachlorophenol, PCE, TCE, and vinyl chloride were identified as COCs based on their contributions to the cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

Chromium, 1,2-dichloroethane, and manganese were identified as groundwater COCs based on their contributions to cumulative HI. 1,2-DCA, 1,1-DCE, PCE, and vinyl chloride were identified as COCs based their contributions to the cumulative ILCR.

10.3.5.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

Residential use of the site is not expected, based on current usage and the nature of surrounding buildings. If this area were to be used as a residential site, the concrete footing would be demolished, and surface soil conditions would likely change dramatically. The surface soil could be covered with landscaping soil and/or a house. Consequently, uniform exposure to current surface soil conditions would not be likely under a true future residential scenario. These factors indicate that exposure pathways assessed in this HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Therefore, risk/hazard projections for groundwater exposure are highly conservative, and associated pathways are not expected to be completed.

Determination of Exposure Point Concentrations

Ninety-five percent UCLs were applied as the EPC to estimate risk and hazard for all soil COPCs. Use of point estimates for exposure modeling is limited because actual exposure may include contact with extremely high and extremely low soil concentrations throughout the day. The 95% UCL considers that this variability provides an upper-bound estimate of the average soil concentration. It is impossible to forecast how redevelopment may alter the distribution of reported soil concentrations.

The 95% UCL, arithmetic mean of detected concentrations, or only the detected concentration of each groundwater COPC was applied as the EPC. Region IV guidance states that the average concentration of each COPC in the most concentrated area of the plume should be used as the EPC. Since a plume cannot be readily defined, this guidance applies only marginally. Phase II groundwater samples taken with improved techniques cast some doubt on the validity of Phase I

Chromium contributes 80% of the HI for Site 27 groundwater. A substantial decrease is seen when Phase I and Phase II groundwater chromium concentrations are compared. Phase I sampling of monitoring wells 27GS10, 27GS04, and 027GI001 produced chromium concentrations of 5.81 mg/L, 2.17 mg/L, and 0.39 mg/L. The same wells, when resampled, produced chromium concentrations of 0.31 mg/L, 0.04 mg/L, and nondetect, respectively.

CT was not formally analyzed for Site 27 groundwater; but a simplified approach was used to show the potential effects of CT analysis, as described earlier. At CT, the residential groundwater pathway-related risk (incidental ingestion and inhalation) would drop from 7E-04 to approximately 1E-4, still exceeding the 1E-6 point of departure. CT analysis for HQs based on residential child exposure, using an exposure frequency of 234 days/year, would drop the HI from 30 (incidental ingestion and dermal contact) to 20.

Iron

Iron was detected in soil at a maximum concentration (13,100 mg/kg) that did not exceed its RBC (23,000 mg/kg; THQ = 1). Iron was detected in groundwater (Phase I) at a maximum concentration (75.6 mg/L) which exceeds its RBC (11 mg/L; THQ = 1). The maximum iron concentration of iron reported in Phase II groundwater samples (4.47 mg/L) did not exceed its RBC. As a result, hazard estimates for groundwater have potentially been underestimated due to the uncertainty associated with the iron reference dose.

10.3.5.7 Risk Summary

Risk and hazard posed by Site 27 contaminants were assessed for the hypothetical site worker and future resident under RME assumptions. For surface soil, the incidental ingestion and dermal contact pathways were assessed in this HHRA. Ingestion and inhalation pathways were evaluated for groundwater. Table 10.3.5-24 summarizes the risk for each pathway/receptor group evaluated for Site 27.

10.3.5.8 Remedial Goal Options

Soil

Surface soil RGOs for carcinogens presented in Table 10.3.5-25 were based on the LWA site resident and adult site worker. Calculation of hazard-based RGOs were based on either the hypothetical child resident or the adult site worker, as noted in the corresponding tables. Both ingestion and dermal exposure are used to calculate soil-based RGOs. The most conservative RGOs for arsenic, BEQs, and beryllium are based on residential exposure and a target risk of 1E-06. All three of these RGOs are lower than the Florida soil cleanup goal. The background concentration for both arsenic and beryllium would equal a risk between 1E-06 and 1E-05.

Groundwater

Groundwater RGOs based on site residents and workers shown in Table 10.3.5-26, were based on the LWA site resident and adult site worker. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker, as noted in the corresponding tables. Both ingestion and inhalation (VOCs only) exposure are used to calculate groundwater-based RGOs. The most conservative RGOs for chloroform, 1,4-dichlorobenzene, 1,2-DCA, 1,1-DCE, dieldrin, pentachlorophenol, PCE, TCE, and vinyl chloride are based on residential exposure and a target risk of 1E-06. The most conservative RGOs for chromium, 1,1-DCA, 1,2-DCE (total), iron, manganese, 4-methylphenol, and 1,1,1-TCA are based on a target HQ of 1. Except for 1,1-DCA, iron, pentachlorophenol, and TCA, all of these RGOs are lower than the FGGC.

Table 10.3.5-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 27

Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
0001	4	4	4	4
0002	4	4	4	4
0003	6	6	6	6
0004	6	6	6	6
0005	6	6	6	6
0006	6	6	6	6
0007	6	6	6	6
0008	6	6	6	6
0009	4	4	4	4
0010	3	3	3	3
0012	3	3	3	3
0013	3	3	3	3
0014	3	3	3	3
0015	2	2	2	2
0017	6	6	6	6
0018	3	3	3	
0019	3	3	3	3
0020	5	5	5	5
0021	3	3	3	3
0022	3	3	3	3
0023	3	3	3	3
0024	3	3	3	3
0026	5	5	5	5
0027	6	6	6	6
0028	3	3	3	3
0029	3	3	3	3
0030	3	3	3	3

Table 10.3.5-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 27

Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
0031	2	2	2	3
0032	3	3	3	3
0033	3	3	3	3
0040	5	5	5	5
0041	5	5	5	5
0042	3	3	3	3
0043	3	3	3	3
0044	3	3	3	3
0045	3	3	3	3
0046	3	3	3	3
0047	3	3	3	3
0049	3	3	3	3
0050	3	3	3	3
0051	3	3	3	7
0052	7	7	7	7
0053	7	7	7	7

Notes:
Legend:
1 = Surface soil interval (within the top 6 inches)
2 = Surface soil interval (0-1 foot)
3 = Surface soil interval (0-2 feet)
4 = Two surface soil samples were collected at this location, one within the top 6 inches and one from the next interval down to 1 foot.
5 = Two surface soil samples were collected at this location, one within the top 6 inches and one from the next interval down to 2 feet.
6 = Two surface soil samples were collected at this location, one from the 0 to 1 foot interval and one from the 1 to 2 foot interval.
7 = Three surface soil samples were collected at this location, one from the top 6 inches, one from the next interval down to 1 foot, and one from 1 to 2 feet.

Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides: Method 8080
Volatile Organic Analysis: Method 8240
Semivolatile Organic Analysis: Method 8720

Table 10.3.5-2
Samples and Analytical Methods Used for Risk Assessment
Groundwater at Site 27

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
Intermediate	I001	1	1	1	1, 2
	I002	1	1	1, 2	1
	I003	1	1	1	1
	I004	1	1	1	1
	I005	1	1	1	1
	I006	1	1	1	1
Shallow	GS02	1	1	1	1, 2
	S001	1	1	1	1, 2
	S002	1	1	1, 2	1
	S003	1	1	1	1,2
	S004	1	1	1, 2	1, 2
	S005	1	1	1	1
	S006	1	1, 2	1	1
	S007	1	1	1	1, 2
	S008	1	1	1	1
	S009	1	1	1	1
	S010	1	1	1, 2	1, 2
	S011	1	1	1, 2	1
	S013	1	1	1	1
	S015	1	1, 2	1	1, 2
	S016	1	1	1	1
	S018	1	1, 2	1	1
	S019	1	1, 2	1, 2	1
	S020	1	1, 2	1	1
	S021	1	1, 2	1, 2	1

Notes:
1 = Sample collected during Phase I
2 = Sample collected during Phase II

Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides: Method 8080
Volatile Organic Analysis: Method 8240
Semivolatile Organic Analysis: Method 8720

Table 1(
Chemicals . resent in Site Samples
Site 27, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration Soil to air RBC		SSL		Reference	Units	Number Exceeding RBC	Ref.
Carcinogenic PAHs																
Benzo(a)pyrene Equivalents	C	13	41	4.07	9526.4	1030	739.52	15252.6	88	a	NA		NA	ug/kg	8	
Benzo(a)anthracene	C	10	41	59	9500	1290	320	6600	880	a	NA		NA	ug/kg	2	
Benzo(b)fluoranthene	C	13	41	37	13000	1440	320	6600	880	a	NA		NA	ug/kg	2	
Chrysene	N	11	41	50	6400	870	320	6600	88000	a	NA		NA	ug/kg		
Dibenz(a,h)anthracene	C	4	41	59	1200	383	320	6600	88	a	NA		NA	ug/kg	3	
Indeno(1,2,3-cd)pyrene	C	7	41	49	3400	674	320	6600	880	a	NA		NA	ug/kg	1	
Benzo(k)fluoranthene	C	12	41	37	13000	1560	320	6600	8800	a	NA		NA	ug/kg	1	
Benzo(a)pyrene	C	9	41	40	5600	894	320	6600	88	a	NA		NA	ug/kg	8	
Inorganics																
Aluminum	C	40	40	660	30200	4830	NA	NA	7800	a	NA		3833.36	mg/kg	6	11
Antimony	N	1	40	9.5	9.5	9.5	7.2	10.9	3.1	a	NA		9.5	mg/kg	1	
Arsenic	C	25	40	0.76	5.9	2.22	0.61	0.97	0.43	a	750	c	1.56	mg/kg	25	15
Barium	N	39	40	1.1	35.8	7.88	1.8	1.8	550	a	690000	c	4.63	mg/kg		18
Beryllium	C	1	40	0.44	0.44	0.44	0.2	0.97	0.15	a	1300	c	0.41	mg/kg	1	1
Cadmium	C	13	40	1.1	67.1	11.9	0.62	1.2	3.9	a	1800	c	1	mg/kg	12	13
Calcium	N	40	40	29.9	92500	5380	NA	NA	NA		NA		912.37	mg/kg		12
Chromium	C	31	40	2.2	314	43	1.6	2.2	39	a	270	c	6.13	mg/kg	6	21
Hexavalent Chromium	N	1	2	0.152	0.152	0.15	0.01	0.01	NA		270	c		mg/kg		
Cobalt	N	1	40	2.7	2.7	2.7	1.6	2.2	470	a	NA		1.87	mg/kg		1
Copper	N	23	40	1.1	137	20.2	0.82	5.4	310	a	NA		5.74	mg/kg		14
Cyanide	N	3	40	0.93	3	1.62	0.5	0.61	160	a	NA		0.52	mg/kg		3
Iron	U	40	40	291	13100	3410	NA	NA	2300	a	NA		2745	mg/kg	13	13
Lead	C	39	40	0.76	1550	90.3	3.4	3.4	400	b	NA		7.32	mg/kg	2	16
Magnesium	N	30	40	68.2	1470	215	29.4	103	NA		NA		133.33	mg/kg		14
Manganese	C	29	40	3.3	636	71.3	1.3	6.3	180	a	NA		21.36	mg/kg	2	14
Mercury	C	14	40	0.11	84	7.59	0.1	0.11	2.3	a	NA		0.1	mg/kg	3	14
Nickel	N	8	40	4.6	20.1	8.7	3.5	8.5	160	a	13000	c	6.38	mg/kg		4
Potassium	N	1	40	535	535	535	263	553	NA		NA		460.67	mg/kg		1
Silver	C	3	40	0.87	156	53.1	0.81	2.2	39	a	NA		2.07	mg/kg	1	2
Sodium	N	19	40	38.2	741	144	23.1	163	NA		NA		107.85	mg/kg		5
Vanadium	N	36	40	2.3	41.9	8.18	1.3	4.2	55	a	NA		5.83	mg/kg		11
Zinc	N	36	40	2	473	71	0.65	5.9	2300	a	NA		16.87	mg/kg		19
Pesticides and PCBs																
Aldrin	N	8	41	0.074	0.98	0.33	0.05	2	38	a	3000	c	NA	ug/kg		
Aroclor-1254	N	1	41	8.3	8.3	8.3	33	39	83	a	NA		NA	ug/kg		
Aroclor-1260	N	8	41	2.5	62	27.4	33	39	83	a	NA		NA	ug/kg		
beta-BHC	N	1	41	0.85	0.85	0.85	1.7	2	350	a	NA		NA	ug/kg		
alpha-BHC	N	3	41	0.1	1.4	0.61	1.7	2	100	a	800	c	NA	ug/kg		
delta-BHC	N	8	41	0.063	0.53	0.29	1.7	2	100	a	NA		NA	ug/kg		
gamma-BHC (Lindane)	N	1	41	0.43	0.43	0.43	1.7	2	490	a	NA		NA	ug/kg		
alpha-Chlordane	N	10	41	0.14	21	3.29	0.087	2	470	a	20000	c	NA	ug/kg		
gamma-Chlordane	N	12	41	0.11	4.2	1	0.067	2	470	a	20000	c	NA	ug/kg		
4,4'-DDD	N	13	41	0.17	17	3.94	3.3	3.9	2700	a	NA		NA	ug/kg		
4,4'-DDE	N	18	41	0.14	56	7.13	0.27	3.7	1900	a	NA		NA	ug/kg		
4,4'-DDT	N	21	41	0.11	150	17	3.3	3.9	1900	a	NA		NA	ug/kg		
Dieldrin	C	19	41	0.079	800	70.7	0.12	3.9	40	a	1000	c	NA	ug/kg	4	
Endosulfan I	N	3	41	0.084	0.22	0.14	1.7	2	47000	a	NA		NA	ug/kg		
Endosulfan II	N	1	41	3.3	3.3	3.3	3.3	3.9	47000	a	NA		NA	ug/kg		

Table 10.3.5-3
Chemicals Present in Site Samples
Site 27, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration Soil to air RBC		SSL		Reference	Units	Number Exceeding RBC	Ref.
Endosulfan sulfate	N	8	41	0.1	2.2	0.94	0.31	3.9	47000	a	NA		NA	ug/kg		
Endrin	N	5	41	0.071	1.9	0.51	3.3	3.9	2300	a	NA		NA	ug/kg		
Endrin aldehyde	N	8	41	0.47	3.4	1.43	3.3	3.9	2300	a	NA		NA	ug/kg		
Endrin ketone	N	5	41	0.19	3	1.61	0.24	3.9	2300	a	NA		NA	ug/kg		
Heptachlor	N	2	41	0.076	0.52	0.3	1.7	2	140	a	100	c	NA	ug/kg		
Heptachlor epoxide	N	15	41	0.046	3.1	0.61	1.7	2	70	a	5000	c	NA	ug/kg		
Methoxychlor	N	7	41	0.4	69	26.3	17	20	39000	a	NA		NA	ug/kg		
Semivolatile Organics																
Acenaphthene	N	2	41	350	1800	1080	320	6600	470000	a	NA		NA	ug/kg		
Acenaphthylene	N	1	41	34	34	34	320	6600	310000	a	NA		NA	ug/kg		
Anthracene	N	3	41	58	3200	1360	320	6600	2300000	a	NA		NA	ug/kg		
Benzo(g,h,i)perylene	N	6	41	73	4400	883	320	6600	310000	a	NA		NA	ug/kg		
bis(2-Ethylhexyl)phthalate	N	4	41	73	5700	1630	36	6600	46000	a	3.1E+07	c	NA	ug/kg		
Butylbenzylphthalate	N	3	41	200	330	257	36	6600	1600000	a	930000	c	NA	ug/kg		
Carbazole	N	3	41	48	3000	1270	320	6600	32000	a	NA		NA	ug/kg		
Dibenzofuran	N	2	41	210	770	490	320	6600	31000	a	NA		NA	ug/kg		
Di-n-butylphthalate	N	1	41	160	160	160	320	990	780000	a	2300000	c	NA	ug/kg		
Di-n-octyl phthalate	N	1	41	46	46	46	320	6600	160000	a	1E+07	c	NA	ug/kg		
Fluoranthene	N	11	41	40	19000	2320	320	6600	310000	a	NA		NA	ug/kg		
Fluorene	N	2	41	400	1500	950	320	6600	310000	a	NA		NA	ug/kg		
2-Methylnaphthalene	N	1	41	62	62	62	320	6600	310000	a	NA		NA	ug/kg		
Naphthalene	N	2	41	140	440	290	320	6600	310000	a	NA		NA	ug/kg		
Phenanthrene	N	7	41	56	15000	2790	320	6600	310000	a	NA		NA	ug/kg		
Phenol	N	1	41	930	930	930	320	6600	4700000	a	NA		NA	ug/kg		
Pyrene	N	12	41	38	14000	1520	320	6600	230000	a	NA		NA	ug/kg		
Volatile Organics																
Chloroform	N	1	42	23	23	23	10	12	100000	a	300	c	NA	ug/kg		
4-Methyl-2-Pentanone	N	1	42	1	1	1	10	12	630000	a	NA		NA	ug/kg		
Tetrachloroethene	N	1	42	10	10	10	10	12	12000	a	11000	c	NA	ug/kg		
Xylene (Total)	N	1	42	1	1	1	10	12	16000000	a	410000	c	NA	ug/kg		
Miscellaneous																
Ac-228	N	2	3	0.25	0.26	0.26	0.06	0.06	NA		NA		NA	Pci/g		
Bi-214	N	2	3	0.27	0.65	0.46	0.05	0.05	NA		NA		NA	Pci/g		
Th-234	N	1	3	1.39	1.39	1.39	0.48	0.59	NA		NA		NA	Pci/g		

C - Selected as a COPC based on the screening process explained in Section 10.2.5
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5
U - Iron toxicity is qualitatively discussed in the uncertainty section.
PAHs - Polynuclear Aromatic Hydrocarbons
SQL - Sample Quatitation Limits
a - USEPA Region III residential risk-based concentration
b - USEPA's action level of lead in soil
c - USEPA Soil Screening Guidance

Table 1C
Chemicals . .esent in Site Samples
Site 27, Groundwater, Phase I
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium	N	25	25	4710	77200	20500	NA	NA	NA	NA	17560	ug/L		8
Magnesium	N	25	25	1250	10200	3860	NA	NA	NA	NA	2872.6	ug/L		14
Potassium	N	21	25	1710	29700	6110	1270	5360	NA	NA	12167.6	ug/L		2
Sodium	N	25	25	1880	28700	10300	NA	NA	NA	NA	18.345	ug/L		2
Inorganics														
Aluminum	C	25	25	2180	102000	23300	NA	NA	3700	RBC	3882.8	ug/L	21	21
Antimony	C	8	25	38.5	61.1	50.2	35	35	1.5	RBC	30.2	ug/L	8	8
Arsenic	C	17	25	4	93.6	18.3	4	40	0.045	RBC	2.8	ug/L	17	17
Barium	B	25	25	12.7	147	53.5	NA	NA	260	RBC	13.2	ug/L		24
Beryllium	C	6	25	1.2	3.5	2.12	1	1.6	0.016	RBC	1.1	ug/L	6	6
Cadmium	C	5	25	4.2	63.6	20.2	3	4.1	1.8	RBC	3.4	ug/L	5	5
Chromium	C	21	25	8	5810	430	8	8	18	RBC	35	ug/L	15	9
Cobalt	B	3	25	9.9	26.9	16.1	9	13.9	220	RBC	4.1	ug/L		3
Copper	B	17	25	8.8	96.1	27.7	6.6	34.3	150	RBC	16.2	ug/L		9
Cyanide	N	1	25	13.9	13.9	13.9	10	10	73	RBC	NA	ug/L		
Iron	U	25	25	1620	75600	19400	NA	NA	1100	RBC	1707.8	ug/L	25	24
Lead	C	21	25	3.3	128	36.7	2	4.7	15	TTAL	1.6	ug/L	12	21
Manganese	C	25	25	17.7	1150	156	NA	NA	84	RBC	22	ug/L	11	23
Mercury	C	10	25	0.2	1.2	0.423	0.2	0.2	1.1	RBC	0.2	ug/L	1	10
Nickel	C	8	25	19.6	110	44.5	18	18	73	RBC	39.9	ug/L	1	2
Vanadium	C	22	25	9	260	52.3	6	6	26	RBC	9.6	ug/L	12	21
Zinc	B	23	25	31.5	314	94.2	26.6	42.6	1100	RBC	153.2	ug/L		3
Pesticides														
Aldrin	C	2	25	0.0022	0.0045	0.0034	0.05	0.05	0.004	RBC	NA	ug/L	1	
alpha-BHC	C	4	25	0.0009	0.026	0.008	0.05	0.05	0.011	RBC	NA	ug/L	1	
beta-BHC	N	1	25	0.0058	0.0058	0.0058	0.05	0.05	0.037	RBC	NA	ug/L		
gamma-BHC (Lindane)	N	3	25	0.0036	0.016	0.011	0.05	0.05	0.052	RBC	NA	ug/L		
alpha-Chlordane	N	1	25	0.016	0.016	0.016	0.05	0.05	0.052	RBC	NA	ug/L		
4,4'-DDE	N	1	25	0.037	0.037	0.037	0.1	0.1	0.1	FDEP	NA	ug/L		
4,4'-DDT	N	2	25	0.0029	0.032	0.0175	0.1	0.1	0.1	FDEP	NA	ug/L		
Dieldrin	C	5	25	0.0021	0.0095	0.005	0.1	0.1	0.0042	RBC	NA	ug/L	2	
Endosulfan sulfate	N	1	25	0.0031	0.0031	0.0031	0.1	0.1	0.3	FDEP	NA	ug/L		
Heptachlor	C	2	25	0.0016	0.0024	0.002	0.0058	0.1	0.0023	RBC	NA	ug/L	1	
Heptachlor epoxide	C	2	25	0.0032	0.0066	0.0049	0.05	0.05	0.0012	RBC	NA	ug/L	2	
Methoxychlor	N	3	25	0.0059	0.031	0.015	0.5	0.5	18	RBC	NA	ug/L		
Semivolatile Organics														
4-Chloro-3-methylphenol	N	1	25	1	1	1	10	20	3000	FDEP	NA	ug/L		
1,2-Dichlorobenzene	C	2	25	4	45	24.5	10	20	27	RBC	NA	ug/L	1	
1,3-Dichlorobenzene	N	1	25	4	4	4	10	20	54	RBC	NA	ug/L		
1,4-Dichlorobenzene	C	1	25	15	15	15	10	20	0.44	RBC	NA	ug/L	1	
Diethylphthalate	N	1	25	1	1	1	10	20	2900	RBC	NA	ug/L		
2,4-Dimethylphenol	N	5	25	2	11	5.2	10	10	73	RBC	NA	ug/L		
2-Methylnaphthalene	N	4	25	1	28	10.5	10	10	150	RBC	NA	ug/L		
4-Methylphenol (p-Cresol)	C	6	25	2	100	26	10	10	18	RBC	NA	ug/L	2	
Naphthalene	N	9	25	3	110	20.8	10	10	150	RBC	NA	ug/L		
4-Nitrophenol	N	1	25	1	1	1	25	50	15	FDEP	NA	ug/L		
Pentachlorophenol	C	2	25	1	2	1.5	25	50	0.56	RBC	NA	ug/L	2	
Phenol	N	9	25	1	130	17.8	4	20	2200	RBC	NA	ug/L		

Table 10.3.5-4
Chemicals Present in Site Samples
Site 27, Groundwater, Phase I
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Volatile Organics														
Benzene	C	1	25	25	25	25	10	100	0.36	RBC	NA	ug/L	1	
Chlorobenzene	C	1	25	95	95	95	10	100	3.9	RBC	NA	ug/L	1	
Chloroethane	C	10	25	25	190	90.9	10	10	140	FDEP	NA	ug/L	3	
Chloroform	C	3	25	1	4	2.33	1	100	0.15	RBC	NA	ug/L	3	
Chloromethane	C	1	25	3	3	3	10	100	1.4	RBC	NA	ug/L	1	
1,1-Dichloroethane	C	19	25	2	300	61.2	10	10	81	RBC	NA	ug/L	4	
1,1-Dichloroethene	C	14	25	1	51	13.2	10	100	0.044	RBC	NA	ug/L	14	
1,2-Dichloroethene (total)	C	4	25	1	130	39.3	10	17	5.5	RBC	NA	ug/L	2	
Ethylbenzene	N	7	25	2	63	17.1	10	17	130	RBC	NA	ug/L		
Tetrachloroethene	C	7	25	1	62	19.3	10	10	1.1	RBC	NA	ug/L	6	
Toluene	N	3	25	3	53	20	10	100	75	RBC	NA	ug/L		
1,2,4-Trichlorobenzene	N	2	25	1	3	2	10	20	19	RBC	NA	ug/L		
1,1,1-Trichloroethane	C	17	25	1	300	40.2	10	100	79	RBC	NA	ug/L	2	
Trichloroethene	C	5	25	1	130	28.2	10	100	1.6	RBC	NA	ug/L	4	
Vinyl chloride	C	1	25	4	4	4	10	100	0.019	RBC	NA	ug/L	1	
Xylene (Total)	N	9	25	1	640	143	10	17	1200	RBC	NA	ug/L		

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B - The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
U - Iron toxicity is addressed qualitatively in the uncertainty section.
SQL - Sample Quatitation Limits
RBC - USEPA Region III residential risk-based concentration
TTAL - Treatment technique action level
FDEP - Florida risk-based groundwater guidance concentration

Table 10.3.5-5
Chemicals Present in Site Samples
Site 27, Groundwater, Phase II
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium (Ca)	N	8	8	1350	26400	17400	NA	NA	NA	NA	17560	ug/L		5
Magnesium (Mg)	N	8	8	786	2980	1690	NA	NA	NA	NA	2872.6	ug/L		1
Potassium (K)	N	8	8	1110	4280	2540	NA	NA	NA	NA	12167.6	ug/L		
Sodium (Na)	N	8	8	2590	10300	6610	NA	NA	NA	NA	18345	ug/L		
Inorganics														
Aluminum (Al)	N	1	8	755	755	755	12	194	3700	RBC	3882.8	ug/L		
Antimony (Sb)	R	1	8	2.9	2.9	2.9	2.3	2.3	1.5	RBC	30.2	ug/L	1	
Barium (Ba)	B	2	8	22.3	38.8	31	3.9	12	260	RBC	13.2	ug/L		2
Chromium (Cr)	C	2	8	39.9	309	174	0.64	1.9	18	RBC	35	ug/L	2	2
Cobalt (Co)	N	1	8	0.77	0.77	0.77	0.67	1.2	220	RBC	4.1	ug/L		
Iron (Fe)	U	5	8	543	4470	1560	10.8	17.9	1100	RBC	1707.8	ug/L	1	1
Manganese (Mn)	C[1]	4	8	24.2	371	121	0.32	9.5	84	RBC	22	ug/L	1	4
Mercury (Hg)	N	3	8	0.06	0.09	0.07	0.06	0.06	1.1	RBC	0.2	ug/L		
Vanadium (V)	N	2	8	1.2	4.2	2.7	0.76	1.2	26	RBC	9.6	ug/L		
Zinc (Zn)	N	1	8	72.8	72.8	72.8	1.3	15.8	1100	RBC	153.2	ug/L		
Semivolatile Organics														
Butylbenzylphthalate	N	4	6	0.58	1	0.852	10	10	730	RBC	NA	ug/L		
Di-n-butylphthalate	N	1	6	0.41	0.41	0.41	10	10	370	RBC	NA	ug/L		
Di-n-octyl phthalate	N	1	6	0.22	0.22	0.22	10	10	73	RBC	NA	ug/L		
1,2-Dichlorobenzene	N	1	11	5	5	5	1	10	27	RBC	NA	ug/L		
1,3-Dichlorobenzene	N	1	11	0.7	0.7	0.7	1	10	54	RBC	NA	ug/L		
1,4-Dichlorobenzene	C	1	11	2	2	2	1	10	0.44	RBC	NA	ug/L	1	
bis(2-Ethylhexyl)phthalate	C	6	6	2	9.3	4.35	NA	NA	4.8	RBC	NA	ug/L	2	
2-Methylnaphthalene	N	2	6	4.5	6.3	5.4	10	10	150	RBC	NA	ug/L		
3-Methylphenol/4-Methylphenol	N	1	6	20	20	20	10	10	0	RBC	NA	ug/L		
Naphthalene	N	2	6	49	50	49.5	6.8	6.8	150	RBC	NA	ug/L		
Pentachlorophenol	C	1	6	1.7	1.7	1.7	1	1	0.56	RBC	NA	ug/L	1	
Volatile Organics														
Acetone	N	1	7	4	4	4	5	13	370	RBC	NA	ug/L		
Chloroethane	N	5	7	2	22	8.4	1	1	140	FDEP	NA	ug/L		
Chloroform	C	2	7	0.4	4	2.2	1	1	0.15	RBC	NA	ug/L	2	
1,1-Dichloroethane	C	5	7	3	260	81.4	1	1	81	RBC	NA	ug/L	2	
1,2-Dichloroethane	C	1	7	37	37	37	1	1	0.12	RBC	NA	ug/L	1	
1,1-Dichloroethene	C	2	7	12	110	61	1	1	0.044	RBC	NA	ug/L	2	
cis-1,2-Dichloroethene	C	4	7	2	25	11.8	1	1	6.1	RBC	NA	ug/L	2	
Ethylbenzene	N	1	7	10	10	10	1	1	130	RBC	NA	ug/L		
Tetrachloroethene	C	6	7	0.4	32	7.73	1	1	1.1	RBC	NA	ug/L	4	
Toluene	N	2	7	0.1	5	2.55	1	1	75	RBC	NA	ug/L		
1,2,4-Trichlorobenzene	N	1	6	0.48	0.48	0.48	10	10	19	RBC	NA	ug/L		
1,1,1-Trichloroethane	N	2	7	2	51	26.5	1	320	79	RBC	NA	ug/L		
Trichloroethene	C	4	7	1	17	7	1	1	1.6	RBC	NA	ug/L	3	
Xylene (Total)	N	1	7	79	79	79	1	1	1200	RBC	NA	ug/L		

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B - The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
U - Iron toxicity is addressed qualitatively in the uncertainty section
SQL - Sample Quatitation Limits
RBC - USEPA Region III residential risk-based concentration
FDEP - Florida risk-based groundwater guidance concentration

Table 10.3.5-6
Comparison of Phase I and II Groundwater Data
Site 27
Naval Air Station Pensacola
Pensacola, Florida

Parameter	Phase I units are in micrograms per liter (ug/L)																					
	GGS02	GI001	GI002	GI003	GI004	GI005	GI006	GS001	GS002	GS003	GS004	GS005	GS006	GS007	GS008	GS009	GS010	GS011	GS013	GS015	GS016	GS018
Aldrin	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0022	0.001	0.001	0.001	0.001	0.0045
Aluminum	39500	102000	27600	22000	33800	15500	57600	20400	4070	60900	10000	5860	41500	12400	3270	7080	43200	12900	10200	14100	2930	3010
Antimony	17.5	59.9	17.5	39.2	17.5	17.5	17.5	61.1	17.5	17.5	48	17.5	38.5	17.5	43.6	17.5	61	17.5	17.5	17.5	17.5	17.5
Arsenic	8.1	93.6	23.1	15.4	30.5	17.5	44.3	4.7	2	12.4	20	2	7.6	2	2	2	12.3	5	8.7	8.3	2	4
alpha-BHC	0.00045	0.0009	0.00045	0.0009	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.00045	0.026
Benzene	5	5	25	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8.5	5	5	5	50
Beryllium	2.6	3.5	0.5	0.5	1.6	0.5	2.5	0.5	0.5	1.3	0.5	0.5	1.2	0.5	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5
Cadmium	2.05	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	5.1	1.5	1.5	4.2	1.5	1.5	1.5	19.6	1.5	63.6	1.5	1.5	8.3
Chlorobenzene	5	5	95	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8.5	5	5	5	50
Chloroethane	5	5	5	5	5	5	5	25	5	5	5	5	55	5	5	5	5	84	140	39	160	33
Chloroform	5	5	5	5	1	5	5	5	5	5	5	0.5	2	5	5	5	5	4	5	5	5	50
Chloromethane	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5	8.5	5	5	5	50
Chromium	10.3	392	47.3	33.1	66.3	31.2	119	15.1	8.8	99.6	2170	14.5	46.4	21.5	13.4	28.4	5810	30	4	20.9	8	4
1,2-Dichlorobenzene	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	45	5	5	5	5	5
1,4-Dichlorobenzene	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	15	5	5	5	5	5
1,1-Dichloroethane	6	10	3	10	8	10	10	12	10	60	17	7	300	10	2	16	7	300	92	110	40	20
1,2-Dichloroethane																						
1,1-Dichloroethene	1	5	5	5	14	5	5	5	5	4	51	3	5	5	6	31	10	26	13	4	4	50
1,2-Dichloroethene (cis)																						
1,2-Dichloroethene (total)	5	5	2	5	5	5	5	5	5	5	1	5	5	5	5	5	5	8.5	5	5	5	24
Dieldrin	0.0095	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0021	0.005	0.005	0.005	0.0022	0.005	0.005	0.0064	0.005	0.005	0.005	0.005
Ethylbenzene	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8.5	3	2	5	42
bis(2-Ethylhexyl)phthalat																						
Heptachlor	0.0008	0.0016	0.0008	0.0024	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
Heptachlor epoxide	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0032	0.0016	0.0016	0.0016	0.0016	0.0016
Lead	92.8	84.3	34.9	9.9	13.7	3.5	21.1	4.3	20.4	122	128	2.35	32.4	3.7	13.1	1	44.8	58.5	45.6	9.4	1	20.3
Manganese	1150	297	54.9	65	108	33.5	110	46.1	44.5	144	20	31.8	214	89.5	32.3	23	218	336	192	461	17.7	29.4
Mercury	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	1.2	0.47	0.1	0.22	0.1	0.24	0.1	0.1	0.32	0.32	0.36	0.1	0.34
4-Methylphenol	5	5	5	5	5	5	5	16	5	5	5	5	5	5	5	5	5	2	100	5	5	4
Naphthalene	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	3	10	10	3	3	34
Nickel	9	110	9	9	28.9	9	36.3	19.6	9	33.4	68.3	9	28.5	9	9	9	31.1	9	9	9	9	9
Pentachlorophenol	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	2	1	0.5	0.5
Tetrachloroethene	5	5	5	5	5	5	5	5	5	5	5	5	2	5	5	5	5	4	5	1	5	62
Toluene	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8.5	3	5	5	50
1,1,1-Trichloroethane	5	5	5	5	12	5	5	3	5	28	55	8	26	2	4	31	160	300	18	10	15	50
Trichloroethene	5	5	5	5	5	5	5	5	3	4	3	5	5	5	5	5	1	8.5	5	5	5	50
Vanadium	14.6	260	64.1	45.6	98	35.9	149	33.2	3	88	21.4	17.2	53.7	18.5	16.8	23.7	57.7	66.2	9.9	19.1	11.4	3
Vinyl chloride	2	2	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Xylene (Total)	5	5	34	5	5	5	5	8	5	5	5	5	5	5	5	5	5	8.5	60	1	5	480

Shaded = detected concentration

Table 10.3.5-6
Comp. of Phase I and II Groundwater Data
Site 27
Naval Air Station Pensacola
Pensacola, Florida

Parameter	Phase I (continued)			Phase II units are in micrograms per Liter (ug/L)															
	GS019	GS020	GS021	GGS02	GI001	GI002	GS001	GS002	GS003	GS004	GS006	GS007	GS010	GS011	GS015	GS018	GS019	GS020	GS021
Aldrin	0.001	0.001	0.001																
Aluminum	2180	7320	23000	7	97		44.5		51	8.5		6	10.5		755				
Antimony	17.5	50	17.5	1.15	1.15		1.15		1.15	1.15		2.9	1.15		1.15				
Arsenic	5.3	2	10.7	0.75	0.75		0.75		0.75	0.75		0.75	0.75		0.75				
alpha-BHC	0.00045	0.002	0.00045																
Benzene	50	5	5			0.5		0.5		0.5			0.5	0.5			0.5		0.5
Beryllium	0.5	0.5	0.5	0.04	0.04		0.04		0.04	0.04		0.04	0.04		0.04				
Cadmium	1.5	1.5	1.5	0.11	0.11		0.11		0.11	0.6		0.195	2.35		0.14				
Chlorobenzene	50	5	5			0.5		0.5		0.5			0.5	0.5			0.5		0.5
Chloroethane	96	87	190			0.5		0.5		3			22	7			2		8
Chloroform	50	5	5			0.5		0.5		0.5			0.4	4			0.5		0.5
Chloromethane	50	5	5			0.5		0.5		0.5			0.5	0.5			0.5		0.5
Chromium	4	4	36.6	0.32	0.32		0.32		0.32	39.9		0.32	309		0.95				
1,2-Dichlorobenzene	10	5	5			0.5		0.5		0.5	5		5	0.5	5	5	0.5	5	0.5
1,4-Dichlorobenzene	10	5	5			0.5		0.5		0.5	5		2	0.5	5	5	0.5	5	0.5
1,1-Dichloroethane	72	45	45			0.5		0.5		7			260	120			3		17
1,2-Dichloroethane						0.5		0.5		0.5			37	0.5			0.5		0.5
1,1-Dichloroethene	50	3	15			0.5		0.5		0.5			110	12			0.5		0.5
1,2-Dichloroethene (cis)						0.5		0.5		2			15	5			25		0.5
1,2-Dichloroethene (total)	130	5	5																
Dieldrin	0.005	0.005	0.0037																
Ethylbenzene	63	3	3			0.5		0.5		0.5			0.5	0.5			10		0.5
bis(2-Ethylhexyl)phthalat											2.3				2.3	2	7.7	9.3	2.5
Heptachlor	0.0008	0.0008	0.0008																
Heptachlor epoxide	0.0016	0.0016	0.0066																
Lead	3.3	1	5.2	0.4	0.4		0.4		0.75	1.4		0.4	0.4		0.4				
Manganese	76.5	47.2	60.8	34.6	4.75		371		3.85	24.2		0.15	52.2		0.95				
Mercury	0.1	0.1	0.56	0.03	0.06		0.03		0.03	0.06		0.03	0.03		0.09				
4-Methylphenol	30	5	4								5				5	5	20	5	5
Naphthalene	110	8	13								3.4				3.4	49	50	3.4	3.4
Nickel	9	9	9	0.37	1		0.38		0.65	1.3		0.65	0.7		0.85				
Pentachlorophenol	0.5	0.5	0.5								0.5				0.5	0.5	0.85	0.5	0.5
Tetrachloroethene	61	2	3			0.5		0.4		1			9	2			32		2
Toluene	53	5	4			0.5		0.5		0.1			0.5	0.5			5		0.5
1,1,1-Trichloroethane	50	5	1			0.5		2		0.5			160	51			0.5		0.5
Trichloroethene	130	5	5			0.5		3		7			1	0.5			17		0.5
Vanadium	3	9	38.4	0.38	0.38		1.2		4.2	0.6		0.415	0.38		0.38				
Vinyl chloride	2	2	2			0.5		0.5		0.5			0.5	0.5			0.5		0.5
Xylene (Total)	640	12	50			0.5		0.5		0.5			0.5	0.5			79		0.5

Shaded = detected concentration

Table 10.3.5-7
Exposure Pathways Summary — Site 27

Medium and Exposure Pathway	Resident	Worker	Trespasser	Reason for Selection or Exclusion
Air: Inhalation of volatile contaminants emanating from soil	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Air: Inhalation of chemicals entrained in fugitive dust	Yes	Yes	Yes	Fate and transport screening determined this to be a significant pathway for chromium.
Groundwater: Ingestion of contaminants during potable or general use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Groundwater: Inhalation of volatilized contaminants during domestic use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Soil: Incidental ingestion	Yes	Yes	Yes	COPCs were identified from risk-based and background screening comparisons.
Soil: Dermal contact	Yes	Yes	Yes	COPCs were identified from risk-based and background screening comparisons.
Wild game or domestic animals: Ingestion of tissue impacted by media contamination	No	No	No	Hunting/taking of game and/or raising livestock is prohibited at NAS Pensacola.
Fruits and vegetables: Ingestion of plant tissues grown in media	No	No	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Table 10.3.5-8
Statistical Analysis of COPCs
Surface Soils at Site 27
Naval Air Station Pensacola
Pensacola, Florida

COPC	n	Natural Log Transformed mean	SD	H-stat	UCL (mg/kg)	MAX (mg/kg)	EPC (mg/kg)	
Aluminum	40	8.022	0.878	2.241	6145	19500	6145	UCL Used
Arsenic	40	0.052	0.884	2.247	2.1	5.9	2.1	UCL Used
Benzo(a)pyrene Equiv.	40	-0.801	0.589	1.973	0.64	9.5	0.64	UCL Used
Beryllium	40	-1.363	0.627	2.004	0.38	0.44	0.38	UCL Used
Cadmium	40	0.037	1.367	2.817	4.9	57	4.9	UCL Used
Chromium	40	1.984	1.666	3.215	69	314	69	UCL Used
Dieldrin	41	-5.798	1.749	3.318	0.035	0.30	0.035	UCL Used
Lead	40	2.069	2.228	4.023	398	1550	398	UCL Used
Manganese	40	2.641	1.665	3.215	132	636	132	UCL Used
Mercury	40	-2.057	1.699	3.261	1.3	84	1.3	UCL Used
Silver	40	-0.259	0.996	2.366	1.8	156	1.8	UCL Used

Notes:

mean Arithmetic mean of the logtransformed data
n Number of samples analyzed
SD Standard deviation for a sample of data
H-stat "H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA Not applicable
EPC Exposure point concentration
UCL 95 percentile upper confidence level mean
MAX Maximum reported concentration

Table 10.3.5-9
Statistical Analysis of COPCs
Groundwater at Site 27
Naval Air Station, Pensacola
Pensacola, Florida

COPC	Number of Detects	Number of Samples	Average ln(a)	Sample Standard Deviation sd(a)	H Statistic	Arithmetic Mean Detected Concentration (mg/L)	95% UCL (mg/L)	Maximum Detected Conc. (mg/L)	EPC (mg/L)	
Aldrin	2	25	-6.816	0.334	1.840	0.0000034	0.0000013	0.0000045	0.0000034	Mean
alpha-BHC	4	25	-7.429	0.859	2.335	0.0000075	0.0000013	0.000026	0.0000075	Mean
Chloroethane	15	32	2.337	1.552	3.142	0.063	0.083	0.19	0.083	UCL
Chloroform	5	32	1.150	1.212	2.682	0.0023	0.012	0.0040	0.0023	Mean
Chromium	23	33	2.751	2.412	4.417	0.41	1.9	5.8	1.9	UCL
1,2-Dichlorobenzene	3	36	1.300	0.982	2.374	0.018	0.0088	0.045	0.018	Mean
1,4-Dichlorobenzene	2	36	1.250	0.921	2.307	0.0085	0.0076	0.015	0.0085	Mean
1,1-Dichloroethane	24	32	2.800	1.623	3.243	0.065	0.16	0.30	0.16	UCL
1,2-Dichloroethane	1	7	-0.078	1.627	NA	NA	NA	0.037	0.037	Max
1,1-Dichloroethene	16	32	1.719	1.453	3.004	0.019	0.035	0.11	0.035	UCL
1,2-Dichloroethene (cis)	4	7	0.879	1.673	NA	0.012	NA	0.025	0.012	Mean
1,2-Dichloroethene (total)	4	25	1.723	0.828	2.298	0.039	0.012	0.13	0.039	Mean
Dieldrin	5	25	-5.342	0.284	1.808	0.0000048	0.0000055	0.0000095	0.0000055	UCL
Ethylbenzene	8	32	1.278	1.160	2.617	0.016	0.012	0.063	0.016	Mean
bis(2-Ethylhexyl)phthalate	6	6	1.258	0.686	NA	0.0044	NA	0.0093	0.0044	Mean
Heptachlor	2	25	-7.059	0.255	1.791	0.0000020	0.0000010	0.0000024	0.0000020	Mean
Heptachlor epoxide	2	25	-6.353	0.310	1.824	0.0000049	0.0000021	0.0000066	0.0000049	Mean
Manganese*	29	33	3.880	1.770	3.443	0.15	0.68	1.2	0.68	UCL
4-Methylphenol	7	31	1.802	0.713	2.115	0.025	0.010	0.10	0.025	Mean
Naphthalene	12	31	1.894	0.912	2.324	0.025	0.015	0.11	0.025	Mean
Pentachlorophenol	2	31	-0.609	0.287	1.786	0.0015	0.0062	0.0020	0.0015	Mean
Tetrachloroethene	13	32	1.454	1.080	2.517	0.014	0.012	0.062	0.014	Mean
Toluene	5	32	1.267	1.264	2.748	0.013	0.015	0.053	0.015	UCL
1,1,1-Trichloroethane	19	32	2.128	1.733	3.401	0.039	0.11	0.30	0.11	UCL
Trichloroethene	9	32	1.477	1.124	2.572	0.019	0.014	0.13	0.019	Mean
Vinyl chloride	1	32	0.412	0.606	2.012	NA	0.0023	0.0040	0.0040	Max
Xylene (Total)	10	32	1.776	1.813	3.519	0.14	0.096	0.64	0.14	Mean

Notes:

ln(a)	arithmetic mean of the logtransformed data
sd(a)	standard deviation for a sample of data
H-statistic	"H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA	not applicable
ND	not determined
EPC	exposure point concentration
UCL	95 percentile upper confidence level mean

Table 10.3.5-10
Chronic Daily Intakes (CDI)
Incidental Ingestion of Surface Soil
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	FI *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	1	6145	8.42E-03	7.86E-02	9.62E-03	3.01E-03	1.07E-03	1.95E-03	2.78E-04
Arsenic	1	2.1	2.93E-06	2.74E-05	3.35E-06	1.05E-06	3.74E-07	6.78E-07	9.67E-08
Benzo(a)pyrene Equiv.	1	0.64	8.81E-07	8.22E-06	1.01E-06	3.15E-07	1.12E-07	2.04E-07	2.91E-08
Beryllium	1	0.38	5.21E-07	4.87E-06	5.96E-07	1.86E-07	6.65E-08	1.21E-07	1.72E-08
Cadmium	1	4.9	6.71E-06	6.26E-05	7.66E-06	2.40E-06	8.55E-07	1.55E-06	2.21E-07
Chromium	1	69	9.41E-05	8.78E-04	1.07E-04	3.36E-05	1.20E-05	2.18E-05	3.10E-06
Dieldrin	1	0.035	4.80E-08	4.48E-07	5.49E-08	1.72E-08	6.13E-09	1.11E-08	1.59E-09
Lead	1	398	5.45E-04	5.09E-03	6.23E-04	1.95E-04	6.95E-05	1.26E-04	1.80E-05
Manganese	1	132	1.81E-04	1.69E-03	2.07E-04	6.47E-05	2.31E-05	4.19E-05	5.98E-06
Mercury	1	1.3	1.80E-06	1.68E-05	2.06E-06	6.43E-07	2.30E-07	4.17E-07	5.94E-08
Silver	1	1.8	2.53E-06	2.37E-05	2.90E-06	9.05E-07	3.23E-07	5.86E-07	8.36E-08

Notes:

TEF Toxicity equivalence factor relative to benzo(a)pyrene
lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.5-11
Chronic Daily Intakes (CDI)
Dermal Contact with Surface Soil
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/kg)	FC *	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	6145	1	0.001	3.45E-04	1.14E-03	2.16E-04	2.47E-04	8.80E-05	7.99E-05	1.14E-05
Arsenic	2.1	1	0.001	1.20E-07	3.97E-07	7.52E-08	8.58E-08	3.07E-08	2.78E-08	3.96E-09
Benzo(a)pyrene Equiv.	0.64	1	0.01	3.61E-07	1.19E-06	2.26E-07	2.58E-07	9.21E-08	8.36E-08	1.19E-08
Beryllium	0.38	1	0.001	2.14E-08	7.06E-08	1.34E-08	1.53E-08	5.45E-09	4.95E-09	7.04E-10
Cadmium	4.9	1	0.001	2.75E-07	9.08E-07	1.72E-07	1.96E-07	7.01E-08	6.36E-08	9.06E-09
Chromium	69	1	0.001	3.86E-06	1.27E-05	2.41E-06	2.75E-06	9.84E-07	8.93E-07	1.27E-07
Dieldrin	0.04	1	0.01	1.97E-08	6.50E-08	1.23E-08	1.41E-08	5.03E-09	4.56E-09	6.49E-10
Lead	398	1	0.001	2.23E-05	7.37E-05	1.40E-05	1.60E-05	5.70E-06	5.17E-06	7.36E-07
Manganese	132	1	0.001	7.43E-06	2.45E-05	4.65E-06	5.31E-06	1.89E-06	1.72E-06	2.45E-07
Mercury	1.3	1	0.001	7.39E-08	2.44E-07	4.62E-08	5.28E-08	1.88E-08	1.71E-08	2.43E-09
Silver	1.8	1	0.001	1.04E-07	3.43E-07	6.50E-08	7.42E-08	2.65E-08	2.40E-08	3.42E-09

Notes:

TEF Toxicity Equivalence Factor relative to benzo(a)pyrene
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
\- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.5-12
Chronic Daily Intakes (CDI)
Inhalation of Surface Soil COPCs Resulting from Dust Emission
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Fraction Contacted from Contaminated Source *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Site Worker adult H-CDI (mg/kg-day)	Site Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Inorganics									
Chromium	1	69	1.43E-08	3.99E-08	8.30E-09	1.02E-08	3.64E-09	2.88E-09	4.12E-10

Notes:

lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.5-13
Chronic Daily Intakes (CDI)
Ingestion of COPCs in Groundwater
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/liter)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Aldrin	0.0000034	9.2E-08	2.1E-07	5.0E-08	3.3E-08	1.6E-08
alpha-BHC	0.0000075	2.0E-07	4.8E-07	1.1E-07	7.3E-08	3.6E-08
Chloroethane	0.083	2.3E-03	5.3E-03	1.2E-03	8.1E-04	4.0E-04
Chloroform	0.0023	6.2E-05	1.5E-04	3.4E-05	2.2E-05	1.1E-05
Chromium	1.9	5.2E-02	1.2E-01	2.8E-02	1.8E-02	9.1E-03
1,2-Dichlorobenzene	0.018	4.9E-04	1.2E-03	2.7E-04	1.8E-04	8.7E-05
1,4-Dichlorobenzene	0.0085	2.3E-04	5.4E-04	1.3E-04	8.3E-05	4.1E-05
1,1-Dichloroethane	0.16	4.3E-03	1.0E-02	2.4E-03	1.5E-03	7.6E-04
1,2-Dichloroethane	0.037	1.0E-03	2.4E-03	5.6E-04	3.6E-04	1.8E-04
1,1-Dichloroethene	0.035	9.6E-04	2.2E-03	5.3E-04	3.4E-04	1.7E-04
1,2-Dichloroethene (cis)	0.012	3.2E-04	7.5E-04	1.8E-04	1.1E-04	5.7E-05
1,2-Dichloroethene (total)	0.039	1.1E-03	2.5E-03	5.9E-04	3.8E-04	1.9E-04
Dieldrin	0.0000055	1.5E-07	3.5E-07	8.3E-08	5.4E-08	2.7E-08
Ethylbenzene	0.016	4.5E-04	1.0E-03	2.4E-04	1.6E-04	7.8E-05
bis(2-Ethylhexyl)phthalat	0.0044	1.2E-04	2.8E-04	6.6E-05	4.3E-05	2.1E-05
Heptachlor	0.0000020	5.5E-08	1.3E-07	3.0E-08	2.0E-08	9.6E-09
Heptachlor epoxide	0.0000049	1.3E-07	3.1E-07	7.4E-08	4.8E-08	2.4E-08
Manganese	0.68	1.9E-02	4.4E-02	1.0E-02	6.7E-03	3.3E-03
4-Methylphenol	0.025	6.9E-04	1.6E-03	3.8E-04	2.5E-04	1.2E-04
Naphthalene	0.025	6.8E-04	1.6E-03	3.7E-04	2.4E-04	1.2E-04
Pentachlorophenol	0.0015	4.1E-05	9.6E-05	2.3E-05	1.5E-05	7.2E-06
Tetrachloroethene	0.014	3.8E-04	8.9E-04	2.1E-04	1.4E-04	6.7E-05
Toluene	0.015	4.0E-04	9.4E-04	2.2E-04	1.4E-04	7.1E-05
1,1,1-Trichloroethane	0.11	3.0E-03	6.9E-03	1.6E-03	1.1E-03	5.2E-04
Trichloroethene	0.019	5.1E-04	1.2E-03	2.8E-04	1.8E-04	9.0E-05
Vinyl chloride	0.0040	1.1E-04	2.6E-04	6.0E-05	3.9E-05	1.9E-05
Xylene (Total)	0.14	3.8E-03	8.8E-03	2.1E-03	1.3E-03	6.6E-04

NOTES:

lwa Lifetime weighted average
CDI Chronic Daily Intake
H-CDI Non-carcinogenic hazard based Chronic Daily Intake
C-CDI Carcinogenic risk based Chronic Daily Intake

Tab. 3.5-14
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Surface Soil Ingestion
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	1	NA	0.0084	0.079	ND	0.0030	ND	0.0019	ND
Arsenic	0.0003	1.5	0.010	0.091	5.0E-06	0.0035	5.6E-07	0.0023	1.5E-07
Benzo(a)pyrene Equiv.	NA	7.3	ND	ND	7.3E-06	ND	8.2E-07	ND	2.1E-07
Beryllium	0.005	4.3	0.000104	0.00097	2.6E-06	0.000037	2.9E-07	0.000024	7.4E-08
Cadmium	0.001	NA	0.0067	0.063	ND	0.0024	ND	0.0016	ND
Chromium	0.005	NA	0.019	0.18	ND	0.0067	ND	0.0044	ND
Dieldrin	5E-05	16	0.0010	0.009	8.8E-07	0.0003	9.8E-08	0.00022	2.5E-08
Lead	NA	NA	ND	ND	ND	ND	ND	ND	ND
Manganese	0.047	NA	0.0039	0.036	ND	0.00138	ND	0.00089	ND
Mercury	0.0003	NA	0.0060	0.056	ND	0.0021	ND	0.0014	ND
Silver	0.005	NA	0.00051	0.0047	ND	0.00018	ND	0.00012	ND
SUM Hazard Index/ILCR			0.05	0.5	2E-05	0.02	2E-06	0.01	5E-07

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.5-15
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	ABS	Oral RfD Used (mg/kg-day)	Oral SF Used $(mg/kg\text{-}day)^{-1}$	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	0.2	0.2	NA	0.0017	0.0057	ND	0.0012	ND	0.00040	ND
Arsenic	0.2	6E-05	7.5	0.0020	0.0066	5.6E-07	0.0014	2.3E-07	0.00046	3.0E-08
Benzo(a)pyrene Equiv.	0.5	NA	14.6	ND	ND	3.3E-06	ND	1.3E-06	ND	1.7E-07
Beryllium	0.2	0.001	21.5	0.000021	0.000071	2.9E-07	0.000015	1.2E-07	0.0000049	1.5E-08
Cadmium	0.2	0.0002	NA	0.0014	0.0045	ND	0.0010	ND	0.00032	ND
Chromium	0.2	0.001	NA	0.004	0.013	ND	0.0028	ND	0.00089	ND
Dieldrin	0.5	2.5E-05	32	0.0008	0.003	3.9E-07	0.0006	1.6E-07	0.00018	2.1E-08
Lead	0.2	NA	NA	ND	ND	ND	ND	ND	ND	ND
Manganese	0.2	0.0094	NA	0.00079	0.0026	ND	0.00056	ND	0.00018	ND
Mercury	0.2	6E-05	NA	0.0012	0.0041	ND	0.00088	ND	0.00028	ND
Silver	0.2	0.001	NA	0.000104	0.00034	ND	0.000074	ND	0.000024	ND
SUM Hazard Index/ILCR				0.01	0.03	5E-06	0.008	2E-06	0.003	2E-07

Notes:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
ABS Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)
Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.5-16
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Surface Soil COPCs Resulting from Dust Emission
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation RfD Used (mg/kg-day)	Inhalation SF Used . $(mg/kg\text{-}day)^{-1}$	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Site Worker adult Hazard Quotient	Site Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Inorganics									
Chromium	ND	42	ND	ND	3.5E-07	ND	1.5E-07	ND	1.7E-08
SUM Hazard Index/ILCR			ND	ND	3E-07	ND	2E-07	ND	2E-08

Notes:

ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Table 10.3.5-17
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0001	Aluminum	5990	mg/kg	0.0821	NA
0001	Arsenic	2.8	mg/kg	0.1280	7.3136
0001	Cadmium	2.7	mg/kg	0.0371	NA
0001	Chromium	12.3	mg/kg	0.0337	NA
0001	Dieldrin	800	ug/kg	0.2639	29.0373
0001	Lead	263	mg/kg	NA	NA
0001	Manganese	132	mg/kg	0.0385	NA
0001	Mercury	0.16	mg/kg	0.0073	NA
	Total			0.5907	36.3509
0002	Aluminum	2000	mg/kg	0.0274	NA
0002	Arsenic	0.99	mg/kg	0.0453	2.5859
0002	Chromium	3.2	mg/kg	0.0088	NA
0002	Dieldrin	1.9	ug/kg	0.0006	0.0690
0002	Lead	31.1	mg/kg	NA	NA
0002	Manganese	9.9	mg/kg	0.0029	NA
	Total			0.0850	2.6548
0003	Aluminum	1910	mg/kg	0.0262	NA
0003	Cadmium	1.1	mg/kg	0.0151	NA
0003	Dieldrin	0.42	ug/kg	0.0001	0.0152
0003	Lead	6.5	mg/kg	NA	NA
0003	Manganese	4.8	mg/kg	0.0014	NA
	Total			0.0428	0.0152
0004	Aluminum	6800	mg/kg	0.0932	NA
0004	Arsenic	1.5	mg/kg	0.0686	3.9180
0004	B(a)P Equiv.	9526.4	ug/kg	NA	157.7602
0004	Cadmium	23.7	mg/kg	0.4323	NA
0004	Chromium	314	mg/kg	0.8611	NA
0004	Dieldrin	21	ug/kg	0.0069	0.7622
0004	Lead	171	mg/kg	NA	NA
0004	Manganese	64.4	mg/kg	0.0188	NA
0004	Mercury	0.99	mg/kg	0.0453	NA
	Total			1.5262	162.4404
0005	Aluminum	2930	mg/kg	0.0402	NA
0005	Arsenic	1.7	mg/kg	0.0777	4.4404
0005	Chromium	6.9	mg/kg	0.0189	NA
0005	Lead	82.5	mg/kg	NA	NA
0005	Manganese	17.1	mg/kg	0.0050	NA
	Total			0.1418	4.4404
0006	Aluminum	2360	mg/kg	0.0324	NA
0006	Arsenic	2.3	mg/kg	0.1051	6.0076
0006	B(a)P Equiv.	316.38	ug/kg	NA	5.2394
0006	Cadmium	3.2	mg/kg	0.0440	NA
0006	Chromium	23.3	mg/kg	0.0639	NA
0006	Dieldrin	360	ug/kg	0.1188	13.0668
0006	Lead	2	mg/kg	NA	NA
0006	Manganese	18.1	mg/kg	0.0052	NA
	Total			0.3693	24.3137
0007	Aluminum	13900	mg/kg	0.1906	NA
0007	Arsenic	1.2	mg/kg	0.0548	3.1344
0007	Beryllium	0.44	mg/kg	0.0012	3.2946
0007	Chromium	40.5	mg/kg	0.1111	NA
0007	Dieldrin	0.13	ug/kg	NA	0.0047
0007	Lead	13.7	mg/kg	NA	NA
0007	Manganese	10.1	mg/kg	0.0029	NA
	Total			0.3606	6.4337
0008	Aluminum	10800	mg/kg	0.1481	NA
0008	Arsenic	2	mg/kg	0.0914	5.2240
0008	B(a)P Equiv.	6.38	ug/kg	NA	0.1057
0008	Cadmium	2.6	mg/kg	0.0357	NA
0008	Chromium	10.8	mg/kg	0.0296	NA
0008	Dieldrin	32	ug/kg	0.0106	1.1615
0008	Lead	11.8	mg/kg	NA	NA
0008	Manganese	636	mg/kg	0.1856	NA
0008	Mercury	0.17	mg/kg	0.0078	NA
	Total			0.5088	6.4911
0009	Aluminum	30200	mg/kg	0.4141	NA
0009	Arsenic	4.4	mg/kg	0.2011	11.4928

Table 10.3.5-17
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

0009	Chromium	20.1	mg/kg	0.0551	NA
0009	Lead	0.76	mg/kg	NA	NA
0009	Manganese	95.4	mg/kg	0.0278	NA
	Total			0.6981	11.4928
0010	Aluminum	1380	mg/kg	0.0189	NA
0010	Lead	0.89	mg/kg	NA	NA
	Total			0.0189	NA
0012	Aluminum	2020	mg/kg	0.0277	NA
0012	Lead	0.84	mg/kg	NA	NA
	Total			0.0277	NA
0013	Aluminum	7480	mg/kg	0.1026	NA
0013	Arsenic	0.91	mg/kg	0.0416	2.3769
0013	Chromium	6.2	mg/kg	0.0170	NA
0013	Lead	5.7	mg/kg	NA	NA
0013	Manganese	60.6	mg/kg	0.0176	NA
	Total			0.1788	2.3769
0014	Aluminum	2020	mg/kg	0.0277	NA
0014	Lead	1	mg/kg	NA	NA
0014	Manganese	3.3	mg/kg	0.0010	NA
	Total			0.0287	NA
0015	Aluminum	2230	mg/kg	0.0306	NA
0015	Arsenic	0.76	mg/kg	0.0347	1.9851
0015	Chromium	2.3	mg/kg	0.0063	NA
0015	Lead	1.1	mg/kg	NA	NA
	Total			0.0716	1.9851
0017	Aluminum	19500	mg/kg	0.2674	NA
0017	Arsenic	5.9	mg/kg	0.2697	15.4108
0017	B(a)P Equiv.	250.04	ug/kg	NA	4.1407
0017	Cadmium	3.3	mg/kg	0.0453	NA
0017	Chromium	21	mg/kg	0.0576	NA
0017	Dieldrin	3.8	ug/kg	0.0013	0.1379
0017	Lead	51.7	mg/kg	NA	NA
0017	Manganese	90.7	mg/kg	0.0265	NA
0017	Mercury	0.4	mg/kg	0.0183	NA
	Total			0.6860	19.6895
0019	Aluminum	3200	mg/kg	0.0439	NA
0019	Arsenic	2.1	mg/kg	0.0960	5.4852
0019	B(a)P Equiv.	160.55	ug/kg	NA	2.6588
0019	Cadmium	6.3	mg/kg	0.0865	NA
0019	Chromium	19.3	mg/kg	0.0529	NA
0019	Dieldrin	19	ug/kg	0.0063	0.6896
0019	Lead	77.5	mg/kg	NA	NA
0019	Manganese	178	mg/kg	0.0519	NA
0019	Mercury	7.1	mg/kg	0.3245	NA
	Total			0.6620	8.8336
0020	Aluminum	2830	mg/kg	0.0388	NA
0020	Arsenic	3.2	mg/kg	0.1463	8.3584
0020	B(a)P Equiv.	5.45	ug/kg	NA	0.0903
0020	Cadmium	5.8	mg/kg	0.0795	NA
0020	Chromium	131	mg/kg	0.3593	NA
0020	Dieldrin	2.9	ug/kg	0.0010	0.1053
0020	Lead	513	mg/kg	NA	NA
0020	Manganese	122	mg/kg	0.0356	NA
0020	Silver	2.4	mg/kg	0.0066	NA
	Total			0.6669	8.5539
0021	Aluminum	2340	mg/kg	0.0321	NA
0021	B(a)P Equiv.	4.07	ug/kg	NA	0.0674
0021	Cadmium	1.4	mg/kg	0.0192	NA
0021	Chromium	53.4	mg/kg	0.1464	NA
0021	Lead	20.7	mg/kg	NA	NA
0021	Manganese	10.6	mg/kg	0.0031	NA
	Total			0.2008	0.0674
0022	Aluminum	2150	mg/kg	0.0295	NA
0022	Arsenic	1.7	mg/kg	0.0777	4.4404
0022	Manganese	11.1	mg/kg	0.0032	NA
	Total			0.1104	4.4404
0023	Aluminum	1930	mg/kg	0.0265	NA

Table 10.3.5-17
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

0023	Cadmium	3.5 mg/kg	0.0481	NA
0023	Chromium	3.6 mg/kg	0.0099	NA
0023	Lead	1.3 mg/kg	NA	NA
0023	Manganese	10.6 mg/kg	0.0031	NA
	Total		0.0875	NA
0024	Aluminum	1990 mg/kg	0.0273	NA
0024	Dieldrin	1.9 ug/kg	0.0006	0.0690
0024	Lead	1.2 mg/kg	NA	NA
	Total		0.0279	0.0690
0026	Aluminum	2100 mg/kg	0.0288	NA
0026	Arsenic	1.6 mg/kg	0.0731	4.1792
0026	Chromium	3.1 mg/kg	0.0085	NA
0026	Lead	1 mg/kg	NA	NA
	Total		0.1104	4.1792
0027	Aluminum	2370 mg/kg	0.0325	NA
0027	Chromium	3.6 mg/kg	0.0099	NA
0027	Dieldrin	0.21 ug/kg	0.0001	0.0076
0027	Lead	1.2 mg/kg	NA	NA
0027	Silver	0.87 mg/kg	0.0024	NA
	Total		0.0448	0.0076
0028	Aluminum	2460 mg/kg	0.0337	NA
0028	Chromium	12.9 mg/kg	0.0354	NA
0028	Lead	22.7 mg/kg	NA	NA
0028	Manganese	12.4 mg/kg	0.0036	NA
0028	Mercury	0.21 mg/kg	0.0096	NA
	Total		0.0823	NA
0029	Aluminum	1240 mg/kg	0.0170	NA
0029	Chromium	2.2 mg/kg	0.0060	NA
0029	Lead	1.6 mg/kg	NA	NA
0029	Mercury	0.11 mg/kg	0.0050	NA
	Total		0.0281	NA
0030	Aluminum	2320 mg/kg	0.0318	NA
0030	Chromium	2.4 mg/kg	0.0066	NA
0030	Lead	0.98 mg/kg	NA	NA
	Total		0.0384	NA
0032	Aluminum	2180 mg/kg	0.0299	NA
0032	Arsenic	0.91 mg/kg	0.0416	2.3769
0032	Lead	1.4 mg/kg	NA	NA
	Total		0.0715	2.3769
0033	Aluminum	2540 mg/kg	0.0348	NA
0033	Lead	0.94 mg/kg	NA	NA
	Total		0.0348	NA
0040	Aluminum	2190 mg/kg	0.0300	NA
0040	B(a)P Equiv.	428.83 ug/kg	NA	7.1016
0040	Chromium	3.1 mg/kg	0.0085	NA
0040	Dieldrin	0.079 ug/kg	NA	0.0029
0040	Lead	3.4 mg/kg	NA	NA
0040	Manganese	13 mg/kg	0.0038	NA
	Total		0.0423	7.1044
0041	Aluminum	6700 mg/kg	0.0919	NA
0041	Arsenic	4.8 mg/kg	0.2194	12.5376
0041	B(a)P Equiv.	27.989 ug/kg	0.0000	0.4635
0041	Chromium	7.5 mg/kg	0.0206	NA
0041	Dieldrin	2.7 ug/kg	0.0009	0.0980
0041	Lead	217 mg/kg	NA	NA
0041	Manganese	90 mg/kg	0.0263	NA
	Total		0.3590	13.0991
0042	Aluminum	1900 mg/kg	0.0261	NA
0042	Arsenic	0.93 mg/kg	0.0425	2.4292
0042	Chromium	11.4 mg/kg	0.0313	NA
0042	Lead	0.95 mg/kg	NA	NA
0042	Manganese	4 mg/kg	0.0012	NA
	Total		0.1010	2.4292

Table 10.3.5-17
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

0043	Aluminum	3080	mg/kg	0.0422	NA
0043	Chromium	5.6	mg/kg	0.0154	NA
0043	Lead	2.1	mg/kg	NA	NA
0043	Manganese	10.1	mg/kg	0.0029	NA
	Total			0.0605	NA
0044	Aluminum	2390	mg/kg	0.0328	NA
0044	Arsenic	1.2	mg/kg	0.0548	3.1344
0044	B(a)P Equiv.	56.514	ug/kg	NA	0.9359
0044	Chromium	9	mg/kg	0.0247	NA
0044	Dieldrin	3.9	ug/kg	0.0013	0.1416
0044	Lead	63.8	mg/kg	NA	NA
0044	Manganese	27	mg/kg	0.0079	NA
0044	Mercury	10.2	mg/kg	0.4662	NA
	Total			0.5877	4.2118
0045	Aluminum	2780	mg/kg	0.0381	NA
0045	Arsenic	0.89	mg/kg	0.0407	2.3247
0045	Cadmium	7.9	mg/kg	0.1085	NA
0045	Chromium	31.8	mg/kg	0.0872	NA
0045	Dieldrin	1.8	ug/kg	0.0006	0.0653
0045	Lead	216	mg/kg	NA	NA
0045	Manganese	46.8	mg/kg	0.0137	NA
0045	Mercury	0.27	mg/kg	0.0123	NA
0045	Silver	159	mg/kg	0.4278	NA
	Total			0.7290	2.3900
0046	Aluminum	11000	mg/kg	0.1508	NA
0046	Arsenic	4.3	mg/kg	0.1965	11.2316
0046	Chromium	20.9	mg/kg	0.0573	NA
0046	Lead	6	mg/kg	NA	NA
0046	Manganese	38.2	mg/kg	0.0111	NA
0046	Mercury	0.11	mg/kg	0.0050	NA
	Total			0.4208	11.2316
0047	Aluminum	2010	mg/kg	0.0276	NA
0047	Arsenic	1.7	mg/kg	0.0777	4.4404
0047	Chromium	9.7	mg/kg	0.0266	NA
0047	Lead	4.5	mg/kg	NA	NA
0047	Manganese	5.2	mg/kg	0.0015	NA
0047	Mercury	2.2	mg/kg	0.1006	NA
	Total			0.2339	4.4404
0049	Aluminum	660	mg/kg	0.0091	NA
0049	Arsenic	1.3	mg/kg	0.0594	3.3956
0049	B(a)P Equiv.	188.06	ug/kg	NA	3.1143
0049	Dieldrin	47	ug/kg	0.0155	1.7059
0049	Lead	0.94	mg/kg	NA	NA
0049	Mercury	0.11	mg/kg	0.0050	NA
	Total			0.0890	8.2159
0050	Aluminum	2670	mg/kg	0.0366	NA
0050	Chromium	2.3	mg/kg	0.0063	NA
0050	Lead	1.2	mg/kg	NA	NA
0050	Manganese	5.5	mg/kg	0.0016	NA
	Total			0.0445	NA
0051	No COPCs detected			NA	NA
0052	Aluminum	11300	mg/kg	0.1549	NA
0052	Arsenic	3.9	mg/kg	0.1783	10.1868
0052	B(a)P Equiv.	2298.8	ug/kg	NA	38.0688
0052	Cadmium	26.1	mg/kg	0.3585	NA
0052	Chromium	288	mg/kg	0.7898	NA
0052	Dieldrin	41	ug/kg	0.0135	1.4882
0052	Lead	167	mg/kg	NA	NA
0052	Manganese	68.3	mg/kg	0.0199	NA
0052	Mercury	0.24	mg/kg	0.0110	NA
	Total			1.5259	49.7438

Table 10.3.5-17
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

0053	Aluminum	5250	mg/kg	0.0720	NA
0053	Arsenic	2.5	mg/kg	0.1143	6.5300
0053	B(a)P Equiv.	128.12	ug/kg	NA	2.1217
0053	Cadmium	67.1	mg/kg	0.9217	NA
0053	Chromium	252	mg/kg	0.6911	NA
0053	Dieldrin	3.1	ug/kg	0.0010	0.1125
0053	Lead	1550	mg/kg	NA	NA
0053	Manganese	273	mg/kg	0.0796	NA
0053	Mercury	84	mg/kg	3.8395	NA
	Total			5.7191	8.7642

Tab 3.5-18
Hazard Quotients and Incremental Lifetime Cancer Risks
Groundwater Ingestion
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Aldrin	3E-05	17	0.0031	0.0071	8.6E-07	0.0011	2.7E-07
alpha-BHC	NA	6.3	ND	ND	7.1E-07	ND	2.3E-07
Chloroethane	0.4	NA	0.0057	0.0132	ND	0.0020	ND
Chloroform	0.01	0.0061	0.0062	0.0146	2.1E-07	0.0022	6.7E-08
Chromium	0.005	NA	10	24	ND	3.7	ND
1,2-Dichlorobenzene	0.09	NA	0.0055	0.013	ND	0.0020	ND
1,4-Dichlorobenzene	NA	0.024	ND	ND	3.1E-06	ND	9.8E-07
1,1-Dichloroethane	0.1	NA	0.043	0.10	ND	0.015	ND
1,2-Dichloroethane	NA	0.091	ND	ND	5.1E-05	ND	1.6E-05
1,1-Dichloroethene	0.009	0.6	0.11	0.25	3.2E-04	0.038	1.0E-04
1,2-Dichloroethene (cis)	0.01	NA	0.032	0.075	ND	0.011	ND
1,2-Dichloroethene (total)	0.009	NA	0.12	0.28	ND	0.043	ND
Dieldrin	5E-05	16	0.0030	0.0071	1.3E-06	0.0011	4.3E-07
Ethylbenzene	0.1	NA	0.0045	0.010	ND	0.0016	ND
bis(2-Ethylhexyl)phthalate	0.02	0.014	0.0060	0.014	9.2E-07	0.0021	2.9E-07
Heptachlor	0.0005	4.5	0.00011	0.00026	1.4E-07	0.000039	4.3E-08
Heptachlor epoxide	1.3E-05	9.1	0.010	0.024	6.7E-07	0.0037	2.1E-07
Manganese*	0.047	NA	0.40	0.9	ND	0.14	ND
4-Methylphenol	0.005	NA	0.14	0.32	ND	0.049	ND
Naphthalene	0.04	NA	0.017	0.039	ND	0.0060	ND
Pentachlorophenol	0.03	0.12	0.0014	0.0032	2.7E-06	0.00049	8.7E-07
Tetrachloroethene	0.01	0.052	0.038	0.089	1.1E-05	0.014	3.5E-06
Toluene	0.2	NA	0.0020	0.0047	ND	0.00072	ND
1,1,1-Trichloroethane	0.035	NA	0.085	0.20	ND	0.030	ND
Trichloroethene	0.006	0.011	0.086	0.20	3.1E-06	0.031	9.9E-07
Vinyl chloride	NA	1.9	ND	ND	1.1E-04	ND	3.7E-05
Xylene (Total)	2	NA	0.0019	0.0044	ND	0.00067	ND
SUM Hazard Index/ILCR			11	27	5E-04	4	2E-04

NOTES:

NA Not available
ND Not Determined due to lack of available information
LWA Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.5-19
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Contaminants in Groundwater due to Domestic Use
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation Rf Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Chloroethane	2.86	NA	0.00079	0.0019	ND	0.00028	ND
Chloroform	0.01	0.0805	0.0062	0.015	2.8E-06	0.0022	8.8E-07
1,2-Dichlorobenzene	0.04	NA	0.012	0.029	ND	0.0044	ND
1,4-Dichlorobenzene	0.229	NA	0.0010	0.0024	ND	0.00036	ND
1,1-Dichloroethane	0.143	NA	0.030	0.071	ND	0.011	ND
1,2-Dichloroethane	0.00286	0.091	0.3544	0.83	5.1E-05	0.13	6.9E-05
1,1-Dichloroethene	0.009	0.175	0.11	0.25	9.3E-05	0.038	3.1E-05
1,2-Dichloroethene (cis)	0.01	NA	0.032	0.075	ND	0.011	ND
1,2-Dichloroethene (total)	0.009	NA	0.12	0.28	ND	0.043	ND
Ethylbenzene	0.286	NA	0.0016	0.0036	ND	0.00056	ND
Tetrachloroethene	0.01	0.00203	0.038	0.089	4.3E-07	0.014	5.4E-11
Toluene	0.114	NA	0.0035	0.0083	ND	0.0013	ND
1,1,1-Trichloroethane	0.286	NA	0.010	0.024	ND	0.0037	ND
Trichloroethene	0.006	0.006	0.086	0.20	1.7E-06	0.031	5.8E-11
Vinyl chloride	NA	0.3	ND	ND	1.8E-05	ND	5.8E-06
Xylene (Total)	NA	NA	ND	ND	ND	ND	ND
SUM Hazard Index/ILCR			0.8	2	2E-04	0.3	1E-04

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
Oral RfDs have been cross-assigned as Inhalation RfDs

Table 10.3.5-20
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
Summary of Risk and Hazard resulting from Maximum Concentration						
S011	01	1,1,1-Trichloroethane	300	ug/L	0.2801	NA
S006	01	1,1-Dichloroethane	300	ug/L	0.3259	NA
S010	02	1,1-Dichloroethene	110	ug/L	1.5627	1267.91
S010	01	1,2-Dichlorobenzene	45	ug/L	0.1039	NA
S010	02	1,2-Dichloroethane	37	ug/L	1.6541	100.15
S019	01	1,2-Dichloroethene (total)	130	ug/L	1.8468	NA
S010	01	1,4-Dichlorobenzene	15	ug/L	0.0084	10.71
S013	01	4-Methylphenol (p-Cresol)	100	ug/L	1.2785	NA
S018	01	Aldrin	0.0045	ug/L	0.0096	1.14
I001	01	Aluminum	102000	ug/L	6.5205	NA
S001	01	Antimony	61.1	ug/L	9.7648	NA
I001	01	Arsenic	93.6	ug/L	19.9452	2088.14
I002	01	Benzene	25	ug/L	1.8692	21.57
I001	01	Beryllium	3.5	ug/L	0.0447	223.84
S013	01	Cadmium	63.6	ug/L	8.1538	NA
I002	01	Chlorobenzene	95	ug/L	1.3672	NA
S021	01	Chloroethane	190	ug/L	0.0346	NA
S011	01	Chloroform	4	ug/L	0.0511	5.15
I005	01	Chloromethane	3	ug/L	NA	0.86
S010	01	Chromium	5810	ug/L	74.2831	NA
GS02	01	Dieldrin	0.0095	ug/L	0.0121	2.26
I003	01	Heptachlor	0.0024	ug/L	0.0006	0.32
S021	01	Heptachlor epoxide	0.0066	ug/L	0.0649	1.79
S004	01	Lead	128	ug/L	NA	NA
GS02	01	Manganese	1150	ug/L	3.1963	NA
S003	01	Mercury	1.2	ug/L	0.2557	NA
I001	01	Nickel	110	ug/L	0.3516	NA
S013	01	Pentachlorophenol	2	ug/L	0.0043	3.57
S018	01	Tetrachloroethene	62	ug/L	0.7927	49.82
S011	01	1,1,1-Trichloroethane	300	ug/L	0.2801	NA
S019	01	Trichloroethene	130	ug/L	2.7702	32.87
I001	01	Vanadium	260	ug/L	2.3744	NA
I002	01	Vinyl chloride	4	ug/L	NA	130.88
S018	01	alpha-BHC	0.026	ug/L	NA	2.44
S020	02	bis(2-Ethylhexyl)phthalate	9.3	ug/L	0.0297	1.94
		Total			139	3945
Point Estimates of Risk and Hazard						
GS02	01	1,1,1-Trichloroethane	5	ug/L	0.0047	NA
GS02	01	1,1-Dichloroethane	6	ug/L	0.0065	NA
GS02	01	1,1-Dichloroethene	1	ug/L	0.0142	11.5264
GS02	01	Aluminum	39500	ug/L	2.5251	NA
GS02	01	Arsenic	8.1	ug/L	1.7260	180.7045
GS02	01	Beryllium	2.6	ug/L	0.0332	166.2779
GS02	01	Chromium	10.3	ug/L	0.1317	NA
GS02	01	Dieldrin	0.0095	ug/L	0.0121	2.2607
GS02	01	Lead	92.8	ug/L	NA	NA
GS02	01	Manganese	1150	ug/L	3.1963	NA
GS02	01	Vanadium	14.6	ug/L	0.1333	NA
		Total			7.7833	360.7695
GS02	02	Manganese (Mn)	34.6	ug/L	0.0962	NA
		Total			0.0962	NA
I001	01	Aluminum	102000	ug/L	6.5205	NA
I001	01	Antimony	59.9	ug/L	9.5731	NA
I001	01	Arsenic	93.6	ug/L	19.9452	2088.1409
I001	01	Beryllium	3.5	ug/L	0.0447	223.8356
I001	01	Chromium	392	ug/L	5.0119	NA
I001	01	Heptachlor	0.0016	ug/L	0.0004	0.2154
I001	01	Lead	84.3	ug/L	0.0000	NA
I001	01	Manganese	297	ug/L	0.8255	NA
I001	01	Nickel	110	ug/L	0.3516	NA
I001	01	Vanadium	260	ug/L	2.3744	NA
I001	01	alpha-BHC	0.0009	ug/L	NA	0.0843
		Total			44.6474	2312.2762
I001	02	Mercury (Hg)	0.06	ug/L	0.0128	NA
		Total			0.0128	NA
I002	01	1,1-Dichloroethane	3	ug/L	0.0033	NA
I002	01	1,2-Dichloroethene (total)	2	ug/L	0.0284	NA

Table 10.3.5-20
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

I002	01	Aluminum	27600	ug/L	1.7644	NA
I002	01	Arsenic	23.1	ug/L	4.9224	515.3425
I002	01	Benzene	25	ug/L	1.8692	21.5656
I002	01	Chlorobenzene	95	ug/L	1.3672	NA
I002	01	Chromium	47.3	ug/L	0.6047	NA
I002	01	Lead	34.9	ug/L	NA	NA
I002	01	Manganese	54.9	ug/L	0.1526	NA
I002	01	Vanadium	64.1	ug/L	0.5854	NA
I002	01	Vinyl chloride	4	ug/L	NA	130.8806
		Total			11.2976	667.7887
I003	01	Aluminum	22000	ug/L	1.4064	NA
I003	01	Antimony	39.2	ug/L	6.2648	NA
I003	01	Arsenic	15.4	ug/L	3.2816	343.5616
I003	01	Chromium	33.1	ug/L	0.4232	NA
I003	01	Heptachlor	0.0024	ug/L	0.0006	0.3230
I003	01	Lead	9.9	ug/L	NA	NA
I003	01	Manganese	65	ug/L	0.1807	NA
I003	01	Vanadium	45.6	ug/L	0.4164	NA
I003	01	alpha-BHC	0.0009	ug/L	NA	0.0843
		Total			11.9737	343.9690
I004	01	1,1,1-Trichloroethane	12	ug/L	0.0112	NA
I004	01	1,1-Dichloroethane	8	ug/L	0.0087	NA
I004	01	1,1-Dichloroethene	14	ug/L	0.1989	161.3699
I004	01	Aluminum	33800	ug/L	2.1607	NA
I004	01	Arsenic	30.5	ug/L	6.4992	680.4305
I004	01	Beryllium	1.6	ug/L	0.0205	102.3249
I004	01	Chloroform	1	ug/L	0.0128	1.2880
I004	01	Chromium	66.3	ug/L	0.8477	NA
I004	01	Lead	13.7	ug/L	NA	NA
I004	01	Manganese	108	ug/L	0.3002	NA
I004	01	Nickel	28.9	ug/L	0.0924	NA
I004	01	Vanadium	98	ug/L	0.8950	NA
		Total			11.0472	945.4132
I005	01	Aluminum	15500	ug/L	0.9909	NA
I005	01	Arsenic	17.5	ug/L	3.7291	390.4110
I005	01	Chloromethane	3	ug/L	NA	0.8611
I005	01	Chromium	31.2	ug/L	0.3989	NA
I005	01	Lead	3.5	ug/L	NA	NA
I005	01	Manganese	33.5	ug/L	0.0931	NA
I005	01	Vanadium	35.9	ug/L	0.3279	NA
		Total			5.5398	391.2721
I006	01	1,2-Dichlorobenzene	4	ug/L	0.0092	NA
I006	01	Aluminum	57600	ug/L	3.6822	NA
I006	01	Arsenic	44.3	ug/L	9.4399	988.2975
I006	01	Beryllium	2.5	ug/L	0.0320	159.8826
I006	01	Chromium	119	ug/L	1.5215	NA
I006	01	Lead	21.1	ug/L	NA	NA
I006	01	Manganese	110	ug/L	0.3057	NA
I006	01	Nickel	36.3	ug/L	0.1160	NA
I006	01	Vanadium	149	ug/L	1.3607	NA
		Total			16.4672	1148.1800
S001	01	1,1,1-Trichloroethane	3	ug/L	0.0028	NA
S001	01	1,1-Dichloroethane	12	ug/L	0.0130	NA
S001	01	4-Methylphenol (p-Cresol)	16	ug/L	0.2046	NA
S001	01	Aluminum	20400	ug/L	1.3041	NA
S001	01	Antimony	61.1	ug/L	9.7648	NA
S001	01	Arsenic	4.7	ug/L	1.0015	104.8532
S001	01	Chloroethane	25	ug/L	0.0046	NA
S001	01	Chromium	15.1	ug/L	0.1931	NA
S001	01	Lead	4.3	ug/L	NA	NA
S001	01	Manganese	46.1	ug/L	0.1281	NA
S001	01	Nickel	19.6	ug/L	0.0626	NA
S001	01	Vanadium	33.2	ug/L	0.3032	NA
		Total			12.9825	104.8532
S001	02	Manganese (Mn)	371	ug/L	1.0312	NA
S001	02	Vanadium (V)	1.2	ug/L	0.0110	NA
		Total			1.0421	NA
S002	01	1,1,1-Trichloroethane	5	ug/L	0.0047	NA
S002	01	Aluminum	4070	ug/L	0.2602	NA
S002	01	Chromium	8.8	ug/L	0.1125	NA
S002	01	Lead	20.4	ug/L	NA	NA

Table 10.3.5-20
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

S002	01	Manganese	44.5 ug/L	0.1237	NA
S002	01	Mercury	0.2 ug/L	0.0426	NA
S002	01	Trichloroethene	3 ug/L	0.0639	0.7585
		Total		0.6076	0.7585
S002	02	1,1,1-Trichloroethane	2 ug/L	0.0019	NA
S002	02	Tetrachloroethene	0.4 ug/L	0.0051	0.3214
S002	02	Trichloroethene	3 ug/L	0.0639	0.7585
		Total		0.0709	1.0799
S003	01	1,1,1-Trichloroethane	28 ug/L	0.0261	NA
S003	01	1,1-Dichloroethane	60 ug/L	0.0652	NA
S003	01	1,1-Dichloroethene	4 ug/L	0.0568	46.1057
S003	01	Aluminum	60900 ug/L	3.8931	NA
S003	01	Arsenic	12.4 ug/L	2.6423	276.6341
S003	01	Beryllium	1.3 ug/L	0.0166	83.1389
S003	01	Cadmium	5.1 ug/L	0.6538	NA
S003	01	Chromium	99.6 ug/L	1.2734	NA
S003	01	Lead	122 ug/L	NA	NA
S003	01	Manganese	144 ug/L	0.4002	NA
S003	01	Mercury	1.2 ug/L	0.2557	NA
S003	01	Nickel	33.4 ug/L	0.1068	NA
S003	01	Trichloroethene	4 ug/L	0.0852	1.0114
S003	01	Vanadium	88 ug/L	0.8037	NA
		Total		10.2791	406.8900
S003	02	Vanadium (V)	4.2 ug/L	0.0384	NA
		Total		0.0384	NA
S004	01	1,1,1-Trichloroethane	55 ug/L	0.0514	NA
S004	01	1,1-Dichloroethane	17 ug/L	0.0185	NA
S004	01	1,1-Dichloroethene	51 ug/L	0.7245	587.8474
S004	01	1,2-Dichloroethene (total)	1 ug/L	0.0142	NA
S004	01	Aluminum	10000 ug/L	0.6393	NA
S004	01	Antimony	48 ug/L	7.6712	NA
S004	01	Chromium	2170 ug/L	27.7443	NA
S004	01	Dieldrin	0.0021 ug/L	0.0027	0.4997
S004	01	Lead	128 ug/L	NA	NA
S004	01	Manganese	20 ug/L	0.0556	NA
S004	01	Mercury	0.47 ug/L	0.1002	NA
S004	01	Nickel	68.3 ug/L	0.2183	NA
S004	01	Trichloroethene	3 ug/L	0.0639	0.7585
S004	01	Vanadium	21.4 ug/L	0.1954	NA
		Total		37.4994	589.1056
S004	02	1,1-Dichloroethane	7 ug/L	0.0076	NA
S004	02	Chloroethane	3 ug/L	0.0005	NA
S004	02	Chromium (Cr)	39.9 ug/L	0.5101	NA
S004	02	Manganese (Mn)	24.2 ug/L	0.0673	NA
S004	02	Mercury (Hg)	0.06 ug/L	0.0128	NA
S004	02	Tetrachloroethene	1 ug/L	0.0128	0.8036
S004	02	Trichloroethene	7 ug/L	0.1492	1.7699
S004	02	cis-1,2-Dichloroethene	2 ug/L	0.0256	NA
		Total		0.7859	2.5734
S005	01	1,1,1-Trichloroethane	8 ug/L	0.0075	NA
S005	01	1,1-Dichloroethane	7 ug/L	0.0076	NA
S005	01	1,1-Dichloroethene	3 ug/L	0.0426	34.5793
S005	01	Aluminum	5860 ug/L	0.3746	NA
S005	01	Chromium	14.5 ug/L	0.1854	NA
S005	01	Manganese	31.8 ug/L	0.0884	NA
S005	01	Vanadium	17.2 ug/L	0.1571	NA
		Total		0.8632	34.5793
S006	01	1,1,1-Trichloroethane	26 ug/L	0.0243	NA
S006	01	1,1-Dichloroethane	300 ug/L	0.3259	NA
S006	01	Aluminum	41500 ug/L	2.6530	NA
S006	01	Antimony	38.5 ug/L	6.1530	NA
S006	01	Arsenic	7.6 ug/L	1.6195	169.5499
S006	01	Beryllium	1.2 ug/L	0.0153	76.7436
S006	01	Cadmium	4.2 ug/L	0.5385	NA
S006	01	Chloroethane	55 ug/L	0.0100	NA
S006	01	Chloroform	2 ug/L	0.0256	2.5760
S006	01	Chromium	46.4 ug/L	0.5932	NA
S006	01	Lead	32.4 ug/L	NA	NA
S006	01	Manganese	214 ug/L	0.5948	NA
S006	01	Mercury	0.22 ug/L	0.0469	NA
S006	01	Nickel	28.5 ug/L	0.0911	NA

Table 10.3.5-20
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

S006	01	Tetrachloroethene	2 ug/L	0.0256	1.6072
S006	01	Vanadium	53.7 ug/L	0.4904	NA
		Total		13.2070	250.4767
S006	02	bis(2-Ethylhexyl)phthalate	2.3 ug/L	0.0074	0.4789
		Total		0.0074	0.4789
S007	01	1,1,1-Trichloroethane	2 ug/L	0.0019	NA
S007	01	Aluminum	12400 ug/L	0.7927	NA
S007	01	Chromium	21.5 ug/L	0.2749	NA
S007	01	Lead	3.7 ug/L	NA	NA
S007	01	Manganese	89.5 ug/L	0.2488	NA
S007	01	Vanadium	18.5 ug/L	0.1689	NA
		Total		1.4872	NA
S007	02	Antimony (Sb)	2.9 ug/L	0.4635	NA
		Total		0.4635	NA
S008	01	1,1,1-Trichloroethane	4 ug/L	0.0037	NA
S008	01	1,1-Dichloroethane	2 ug/L	0.0022	NA
S008	01	1,1-Dichloroethene	6 ug/L	0.0852	69.1585
S008	01	Aluminum	3270 ug/L	0.2090	NA
S008	01	Antimony	43.6 ug/L	6.9680	NA
S008	01	Chromium	13.4 ug/L	0.1713	NA
S008	01	Dieldrin	0.0022 ug/L	0.0028	0.5235
S008	01	Lead	13.1 ug/L	NA	NA
S008	01	Manganese	32.3 ug/L	0.0898	NA
S008	01	Mercury	0.24 ug/L	0.0511	NA
S008	01	Vanadium	16.8 ug/L	0.1534	NA
		Total		7.7367	69.6820
S009	01	1,1,1-Trichloroethane	31 ug/L	0.0289	NA
S009	01	1,1-Dichloroethane	16 ug/L	0.0174	NA
S009	01	1,1-Dichloroethene	31 ug/L	0.4404	357.3190
S009	01	Aluminum	7080 ug/L	0.4526	NA
S009	01	Chromium	28.4 ug/L	0.3631	NA
S009	01	Manganese	23 ug/L	0.0639	NA
S009	01	Vanadium	23.7 ug/L	0.2164	NA
		Total		1.5828	357.3190
S010	01	1,1,1-Trichloroethane	160 ug/L	0.1494	NA
S010	01	1,1-Dichloroethane	7 ug/L	0.0076	NA
S010	01	1,1-Dichloroethene	10 ug/L	0.1421	115.2642
S010	01	1,2-Dichlorobenzene	45 ug/L	0.1039	NA
S010	01	1,4-Dichlorobenzene	15 ug/L	0.0084	10.7084
S010	01	Aldrin	0.0022 ug/L	0.0047	0.5562
S010	01	Aluminum	43200 ug/L	2.7616	NA
S010	01	Antimony	61 ug/L	9.7489	NA
S010	01	Arsenic	12.3 ug/L	2.6210	274.4031
S010	01	Cadmium	19.6 ug/L	2.5128	NA
S010	01	Chromium	5810 ug/L	74.2831	NA
S010	01	Heptachlor epoxide	0.0032 ug/L	0.0315	0.8662
S010	01	Lead	44.8 ug/L	0.0000	NA
S010	01	Manganese	218 ug/L	0.6059	NA
S010	01	Nickel	31.1 ug/L	0.0994	NA
S010	01	Trichloroethene	1 ug/L	0.0213	0.2528
S010	01	Vanadium	57.7 ug/L	0.5269	NA
		Total		93.6285	402.0510
S010	02	1,1-Dichloroethane	260 ug/L	0.2824	NA
S010	02	1,1-Dichloroethene	110 ug/L	1.5627	1267.9061
S010	02	1,2-Dichlorobenzene	5 ug/L	0.0115	NA
S010	02	1,2-Dichloroethane	37 ug/L	1.6541	100.1534
S010	02	1,4-Dichlorobenzene	2 ug/L	0.0011	1.4278
S010	02	Chloroethane	22 ug/L	0.0040	NA
S010	02	Chloroform	0.4 ug/L	0.0051	0.5152
S010	02	Chromium (Cr)	309 ug/L	3.9507	NA
S010	02	Manganese (Mn)	52.2 ug/L	0.1451	NA
S010	02	Tetrachloroethene	9 ug/L	0.1151	7.2322
S010	02	Trichloroethene	1 ug/L	0.0213	0.2528
S010	02	cis-1,2-Dichloroethene	15 ug/L	0.1918	NA
		Total		7.9449	1377.4875
S011	01	1,1,1-Trichloroethane	300 ug/L	0.2801	NA
S011	01	1,1-Dichloroethane	300 ug/L	0.3259	NA
S011	01	1,1-Dichloroethene	26 ug/L	0.3694	299.6869
S011	01	4-Methylphenol (p-Cresol)	2 ug/L	0.0256	NA
S011	01	Aluminum	12900 ug/L	0.8247	NA

Table 10.3.5-20
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

S011	01	Arsenic	5	ug/L	1.0654	111.5460
S011	01	Chloroethane	84	ug/L	0.0153	NA
S011	01	Chloroform	4	ug/L	0.0511	5.1519
S011	01	Chromium	30	ug/L	0.3836	NA
S011	01	Dieldrin	0.0064	ug/L	0.0082	1.5230
S011	01	Lead	58.5	ug/L	NA	NA
S011	01	Manganese	336	ug/L	0.9339	NA
S011	01	Mercury	0.32	ug/L	0.0682	NA
S011	01	Tetrachloroethene	4	ug/L	0.0511	3.2143
S011	01	Vanadium	66.2	ug/L	0.6046	NA
		Total			5.0070	421.1221
S011	02	1,1,1-Trichloroethane	51	ug/L	0.0476	NA
S011	02	1,1-Dichloroethane	120	ug/L	0.1304	NA
S011	02	1,1-Dichloroethene	12	ug/L	0.1705	138.3170
S011	02	Chloroethane	7	ug/L	0.0013	NA
S011	02	Chloroform	4	ug/L	0.0511	5.1519
S011	02	Tetrachloroethene	2	ug/L	0.0256	1.6072
S011	02	cis-1,2-Dichloroethene	5	ug/L	0.0639	NA
		Total			0.4904	145.0761
S013	01	1,1,1-Trichloroethane	18	ug/L	0.0168	NA
S013	01	1,1-Dichloroethane	92	ug/L	0.0999	NA
S013	01	1,1-Dichloroethene	13	ug/L	0.1847	149.8434
S013	01	4-Methylphenol (o-Cresol)	100	ug/L	1.2785	NA
S013	01	Aluminum	10200	ug/L	0.6521	NA
S013	01	Arsenic	8.7	ug/L	1.8539	194.0900
S013	01	Cadmium	63.6	ug/L	8.1538	NA
S013	01	Chloroethane	140	ug/L	0.0255	NA
S013	01	Lead	45.6	ug/L	NA	NA
S013	01	Manganese	192	ug/L	0.5337	NA
S013	01	Mercury	0.32	ug/L	0.0682	NA
S013	01	Pentachlorophenol	2	ug/L	0.0043	3.5695
S013	01	Vanadium	9.9	ug/L	0.0904	NA
		Total			12.9618	347.5029
S015	01	1,1,1-Trichloroethane	10	ug/L	0.0093	NA
S015	01	1,1-Dichloroethane	110	ug/L	0.1195	NA
S015	01	1,1-Dichloroethene	4	ug/L	0.0568	46.1057
S015	01	Aluminum	14100	ug/L	0.9014	NA
S015	01	Arsenic	8.3	ug/L	1.7686	185.1663
S015	01	Chloroethane	39	ug/L	0.0071	NA
S015	01	Chromium	20.9	ug/L	0.2672	NA
S015	01	Lead	9.4	ug/L	NA	NA
S015	01	Manganese	461	ug/L	1.2813	NA
S015	01	Mercury	0.36	ug/L	0.0767	NA
S015	01	Pentachlorophenol	1	ug/L	0.0021	1.7847
S015	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
S015	01	Vanadium	19.1	ug/L	0.1744	NA
		Total			4.6774	233.8603
S015	02	Aluminum (Al)	755	ug/L	0.0483	NA
S015	02	Mercury (Hg)	0.09	ug/L	0.0192	NA
S015	02	bis(2-Ethylhexyl)phthalate	2.3	ug/L	0.0074	0.4789
		Total			0.0748	0.4789
S016	01	1,1,1-Trichloroethane	15	ug/L	0.0140	NA
S016	01	1,1-Dichloroethane	40	ug/L	0.0435	NA
S016	01	1,1-Dichloroethene	4	ug/L	0.0568	46.1057
S016	01	Aluminum	2930	ug/L	0.1873	NA
S016	01	Chloroethane	160	ug/L	0.0291	NA
S016	01	Chromium	8	ug/L	0.1023	NA
S016	01	Manganese	17.7	ug/L	0.0492	NA
S016	01	Vanadium	11.4	ug/L	0.1041	NA
		Total			0.5863	46.1057
S018	01	1,1-Dichloroethane	20	ug/L	0.0217	NA
S018	01	1,2-Dichloroethene (total)	24	ug/L	0.3409	NA
S018	01	4-Methylphenol (p-Cresol)	4	ug/L	0.0511	NA
S018	01	Aldrin	0.0045	ug/L	0.0096	1.1378
S018	01	Aluminum	3010	ug/L	0.1924	NA
S018	01	Arsenic	4	ug/L	0.8524	89.2368
S018	01	Cadmium	8.3	ug/L	1.0641	NA
S018	01	Chloroethane	33	ug/L	0.0060	NA
S018	01	Lead	20.3	ug/L	NA	NA
S018	01	Manganese	29.4	ug/L	0.0817	NA
S018	01	Mercury	0.34	ug/L	0.0725	NA
S018	01	Tetrachloroethene	62	ug/L	0.7927	49.8218

Table 10.3.5-20
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 27, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

S018	01	alpha-BHC	0.026 ug/L	NA	2.4362
		Total		3.4852	142.6325
S018	02	bis(2-Ethylhexyl)phthalate	2 ug/L	0.0064	0.4164
		Total		0.0064	0.4164
S019	01	1,1-Dichloroethane	72 ug/L	0.0782	NA
S019	01	1,2-Dichloroethene (total)	130 ug/L	1.8468	NA
S019	01	4-Methylphenol (p-Cresol)	30 ug/L	0.3836	NA
S019	01	Aluminum	2180 ug/L	0.1394	NA
S019	01	Arsenic	5.3 ug/L	1.1294	118.2387
S019	01	Chloroethane	96 ug/L	0.0175	NA
S019	01	Lead	3.3 ug/L	NA	NA
S019	01	Manganese	76.5 ug/L	0.2126	NA
S019	01	Tetrachloroethene	61 ug/L	0.7799	49.0182
S019	01	Trichloroethene	130 ug/L	2.7702	32.8689
		Total		7.3575	200.1258
S019	02	1,1-Dichloroethane	3 ug/L	0.0033	NA
S019	02	Chloroethane	2 ug/L	0.0004	NA
S019	02	Pentachlorophenol	1.7 ug/L	0.0036	3.0341
S019	02	Tetrachloroethene	32 ug/L	0.4091	25.7145
S019	02	Trichloroethene	17 ug/L	0.3623	4.2982
S019	02	bis(2-Ethylhexyl)phthalate	7.7 ug/L	0.0246	1.6033
S019	02	cis-1,2-Dichloroethene	25 ug/L	0.3196	NA
		Total		1.1229	34.6501
S020	01	1,1-Dichloroethane	45 ug/L	0.0489	NA
S020	01	1,1-Dichloroethene	3 ug/L	0.0426	34.5793
S020	01	Aluminum	7320 ug/L	0.4679	NA
S020	01	Antimony	50 ug/L	7.9909	NA
S020	01	Chloroethane	87 ug/L	0.0158	NA
S020	01	Manganese	47.2 ug/L	0.1312	NA
S020	01	Tetrachloroethene	2 ug/L	0.0256	1.6072
S020	01	Vanadium	9 ug/L	0.0822	NA
S020	01	alpha-BHC	0.002 ug/L	NA	0.1874
		Total		8.8051	36.3738
S020	02	bis(2-Ethylhexyl)phthalate	9.3 ug/L	0.0297	1.9364
		Total		0.0297	1.9364
S021	01	1,1,1-Trichloroethane	1 ug/L	0.0009	NA
S021	01	1,1-Dichloroethane	45 ug/L	0.0489	NA
S021	01	1,1-Dichloroethene	15 ug/L	0.2131	172.8963
S021	01	4-Methylphenol (p-Cresol)	4 ug/L	0.0511	NA
S021	01	Aluminum	23000 ug/L	1.4703	NA
S021	01	Arsenic	10.7 ug/L	2.2801	238.7084
S021	01	Chloroethane	190 ug/L	0.0346	NA
S021	01	Chromium	36.6 ug/L	0.4679	NA
S021	01	Dieldrin	0.0037 ug/L	0.0047	0.8805
S021	01	Heptachlor epoxide	0.0066 ug/L	0.0649	1.7865
S021	01	Lead	5.2 ug/L	NA	NA
S021	01	Manganese	60.8 ug/L	0.1690	NA
S021	01	Mercury	0.56 ug/L	0.1193	NA
S021	01	Tetrachloroethene	3 ug/L	0.0384	2.4107
S021	01	Vanadium	38.4 ug/L	0.3507	NA
		Total		5.3140	416.6824
S021	02	1,1-Dichloroethane	17 ug/L	0.0185	NA
S021	02	Chloroethane	8 ug/L	0.0015	NA
S021	02	Tetrachloroethene	2 ug/L	0.0256	1.6072
S021	02	bis(2-Ethylhexyl)phthalate	2.5 ug/L	0.0080	0.5205
		Total		0.0535	2.1277

Table 10.3.5-21
Summary of Lead Model Results
Site 27
Naval Air Station Pensacola
Pensacola, Florida

Lead Model Default Inputs		Site Specific Inputs (RME)		(Mean)
Air Concentration	0.1 ug Pb/m3	Soil	398 ug Pb/g	90.3 ug Pb/g
Paint Intake	0 ug Pb/day	House Dust	398 ug Pb/g	90.3 ug Pb/g
Maternal Contribution	2.5 ug Pb/dL			
Drinking Water	4 ug Pb/L			

Lead Model Results

RME Inputs:		
Predicted Geometric Mean Blood Lead Level	5.7 ug Pb/dL	(micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/dL	10.6 %	
Mean Inputs:		
Predicted Geometric Mean Blood Lead Level	2.5 ug Pb/dL	(micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/dL	0.16 %	

Table 10.3.5-22
Summary of Risk and Hazard-based Surface Soil COCs
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident Iwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR	Identification of COCs	
Surface Soil	Incidental Ingestion	Aluminum	0.0084	0.079	ND	0.0030	ND	0.0019	ND		
		Arsenic	0.010	0.091	5.0E-06	0.0035	5.6E-07	0.0023	1.5E-07	2	
		Benzo(a)pyrene Equiv.	ND	ND	7.3E-06	ND	8.2E-07	ND	2.1E-07	2	
		Beryllium	0.000104	0.00097	2.6E-06	0.000037	2.9E-07	0.000024	7.4E-08	2	
		Cadmium	0.0067	0.063	ND	0.0024	ND	0.0016	ND		
		Chromium	0.019	0.18	ND	0.0067	ND	0.0044	ND		
		Dieldrin	0.0010	0.0090	8.8E-07	0.00034	9.8E-08	0.00022	2.5E-08		
		Lead	ND	ND	ND	ND	ND	ND	ND		
		Manganese	0.0039	0.036	ND	0.0014	ND	0.00097	ND		
		Mercury	0.0060	0.056	ND	0.0021	ND	0.0014	ND		
		Silver	0.00051	0.0047	ND	0.00018	ND	0.00012	ND		
	Dermal Contact	Aluminum	0.0017	0.0057	ND	0.0012	ND	0.00040	ND		
		Arsenic	0.0020	0.0066	5.6E-07	0.0014	2.3E-07	0.00046	3.0E-08		
		Benzo(a)pyrene Equiv.	ND	ND	3.3E-06	ND	1.3E-06	ND	1.7E-07	2	4
		Beryllium	0.000021	0.000071	2.9E-07	0.000015	1.2E-07	0.0000049	1.5E-08		
		Cadmium	0.0014	0.0045	ND	0.0010	ND	0.00032	ND		
		Chromium	0.0039	0.013	ND	0.0028	ND	0.00089	ND		
		Dieldrin	0.0008	0.003	3.9E-07	0.0006	1.6E-07	0.00018	2.1E-08		
		Lead	ND	ND	ND	ND	ND	ND	ND		
		Manganese	0.00079	0.00261	ND	0.00056	ND	0.00020	ND		
		Mercury	0.0012	0.0041	ND	0.00088	ND	0.00028	ND		
		Silver	0.000104	0.00034	ND	0.000074	ND	0.000024	ND		
	Inhalation	Chromium	ND	ND	3.5E-07	ND	1.5E-07	ND	1.7E-08		
Surface Soil Pathway Sum			0.07	0.6	2E-05	0.03	4E-06	0.02	7E-07		

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental excess lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.
5- Chemical is a COC by virtue of projected future adolescent trespasser noncarcinogenic hazard.
6- Chemical is a COC by virtue of projected future adolescent trespasser ILCR.

Table 10.3.5-23
Summary of Risk and Hazard-based Groundwater COCs
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident lwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Identification of COCs
Groundwater	Ingestion	Aldrin	0.0031	0.0071	8.6E-07	0.0011	2.7E-07	
		alpha-BHC	ND	ND	7.1E-07	ND	2.3E-07	
		Chloroethane	0.0057	0.0132	ND	0.0020	ND	
		Chloroform	0.0062	0.0146	2.1E-07	0.0022	6.7E-08	
		Chromium	10	24	ND	3.7	ND	1 3
		1,2-Dichlorobenzene	0.0055	0.013	ND	0.0020	ND	
		1,4-Dichlorobenzene	ND	ND	3.1E-06	ND	9.8E-07	2
		1,1-Dichloroethane	0.043	0.10	ND	0.015	ND	1
		1,2-Dichloroethane	ND	ND	5.1E-05	ND	1.6E-05	2 4
		1,1-Dichloroethene	0.11	0.25	3.2E-04	0.038	1.0E-04	1 2 4
		1,2-Dichloroethene (cis)	0.032	0.075	ND	0.011	ND	
		1,2-Dichloroethene (total)	0.12	0.28	ND	0.043	ND	1
		Dieldrin	0.0030	0.0071	1.3E-06	0.0011	4.3E-07	2
		Ethylbenzene	0.0045	0.010	ND	0.0016	ND	
		bis(2-Ethylhexyl)phthalate	0.0060	0.014	9.2E-07	0.0021	2.9E-07	
		Heptachlor	0.00011	0.00026	1.4E-07	0.000039	4.3E-08	
		Heptachlor epoxide	0.010	0.024	6.7E-07	0.0037	2.1E-07	
		Manganese*	0.40	0.9	ND	0.14	ND	1 3
		4-Methylphenol	0.14	0.32	ND	0.049	ND	1
		Naphthalene	0.017	0.039	ND	0.0060	ND	
		Pentachlorophenol	0.0014	0.0032	2.7E-06	0.00049	8.7E-07	2
		Tetrachloroethene	0.038	0.089	1.1E-05	0.014	3.5E-06	2 4
		Toluene	0.0020	0.0047	ND	0.00072	ND	
		1,1,1-Trichloroethane	0.085	0.20	ND	0.030	ND	1
		Trichloroethene	0.086	0.20	3.1E-06	0.031	9.9E-07	1 2
		Vinyl chloride	ND	ND	1.1E-04	ND	3.7E-05	2 4
		Xylene (Total)	0.0019	0.0044	ND	0.00067	ND	
	Inhalation	Chloroethane	0.00079	0.0019	ND	0.00028	ND	
		Chloroform	0.0062	0.015	2.8E-06	0.0022	8.8E-07	2
		1,2-Dichlorobenzene	0.012	0.029	ND	0.0044	ND	
		1,4-Dichlorobenzene	0.0010	0.0024 ND		0.00036	ND	
		1,1-Dichloroethane	0.030	0.071	ND	0.011	ND	
		1,2-Dichloroethane	0.3544	0.83	5.1E-05	0.13	6.9E-05	1 2 3 4
		1,1-Dichloroethene	0.11	0.25	9.3E-05	0.038	3.1E-05	1 2 4
		1,2-Dichloroethene (cis)	0.032	0.075	ND	0.011	ND	
		1,2-Dichloroethene (total)	0.12	0.28	ND	0.043	ND	1
		Ethylbenzene	0.0016	0.0036	ND	0.00056	ND	
		Tetrachloroethene	0.038	0.089	4.3E-07	0.014	5.4E-11	
		Toluene	0.0035	0.0083	ND	0.0013	ND	
		1,1,1-Trichloroethane	0.010	0.024	ND	0.0037	ND	
		Trichloroethene	0.086	0.20	1.7E-06	0.031	5.8E-11	1 2
		Vinyl chloride	ND	ND	1.8E-05	ND	5.8E-06	
		Xylene (Total)	ND	ND	ND	ND	ND	
Groundwater Pathway Sum			12	29	7E-04	4	3E-04	

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental excess lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.

Table 10.3.5-24
Summary of Risk and Hazar
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	HI (Adult)	HI (Child)	ILCR (LWA)	HI (Worker)	ILCR (Worker)	HI (Tresspasser)	ILCR (Tresspasser)
Surface Soil	Incidental Ingestion	0.05	0.5	2E-05	0.02	2E-06	0.01	5E-07
	Dermal Contact	0.01	0.03	5E-06	0.008	2E-06	0.003	2E-07
	Inhalation	NA	NA	3E-07	NA	2E-07	NA	2E-08
Groundwater	Ingestion	11	27	5E-04	4	2E-04	NA	NA
	Inhalation	0.8	1.9	2E-04	0.3	1E-04	NA	NA
Sum of All Pathways		12	29	7E-04	4	3E-04	0.02	7E-07

Notes:

ILCR Indicates incremental lifetime cancer risk
HI Indicates hazard index
NA Not applicable or not available

Table 10.3.5-25
Remedial Goal Options for Surface Soil
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Slope Factor (mg/kg-day)$^{-1}$	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Arsenic	1.5	0.0003	2.1	66	22	2.2	0.38	3.8	38	1.56	0.7
Benzo(a)pyrene Equiv.	7.3	NA	0.64	ND	ND	ND	0.060	0.60	6.0	NA	0.1
Beryllium	4.3	0.005	0.38	1094	365	36	0.13	1.3	13	0.41	0.2

Industrial RGOs

Chemical	Slope Factor (mg/kg-day)$^{-1}$	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Benzo(a)pyrene Equiv.	7.3	NA	0.64	ND	ND	ND	0.30	3.0	30	NA	0.5

Notes:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinogens

Table 10.3.5-26
Remedial Goal Options for Groundwater
Site 27
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Oral SF (mg/kg-day)-	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options **0.1** mg/l	**1.0** mg/l	**3** mg/l	Risk-Based Remedial Goal Options **1E-06** mg/l	**1E-05** mg/l	**1E-04** mg/l	Background Conc. mg/l	ARAR mg/l
Chloroform	0.0061	0.01	0.0023	0.0078	0.078	0.23	0.00077	0.0077	0.077	NA	0.006
Chromium	NA	0.005	1.9	0.0078	0.078	0.23	ND	ND	ND	NA	0.1
1,4-Dichlorobenzene	0.024	NA	0.0085	0.36	3.6	11	0.0028	0.028	0.28	NA	0.075
1,1-Dichloroethane	NA	0.1	0.16	0.092	0.92	2.8	ND	ND	ND	NA	0.7
1,2-Dichloroethane	0.091	NA	0.037	0.0045	0.045	0.13	0.00036	0.0036	0.036	NA	0.003
1,1-Dichloroethene	0.6	0.009	0.035	0.0070	0.070	0.21	0.000086	0.00086	0.0086	NA	0.007
1,2-Dichloroethene (total)	NA	0.009	0.039	0.0070	0.070	0.21	ND	ND	ND	NA	0.07
Dieldrin	16	5E-05	0.0000055	0.000078	0.00078	0.0023	0.0000041	0.000041	0.00041	NA	0.0001
Manganese*	NA	0.047	0.68	0.074	0.74	2.2	ND	ND	ND	0.022	0.05
4-Methylphenol	NA	0.005	0.025	0.0078	0.078	0.23	ND	ND	ND	NA	0.035
Pentachlorophenol	0.12	0.03	0.0015	0.047	0.47	1.4	0.00055	0.0055	0.055	NA	0.001
Tetrachloroethene	0.052	0.01	0.014	0.0078	0.078	0.23	0.0012	0.012	0.12	NA	0.003
1,1,1-Trichloroethane	NA	0.035	0.11	0.049	0.49	1.5	ND	ND	ND	NA	0.2
Trichloroethene	0.011	0.006	0.019	0.0047	0.047	0.14	0.0039	0.039	0.39	NA	0.003
Vinyl chloride	1.9	NA	0.0040	ND	ND	ND	0.000030	0.00030	0.0030	NA	0.001

Industrial RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options **0.1** mg/l	**1** mg/l	**3** mg/l	Risk-Based Remedial Goal Options **1E-06** mg/l	**1E-05** mg/l	**1E-04** mg/l	Background Conc. mg/l	ARAR mg/l
Chromium	NA	0.005	1.9	0.051	0.51	1.5	ND	ND	ND	NA	0.1
1,4-Dichlorobenzene	0.024	NA	0.0085	2.3	23	70	0.0087	0.087	0.87	NA	0.075
1,2-Dichloroethane	0.091	NA	0.037	0.029	0.29	0.88	0.00043	0.0043	0.043	NA	0.003
1,1-Dichloroethene	0.6	0.009	0.035	0.046	0.46	1.4	0.00026	0.0026	0.026	NA	0.007
Manganese*	NA	0.047	0.68	0.48	4.8	14.4	ND	ND	ND	0.022	0.05
Tetrachloroethene	0.052	0.01	0.014	0.051	0.51	1.5	0.0040	0.040	0.40	NA	0.003
Vinyl chloride	1.9	NA	0.0040	ND	ND	ND	0.000094	0.00094	0.0094	NA	0.001

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinoge
* Using the FDEP recommended RfD (0.023 mg/kg-day) e would effectively double its RGO.

10.3.6 Human Health Risk Assessment for Site 30

10.3.6.1 Site Background and Investigative Approach

Site 30 consists of Buildings 649, 755, and 648 and former Site 31 (the area north of Building 648). Buildings 649 and 755 housed metal plating shops from the 1940s until the 1970s. Building 648 housed a painting operation. The Site 30 buildings supported the Dynamic Components Complex until 1997. Past waste handling activities included discharging solutions containing various inorganic constituents, acids, caustics, oxidizers, paint waste, and degreasers into the ditch east of Building 649 and onto the unpaved area north of Building 649. The complex is now light industrial used mainly for storage.

As part of the RI, 59 surface soil samples were collected and analyzed for TCL/TAL, and gross alpha and beta radioactivity. Surface soil was considered the interval down to 2 feet deep. Table 10.3.6-1 lists the analytical methods used for soil samples. All tables referenced in Section 10.3.6 can be found at the end of the section. Sixty-five Phase I groundwater samples were collected from shallow and intermediate intervals. Twenty-one monitoring wells were resampled for Phase II. Phase I groundwater samples were analyzed for full scan TCL/TAL parameters, while Phase II samples were analyzed for inorganic, low concentration VOA, pesticide, and SVOC parameters only. For groundwater, TAL metals were not filtered. Table 10.3.6-2 lists the analytical methods for the groundwater samples. Due to incomplete and/or questionable data sets, preliminary conclusions should be interpreted with caution. Supplemental, full scope (all monitoring wells) groundwater sampling and analysis should precede any formal remedial design.

10.3.6.2 COPC Identification

Soil

Based on the screening comparisons described in Section 10.2.5 of this RI and presented in Table 10.3.6-3, the focus of this HHRA is on the following COPCs: aluminum, Aroclor-1242,

Aroclor-1254, Aroclor-1260, arsenic, BEQs, beryllium, cadmium, chromium, dieldrin, and manganese.

Groundwater

As shown in Table 10.3.6-4, the COPCs identified in Phase I groundwater included aluminum, arsenic, barium, benzene, beryllium, bromodichloromethane, 2-butanone, cadmium, carbazole, chlorobenzene, chloroethane, chloroform, chromium, dibromochloromethane, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,1-DCA, 1,2-DCA, 1,1-DCE, 1,2-DCE (total), ethylbenzene, bis(2-ethylhexyl)phthalate, heptachlor epoxide, lead, manganese, methylene chloride, 4-methylphenol, naphthalene, silver, PCE, toluene, toxaphene, 1,1,1-TCA, TCE, vanadium, vinyl chloride, and xylene. Table 10.3.6-5 presents the screening analysis for Phase II groundwater and identifies arsenic, barium, benzene, bis(2-ethylhexyl)phthalate, carbon tetrachloride, chlorobenzene, chloroethane, chloroform, cadmium, chromium, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,1-DCA, 1,2-DCA, 1,1-DCE, 1,2-DCE (cis), lead, manganese, pentachlorophenol, PCE, 1,1,1-TCA, TCE, and vinyl chloride as COPCs.

One set of Site 30 monitoring wells is near Buildings 648, 649, and 755. Another set is near Buildings 3220 and 3450. Site 30 groundwater data have been separated according to these general groupings for two reasons. The set of monitoring wells near Buildings 648, 649, and 755 is in an area where the OU 2 aquifer flows westerly. The set of monitoring wells near Buildings 3220 and 3450 is in an area where the OU 2 aquifer flows south-southwesterly. The distance between these two sets of Site 30 monitoring wells is such that they are considered to represent two plumes. Additionally, to validate the conclusions made when comparing the two phases of groundwater data, it was useful to focus on a smaller area of the aquifer. The aquifer is expected to be uniform in the immediate area of each of these sets of Site 30 monitoring wells. Phase II data were sufficient to support general conclusions from Phase I. All COPCs identified using Phase I data were resampled and reanalyzed as part of Phase II.

Monitoring Wells Near Buildings 648, 649, and 755

Table 10.3.6-6 shows the monitoring wells near Buildings 648, 649, and 755, and data for COPCs identified in either sampling phase. As shown, 16 of the 36 Phase I monitoring wells were resampled during Phase I: six (one intermediate and five shallow) were analyzed for inorganics, 14 (two intermediate and 12 shallow) were analyzed for VOCs, and five (all shallow) were analyzed for SVOCs.

Phase I and II data were compared for the set of monitoring wells near Buildings 648, 649, and 755. Of the COPCs identified using the entire Site 30 groundwater data set (both phases), some were eliminated for this set of wells. Carbon tetrachloride, heptachlor epoxide and toxaphene were not detected in samples from these monitoring wells in either phase. Chlorobenzene did not exceed its RBC in samples from either phase. Generally, the Phase I inorganic data were considerably higher than those from Phase II. Aluminum and vanadium were not considered COPCs for this set of monitoring wells because the reported concentrations were drastically lower in the Phase II samples from the same monitoring wells (30GI060 and 30GS062). Beryllium and silver were not detected in any Phase II samples from these monitoring wells. As a result, these inorganic parameters were not considered COPCs for groundwater near Buildings 648, 649, and 755.

Monitoring wells 30GS006 and 30GS012 yielded samples with high concentrations of VOCs and SVOCs. The sample from monitoring well 30GS012 also had unusually high SQLs for VOC and SVOC parameters. The VOC and SVOC concentrations from Phase II samples from these same wells were considerably lower, as were the SQLs. Eliminating Phase I data from monitoring well 30GS012 resulted in the elimination of carbazole, ethylbenzene, methylene chloride, toluene, and xylene as COPCs for this subset of wells. Bromodichloromethane and dibromochloromethane were only detected in the Phase I sample from monitoring well GI060. These chemicals were not

detected in any Phase II resample, including monitoring well GI060. As a result, these chemicals were not considered COPCs for these monitoring wells.

Monitoring Wells Near Buildings 3220 and 3450

Table 10.3.6-7 shows the monitoring wells near Buildings 3220 and 3450, and the data associated with COPCs identified in either phase. As shown, 12 of the 29 Phase I monitoring wells were resampled during Phase II: seven (one intermediate and six shallow) were analyzed for inorganics, seven (one intermediate and six shallow) were analyzed for VOCs, and five (all shallow) were analyzed for SVOCs.

Phase I and II data were compared for the set of monitoring wells near Buildings 3220 and 3450. Of the COPCs identified using both phases of Site 30 groundwater data, some were eliminated for this set of wells. Bromodichloromethane, carbazole, dibromochloromethane, pentachlorophenol, and silver were not detected in samples from these monitoring wells in either phase. Toluene, bis(2-ethylhexyl)phthalate, 4-methylphenol, vanadium, and xylene did not exceed their RBCs in samples from either phase. Generally, Phase I inorganic concentrations were higher than those in Phase II. Aluminum was not considered a COPC because concentrations were lower in the Phase II samples. Beryllium was not detected at concentrations exceeding background in samples from either phase. As a result, aluminum and beryllium were not considered COPCs for groundwater near Buildings 3220 and 3450.

Toxaphene was detected only in the Phase I groundwater sample from monitoring well GS123. It was not detected in the Phase II sample from the same well, so it was not considered a COPC.

10.3.6.3 Exposure Assessment

Exposure Setting

Site 30 covers approximately 60 acres in the southwestern portion of OU 2. The site includes both industrial areas and highly vegetated wetlands. The area will likely remain unchanged for the next five years.

Potentially Exposed Populations

Potentially exposed populations are current and future site workers and future site residents. A trespasser scenario was included, although this area is unlikely to attract adolescent trespassers with any significant frequency, and Site 30 is not near the base boundary so as to allow convenient access. In the event of onsite construction, construction workers could potentially be exposed to chemicals in subsurface soil. Therefore construction worker PRGs were calculated as described in Section 10.2.12, and compared with maximum detected chemical concentrations in subsurface soil. The hypothetical future site worker scenario assumed continuous exposure to surface soil and use of groundwater as a source of process and potable water. Current site worker exposure is expected to be less than that assumed for the hypothetical future site worker scenario because groundwater is not currently a source of potable or process water. The current site trespasser is characterized as an adolescent who visits the site once a week during the summer. The future site resident scenario assumes that existing buildings would be removed and replaced with dwellings, and that future site residents would use the onsite shallow zone of the underlying aquifers as a drinking water source.

Exposure Pathways

Exposure pathways for the site workers, future resident, and current trespasser are dermal contact and incidental ingestion of surface soil. Additional pathways for future site residents and workers include ingestion of groundwater and inhalation of VOCs through domestic/process groundwater use. The maximum detected concentration of chromium in surface soil exceeded its soil-to-air

SSL, and thus exposure to chromium via the dust inhalation pathway was added and evaluated in the formal risk assessment. Uniform exposure was assumed for all sample locations. Table 10.3.6-8 presents the exposure pathways assessed in this HHRA.

Exposure Point Concentrations

Table 10.3.6-9 summarizes the statistical data analysis for COPCs identified in surface soil. For nondetects, one-half the sample quantitation limits served as proxy concentrations and were inserted into the data set used to calculate the 95% UCL for all COPCs. The EPC for all soil COPCs was set equal to the 95% UCL.

One-half the sample quantitation limits also served as proxy concentrations for nondetects in the data set used to calculate 95% groundwater UCLs. Data from both phases of groundwater sampling were combined to allow the statistical methods to account for both temporal and spatial data variability. Historically, the 95% UCL has been the most conservative method of providing exposure point concentration estimates using data with different degrees of variability. As mentioned in Section 10.2, the placement of monitoring wells may provide a data set that causes a low bias in the 95% UCL. Additionally, since there are no readily definable plumes for Site 30 groundwater COPCs, the Region IV guidance for groundwater EPCs applies only marginally. As a result, the larger value — either the arithmetic mean of detected concentrations or the 95% UCL — was selected as the EPC.

Table 10.3.6-10 summarizes the statistical analysis of the data for COPCs in groundwater west of Murray Road near Buildings 648, 649, and 755. The 95% UCL was used as the EPC to estimate exposure to groundwater containing the following COPCs: chloroform, 1,3-dichlorobenzene, 1,1-DCA, manganese, 1,1,1-TCA, and TCE. Arithmetic means of detected concentrations were used as EPCs for arsenic, barium, benzene, cadmium, chloroethane, chromium, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-DCA, 1,1-DCE, 1,2-DCE (cis),

1,2-DCE (total), bis (2-ethylhexyl) phthalate, 4-methylphenol, naphthalene, PCE, and vinyl chloride. The only detected concentration of pentachlorophenol was used as its EPC.

Table 10.3.6-11 summarizes the statistical data analysis for COPCs identified in groundwater east of Murray Road near Buildings 3220 and 3450. The 95% UCL was used as the EPC to estimate exposure to groundwater containing the following COPCs: 1,1-DCA, manganese, 1,2-DCE (total), manganese, methylene chloride, and TCE. Arithmetic means of detected concentrations were used as EPCs for arsenic, barium, benzene, cadmium, chlorobenzene, chloroform, chromium, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,1-DCE, naphthalene, PCE, 1,1,1-TCE, and vinyl chloride. The only detected concentrations of 2-butanone, carbon tetrachloride, 1,2-DCA, 1,2-DCE (cis), and heptachlor epoxide were used as their EPCs.

Quantification of Exposure

Soil

CDIs for ingestion, dermal contact, and inhalation pathways are shown in Tables 10.3.6-12, 10.3.6-13, and 10.3.6-14, respectively.

Groundwater

The CDIs for groundwater ingestion are presented in Table 10.3.6-15 (west of Murray Road) and Table 10.3.6-16 (east of Murray Road). CDIs for VOC inhalation are assumed to be approximately equal to those for ingestion as indicated in the *Technical Memorandum Guidance on Estimating Exposure to VOCs During Showering* (USEPA, 1991e).

10.3.6.4 Toxicity Assessment

Table 10.4.1-1 presents toxicological information specific to each COPC identified at Site 30. This information was used to quantify risk/hazard associated with soil and groundwater contaminants. Brief toxicological profiles for COPCs are provided in Section 10.4.

10.3.6.5 Risk Characterization

Surface Soil Pathways

Exposure to surface soil onsite was evaluated under residential, industrial (site worker), and trespasser scenarios. For these scenarios, the incidental ingestion, dermal contact, and inhalation of dust exposure pathways were evaluated. For noncarcinogenic contaminants evaluated for future site residents, hazard was computed separately to address child and adult exposure. Tables 10.3.6-17, 10.3.6-18, and 10.3.6-19 present the computed carcinogenic risks and/or HQs associated with the incidental ingestion, dermal contact, and inhalation pathways, respectively.

Hypothetical Site Residents

The ingestion, dermal contact, and inhalation ILCRs (based on the adult and child residents' LWA) for Site 30 surface soil are 2E-05, 7E-06, and 3E-07, respectively. Arsenic, BEQs, and beryllium were the primary contributors to the ingestion pathway, with BEQs contributing significantly to the dermal pathway. Computed HIs for adult and child residents were less than one for both the ingestion and dermal contact pathways.

Hypothetical Site Workers

The ingestion, dermal contact, and inhalation ILCRs for the site worker are 2E-06, 3E-06, and 1E-07, respectively. BEQs were the primary contributors to risk in these pathways. HIs were less than 0.1 for both the ingestion and the dermal contact pathways.

Hypothetical Adolescent Trespasser

The ingestion, dermal contact, and inhalation ILCRs for the adolescent trespasser are 6E-07, 4E-07, and 1E-08, respectively. HIs for the ingestion and dermal pathways were less than 0.01.

Construction Worker

Table 10.3.6-20 presents a summary of subsurface soil with a comparison to PRGs. As shown, the maximum chemical concentrations reported in Site 30 subsurface soil did not exceed construction worker PRGs.

Point Risk and Point Hazard Estimates for Soil Pathways

Figures 10-23 and 10-24 are the risk and hazard maps for Site 30 soil. Table 10.3.6-21 details the contributors to risk and hazard at each sampling location. As shown, three of 59 soil locations reported COPC soil concentrations equivalent to an HI marginally greater than 1. HI projections over 1 are generally due to concentrations of aluminum, arsenic, cadmium, and chromium. As shown, most of the reported soil concentrations of arsenic, BEQs, and beryllium equate with cumulative risks ranging from 1E-06 to 1E-05. The notable exceptions are locations 30S137, 30S138, 30S140, just south of Buildings 649 and 755, and 30S102, just north of Building 3644. The reported concentrations of BEQs, arsenic, and PCBs at these locations equate with risks ranging from 1E-05 to more than 1E-04.

Groundwater Pathways

Exposure to groundwater onsite was evaluated under both residential and industrial scenarios. The groundwater exposure pathways were evaluated assuming that site groundwater will be used for potable and/or domestic purposes and that an unfiltered well, drawing from the corresponding water-bearing zone, will be installed. For noncarcinogenic contaminants evaluated relative to future site residents, hazard was computed separately for child and adult receptors. Tables 10.3.6-22 and 10.3.6-23 present risk and hazard for ingestion and inhalations pathways,

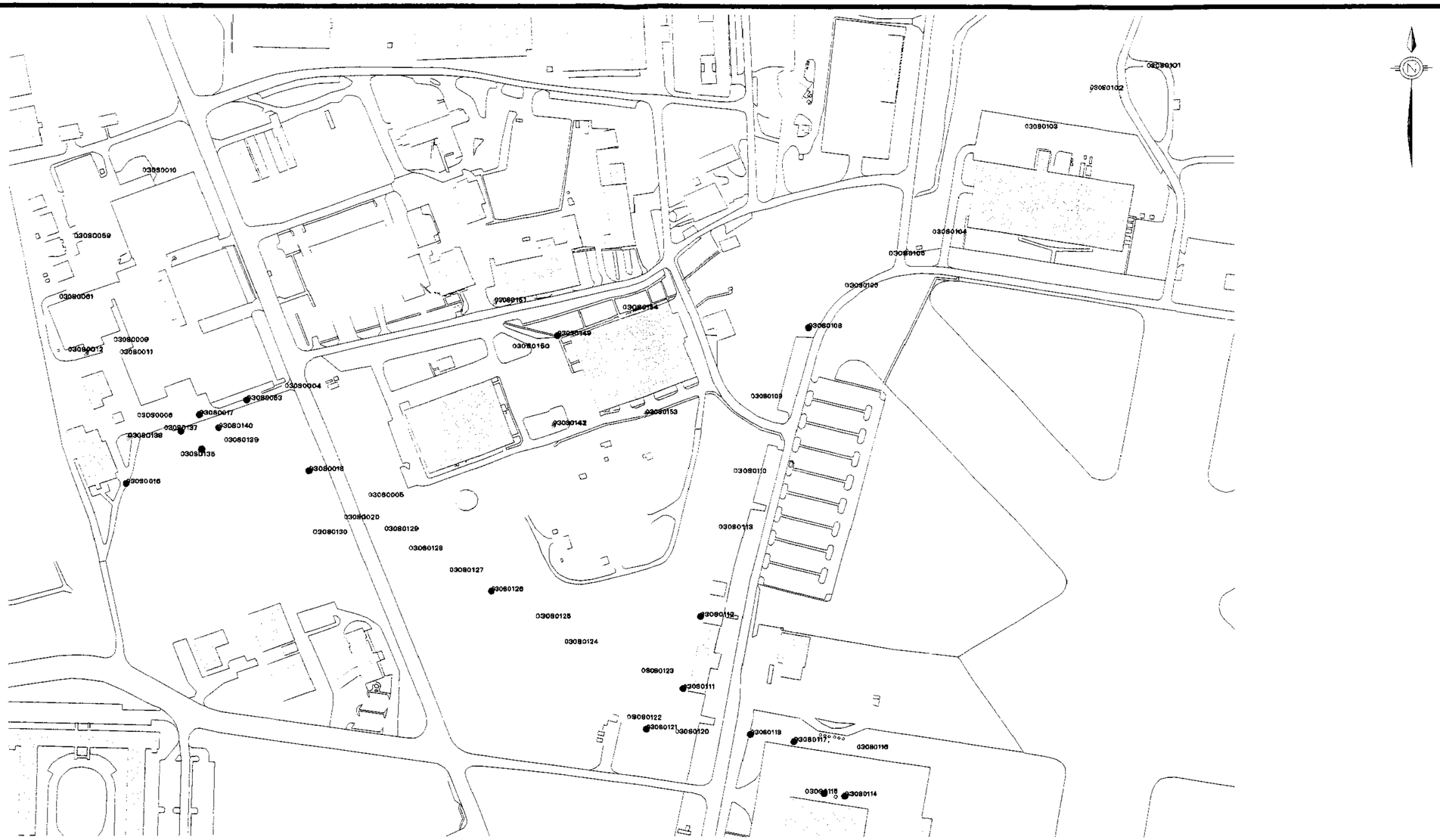
respectively, for groundwater west of Murray Road. Tables 10.3.6-24 and 10.3.6-25 present the risk and hazard for the ingestion and inhalation pathways, respectively, for groundwater east of Murray Road.

Groundwater West of Murray Road

Hypothetical Site Residents: For the ingestion and inhalation pathways, the LWA ILCRs for future residents were computed to be 1E-03 and 4E-04, respectively. For the ingestion pathway, arsenic, benzene, 1,2-DCA, 1,1-DCE, PCE, and vinyl chloride were the primary contributors to risk, with secondary contributions from chloroform, 1,4-dichlorobenzene, bis (2-ethylhexyl) phthalate, pentachlorophenol, and TCE. For the inhalation pathway, benzene, chloroform, 1,2-DCA, and 1,1-DCE were the primary contributors to risk, with secondary contributions from PCE, TCE, and vinyl chloride.

HIs for the adult and child resident were 6 and 14 for the ingestion pathway, and 3 and 8 for the inhalation pathway. For the ingestion pathway, arsenic, cadmium, chromium, and 1,1,1-TCA were the primary contributors to HI, with secondary contributions from chloroform, 1,1-DCA, 1,1-DCE, 1,2-DCE (cis), 1,2-DCE (total), manganese, 4-methylphenol, PCE, and TCA. For the inhalation pathway benzene and 1,2-DCA were the primary contributors, with secondary contributions from chloroform, 1,1-DCA, 1,1-DCE, 1,2-DCE (cis), 1,2-DCE (total), PCE, 1,1,1-TCA, and TCE.

Hypothetical Site Workers: For the ingestion and inhalation pathways, the ILCRs for future workers were computed to be 4E-04 and 1E-04, respectively. For the ingestion pathway, arsenic, 1,2-DCA, 1,1-DCE, and PCE were the primary contributors to risk, with secondary contributions from benzene, 1,4-dichlorobenzene, and vinyl chloride. For the inhalation pathway, benzene, chloroform, 1,2-DCA, and 1,1-DCE were the primary contributors to risk. Worker HIs were computed to be 2 and 1 for the ingestion and inhalation pathways, respectively. For the ingestion



LEGEND - RISK VALUES

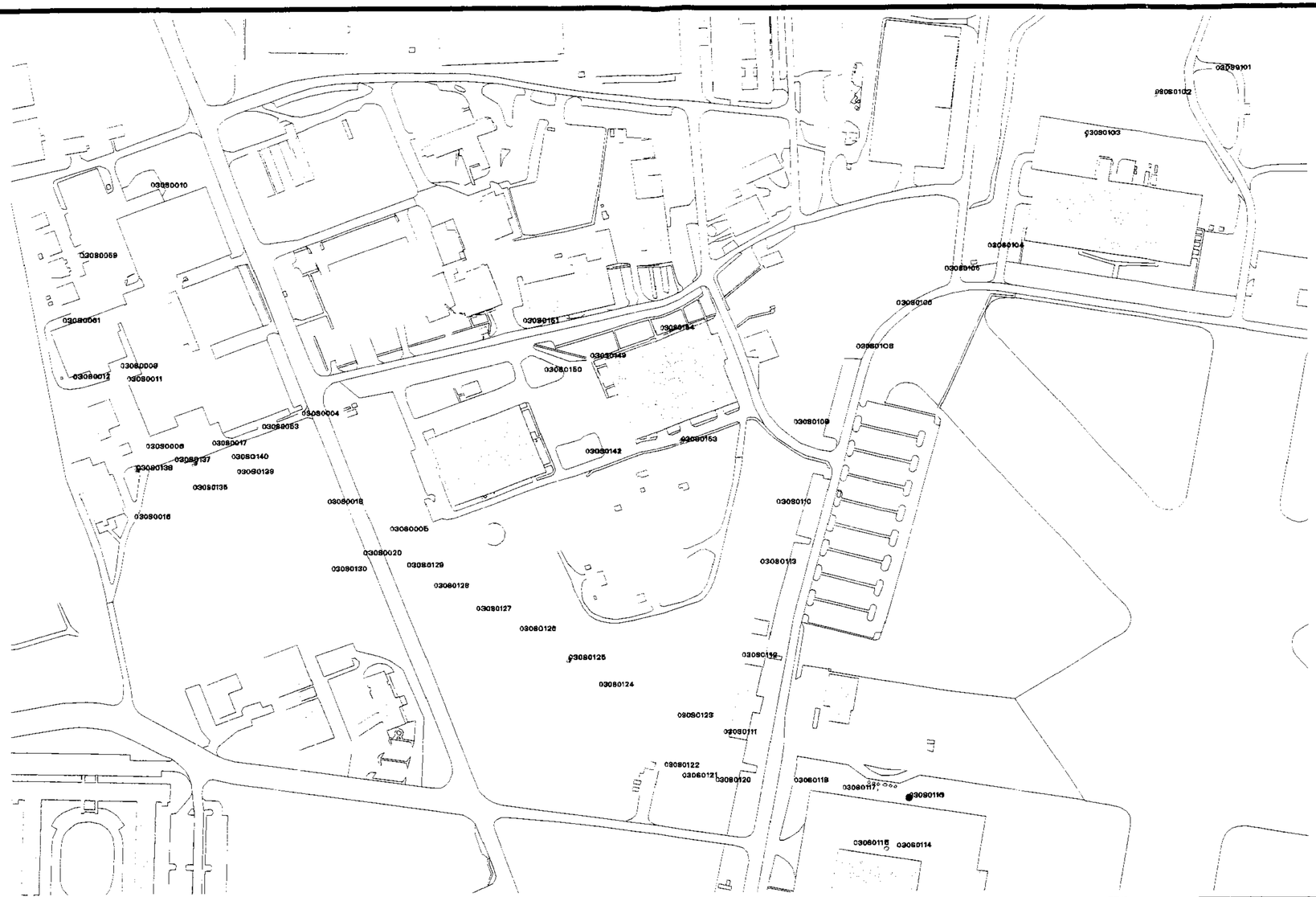
- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 600

OPERABLE UNIT 2
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-23
SAMPLE POINT ESTIMATES OF RISK
SITES 30, SURFACE SOIL
RESIDENTIAL SCENARIO

AMIL: /home4/pensacola_dir/risk_assess/ou2_sir/soil_dir/bomaint1x17.aml



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 600

OPERABLE UNIT 2
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-24
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 30, SURFACE SOIL
RESIDENTIAL SCENARIO

AMIL: /home4/pensacola_dir/risk_assess/ou2_dir/soil_dir/bornsird1x17.aml

pathway, arsenic, cadmium, chromium, 1,1-DCE, PCE, and 1,1,1-TCA were the primary contributors to HI. For the inhalation pathway, benzene, 1,2-DCA, and PCE were the primary contributors to HI.

Groundwater East of Murray Road

Hypothetical Site Residents: For the ingestion and inhalation pathways, the LWA ILCRs for future residents were computed to be 2E-03 and 4E-04, respectively. For the ingestion pathway, arsenic, 1,4-dichlorobenzene, 1,1-DCE, and vinyl chloride were the primary contributors to risk, with secondary contributions from benzene, carbon tetrachloride, 1,2-DCA, heptachlor epoxide, methylene chloride, PCE, and TCE. For the inhalation pathway, 1,1-DCE and vinyl chloride were the primary contributors to risk, with secondary contributions from benzene, carbon tetrachloride, chloroform, 1,2-DCA, and TCE.

HIs for the adult and child resident were 2 and 5 for the ingestion pathway and 1 and 3 for the inhalation pathway. For the ingestion pathway, arsenic was the primary contributors to HI, with secondary contributions from barium, cadmium, carbon tetrachloride, chlorobenzene, chromium, 1,1-DCE, heptachlor epoxide, manganese, 1,1,1-TCA, and TCE. For the inhalation pathway, chlorobenzene was the primary contributor to HI, with secondary contributions from benzene, 2-butanone, carbon tetrachloride, 1,1-DCE, and TCE.

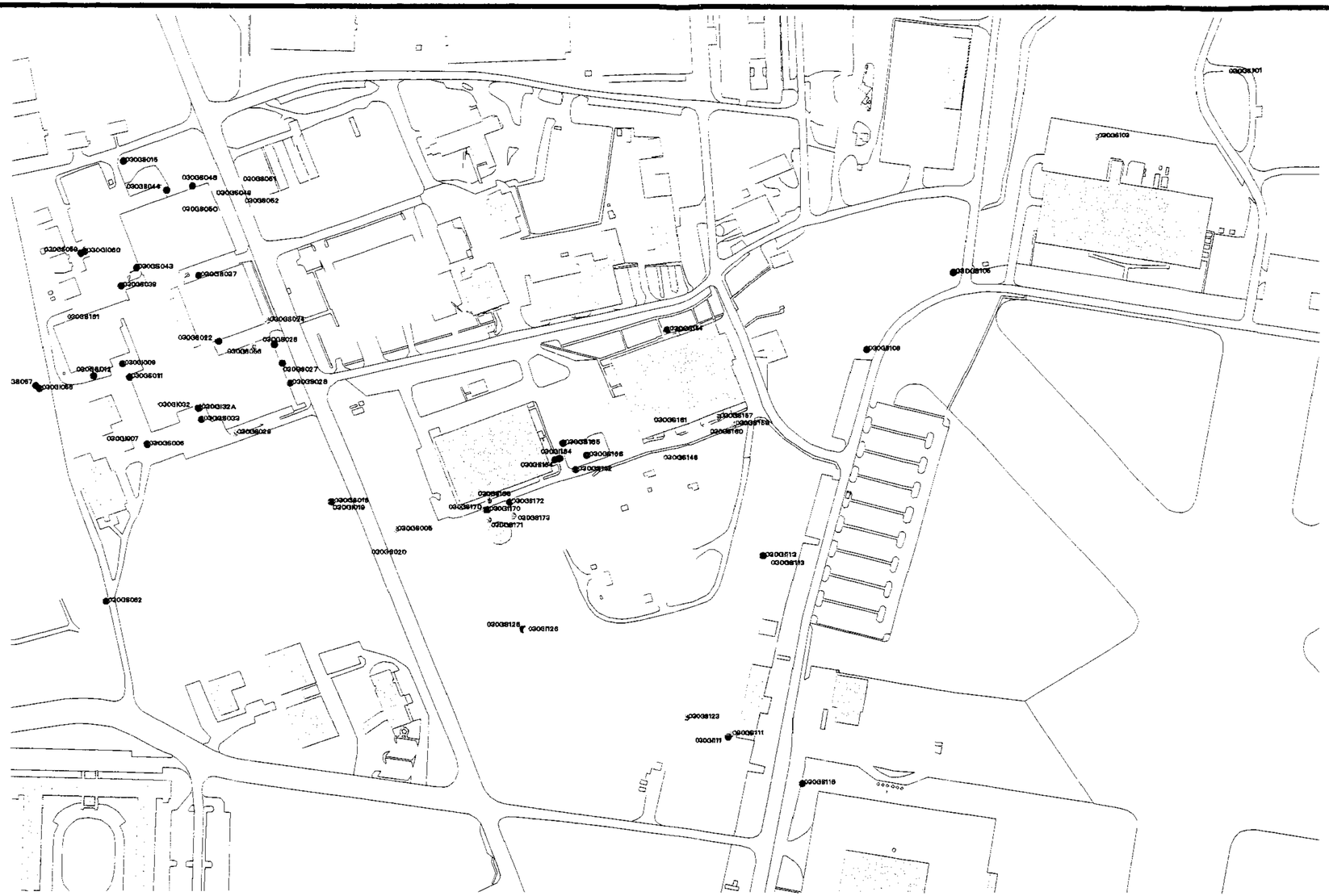
Hypothetical Site Workers: For the ingestion and inhalation pathways, the LWA ILCRs for future workers were computed to be 6E-04 and 1E-04, respectively. For the ingestion pathway, arsenic, 1,1-DCE, and vinyl chloride were the primary contributors to risk, with secondary contributions from benzene, carbon tetrachloride, 1,2-dichloroethane, heptachlor epoxide, methylene chloride, tetrachloroethene, and trichloroethene. For the inhalation pathway, 1,1-DCE and vinyl chloride were the primary contributors. HIs for the ingestion and inhalation pathways are 1 and 0.4, respectively. For the ingestion pathway, arsenic was the primary contributor to HI.

Point Risk and Point Hazard Estimates for Groundwater Pathways

Figures 10-25 and 10-26 are the risk and hazard maps, respectively, for Site 30 groundwater. Table 10.3.6-26 details the contributors to risk and hazard at each monitoring well location. Phase I groundwater data have been used to generate the groundwater map because not all monitoring wells were resampled during Phase II. Based on Phase I data, groundwater from 24 of 65 monitoring wells reported concentrations equivalent to a cumulative risk of 1E-04 and above.

Reported groundwater concentrations of arsenic, 1,1-DCE, 1,4-dichlorobenzene, and tetrachloroethane contribute to elevated risk while cadmium, chromium, 1,1-DCE, 1,2-DCE (total), PCE, and 1,1,1-TCA contribute to elevated HIs at monitoring well locations 30GS22, 30GS26, 30GS27, and 30GS28. This area is just east of Building 649. Reported groundwater concentrations of arsenic, benzene, chloroform, 1,1-DCE, 1,2-DCA, and PCE account for elevated risk at locations represented by 30GS162, 30GS164, 30GS165, 30GS166, and 30GS172, just south of Building 3220. Groundwater concentrations of vinyl chloride contribute significantly to elevated risk at locations represented by monitoring well 30GS154, just north of Building 3450.

Groundwater concentrations of arsenic, benzene, 1,4-dichlorobenzene, and vinyl chloride contribute significantly to elevated risk, while chlorobenzene contributes significantly to elevated HIs at the location represented by monitoring well pair GS111 and GI111, just west of Building 3189. Reported groundwater concentrations of arsenic equate with a risk exceeding 1E-04 throughout Site 30. Using maximum concentrations of COPCs in groundwater to provide risk and hazard estimates, as prescribed by FDEP when calculating RME risk and hazard, would yield a residential groundwater pathway risk of 2E-02 and a hazard quotient of 220. This is shown on Table 10.3.6-26 as a summary of point risks and hazards associated with the maximum detected concentrations for each Site 30 groundwater COPC.



LEGEND - RISK VALUES

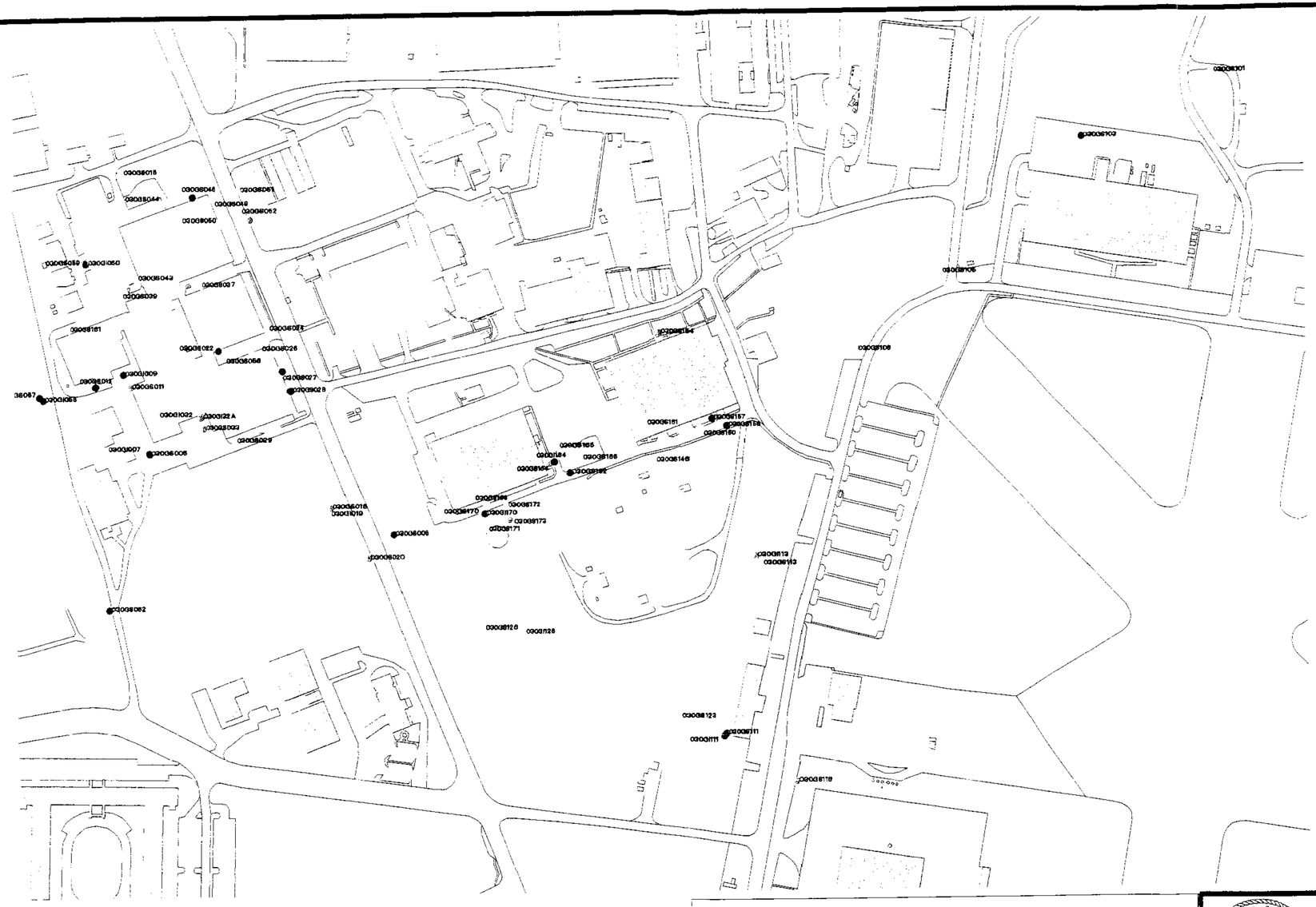
- NA
- < 1E-6
- 1E-6 to 1E-5
- 1E-5 to 1E-4
- > 1E-4

0 feet 600

OPERABLE UNIT 2
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-25
SAMPLE POINT ESTIMATES OF RISK
SITES 30, GROUNDWATER
RESIDENTIAL SCENARIO

AMIL: /home4/pensacola_dir/risk_assess/ou2_dir/well_dir/bmain11x17.aml



LEGEND - HAZARD VALUES

- NA
- 0 to 0.1
- 0.1 to 1.0
- 1.0 to 3.0
- > 3.0

0 feet 600

OPERABLE UNIT 2
REMEDIAL INVESTIGATION
NAS PENSACOLA
PENSACOLA, FLORIDA

FIGURE 10-26
SAMPLE POINT ESTIMATES OF HAZARD INDEX
SITE 30, GROUNDWATER
RESIDENTIAL SCENARIO

Current Site Workers: Groundwater is not currently used as a potable water source at NAS Pensacola. In the absence of a completed exposure pathway, no threat to human health is posed by reported groundwater contamination.

Lead Toxicity

Table 10.3.6-27 summarizes the lead model inputs for Site 30. Default concentrations are used for exposure to air (0.1 μg Pb/m^3), and maternal blood lead level (2.5 μg Pb/dL). The arithmetic mean of the detected concentrations (48.4 mg/kg) was used for soil and house dust values. The EPCs for lead in groundwater, provided on Tables 10.3.6-10 (west of Murray Road) and 10.3.6-11 (east of Murray Road), were used for drinking water values.

Based on this model output, the geometric mean blood level is estimated to be 2.9 μg/dL, and the probability of blood lead concentrations exceeding 10 μg/dL is 0.41% for the groundwater west of Murray Road. The geometric mean blood level is estimated to be 3.2 μg/dL, and the probability of blood lead concentrations exceeding 10 μg/dL is 0.73% for the groundwater east of Murray Road. USEPA generally considers media concentrations that result in probability estimates of 5% or less sufficiently protective of potential child receptors. As a result, groundwater lead concentrations at Site 30 would not require action under this hypothetical exposure scenario.

COCs Identified

COCs were identified based on cumulative (all pathway) risk and hazard projected for this site. USEPA has established a generally acceptable risk range of 1E-4 to 1E-6, and an HI threshold of 1 (unity). In accordance with FDEP guidance, a COC was considered to be any chemical contributing to a cumulative risk level of 1E-6 or greater and/or a cumulative HI above 1, whose individual ILCR exceeds 1E-6 or HQ exceeds 0.1. For carcinogens, this approach is relatively conservative because USEPA's trigger for establishing COCs is a cumulative risk level of 1E-4

(and individual ILCR of 1E-6). This COC selection method was used to provide a more comprehensive evaluation of chemicals contributing to carcinogenic risk or noncarcinogenic hazard during the RGO development process. Table 10.3.6-28 summarizes soil COCs. Tables 10.3.6-29 and 10.3.6-30 summarize COCs for groundwater west and east of Murray Road, respectively.

Surface Soil

Hypothetical Site Residents (Future Land Use)

Arsenic, BEQs, and beryllium were identified as COCs based on their contributions to cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

BEQs were identified as COCs based on their contributions to cumulative ILCR.

Groundwater West of Murray Road

Hypothetical Site Residents (Future Land Use)

Arsenic, benzene, cadmium, chloroform, chromium, 1,1-DCA, 1,2-DCA, 1,1-DCE, 1,2-DCE (cis), 1,2-DCE (total), manganese, 4-methylphenol, PCE, 1,1,1-TCA, and TCE were identified as Phase I groundwater COCs based on contributions to cumulative HI. Arsenic, benzene, chloroform, 1,4-dichlorobenzene, 1,2-DCA, 1,1-DCE, bis(2-ethylhexyl)phthalate, pentachlorophenol, PCE, TCE, and vinyl chloride were identified as COCs based on their contributions to cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

Arsenic, benzene, cadmium, chromium, 1,2-dichloroethane, and 1,1,1-trichloroethane were identified as groundwater COCs based on their contributions to cumulative HI. Arsenic, benzene, chloroform, 1,4-dichlorobenzene, 1,2-DCA, 1,1-DCE, PCE, and vinyl chloride were identified as COCs based their contributions to cumulative ILCR.

Groundwater East of Murray Road

Hypothetical Site Residents (Future Land Use)

Arsenic, barium, cadmium, carbon tetrachloride, chlorobenzene, chromium, 1,1-DCE, heptachlor epoxide, manganese, 1,1,1-TCA, and TCE were identified as groundwater COCs based on contributions to cumulative HI. Arsenic, benzene, carbon tetrachoride, chloroform, 1,4-dichlorobenzene, 1,2-DCA, 1,1-DCE, heptachlor epoxide, methylene chloride, PCE, TCE, and vinyl chloride were identified as COCs based on their contributions to cumulative ILCR.

Hypothetical Site Workers (Future Land Use)

Arsenic and chlorobenzene were identified as groundwater COCs based on their contribution to cumulative HI. Arsenic, carbon tetrachloride, 1,4-dichlorobenzene, 1,1-DCE, heptachlor epoxide, and vinyl chloride were identified as COCs based their contribution to cumulative ILCR.

10.3.6.6 Risk Uncertainty

Characterization of Exposure Setting and Identification of Exposure Pathways

The highly conservative assumptions (i.e., future residential use) recommended by USEPA Region IV and FDEP introduce potential for high bias through exposure setting and pathway selection when assessing potential future and current exposure. The exposure assumptions in the site worker scenario are highly protective and would overestimate exposure. Due to the uncertainty of future site use, these conservative exposure estimates are warranted.

Residential use of the site is not expected, based on current usage and the nature of surrounding buildings. If this area were to be used as a residential site, surface soil conditions would likely change dramatically. Consequently, uniform exposure to current surface soil conditions would not be likely under a true future residential scenario. These factors indicate that exposure pathways assessed in this HHRA would generally overestimate the risk and hazard posed to current site workers and future site residents.

Groundwater is not currently used at NAS Pensacola for potable or industrial purposes. Therefore, risk/hazard projections for groundwater exposure are highly conservative, and associated pathways are not expected to be completed.

Determination of Exposure Point Concentrations

Ninety-five percent UCLs were applied as the EPC to estimate risk and hazard for all soil COPCs. Use of point estimates for exposure modeling is limited because a receptor may contact extremely high and extremely low soil concentrations throughout the course of exposure. The 95% UCL uses this variability to provide an upper-bound estimate of the average soil concentration. It is impossible to forecast how redevelopment might change reported soil concentrations.

The 95% UCL, arithmetic mean of detected concentrations, or only the detected concentration of each COPC was applied as the groundwater EPC. Region IV guidance states that the average concentration of each COPC in the most concentrated area of the plume should be used as EPCs. Since a plume cannot be readily defined, this guidance applies only marginally. Phase II groundwater samples collected using improved techniques cast some doubt on the validity of Phase I data. As with soil, groundwater data variability contributes greatly to uncertainty, both through spatial and temporal variability, and through differences in sampling techniques. The 95% UCLs were calculated to provide point estimates for groundwater to account for this uncertainty, providing an upper-bound estimate for modeling exposure. For any given COPC, the placement of monitoring wells in uncontaminated areas of the aquifer could cause a low bias on the 95% UCL. As a result, the larger of the arithmetic mean of detected concentrations or 95% UCL was selected as the EPC. For some COPCs, the arithmetic mean of all detected concentrations would be lower than the mean values in the most concentrated area of the plume, assuming a plume could be adequately defined with the current data. To address this uncertainty and provide additional perspective, risk/hazard maps have been included in this HHRA.

Quantification of Risk/Hazard

Many site-specific factors which have affected the uncertainty of this assessment would bias risk and hazard estimates. Sources of uncertainty specific to each exposure pathway are discussed below.

Soil

Of the organic CPSS screened and eliminated from formal assessment, only two were reported at a maximum concentrations within approximately 10% of their RBCs. The use of maximum concentrations for the screening comparison reduces the likelihood of potentially significant cumulative risk/hazard based on the eliminated organic CPSS. No inorganic CPSS were eliminated based only on comparison with their corresponding background reference concentrations.

CT was not formally analyzed for Site 30 surface soil, but a simplified approach was taken to assess the potential influences of assumptions, as described earlier. At CT, residential surface soil pathway-related risk (incidental ingestion and dermal contact) would drop from 3E-05 to approximately 6E-06, but would still marginally exceed the 1E-6 point of departure.

Although the future land use of Site 30 is unknown, both the worker and residential exposure scenarios were assessed in this HHRA. Base redevelopment plans for NAS Pensacola are drafted every five years, and as such Site 30 is likely to continue as a light industrial operations for the foreseeable future. As previously discussed, it is likely that these scenarios would overestimate risk and/or hazard.

Groundwater

Of the organic CPSS screened and eliminated from formal assessment, none was reported at a concentration near (within approximately 10%) the RBC. No inorganic parameters were

eliminated from formal assessment, based strictly on comparison with background reference concentrations.

Groundwater is not currently a potable water source at NAS Pensacola. If residences were built onsite and an unfiltered well were installed, the dissolved solids would preclude this aquifer from being an acceptable source of potable water.

CT was not formally analyzed for Site 30 groundwater, but a simplified approach was used to show the effect of CT assumptions, as described earlier. At CT, the residential groundwater pathway-related risk (incidental ingestion and inhalation) would drop from 2E-03 (the cumulative risk from both sets of monitoring wells) to approximately 4E-4, still exceeding the 1E-6 point of departure. CT analysis based on residential child exposure (234 days/year) would reduce HIs approximately 44%. This would drop the HI for monitoring wells west of Murray Road from 22 (incidental ingestion and dermal contact) to 15, and for wells east of Murray Road from 8 to 5.

Iron

Iron was detected in soil at a maximum concentration (16,100 mg/kg) that did not exceed its RBC (23,000 mg/kg; THQ = 1). Iron was detected in groundwater (Phase I) at a maximum concentration (17.5 mg/L) which exceeds its RBC (11 mg/L; THQ = 1). The maximum iron concentration of iron reported in Phase II groundwater samples (6.97 mg/L) did not exceed its RBC. As a result, hazard estimates for groundwater have potentially been underestimated due to the uncertainty associated with the iron reference dose.

10.3.6.7 Risk Summary

The risk and hazard posed by contaminants at Site 30 were assessed for the hypothetical site worker and the hypothetical future site resident under RME assumptions. For surface soil the incidental ingestion and dermal contact pathways were assessed in this HHRA. The ingestion and

inhalation pathways were evaluated for groundwater. Table 10.3.6-31 summarizes risk for each pathway/receptor group evaluated for Site 30.

10.3.6.8 Remedial Goal Options

Soil

Surface soil RGOs for carcinogens presented in Table 10.3.6-32 were based on the LWA site resident and adult site worker. Hazard-based RGOs were calculated based on either the hypothetical child resident or the adult site worker, as noted in the corresponding tables. Both ingestion and dermal exposure are used to calculate soil-based RGOs.

Groundwater

Groundwater RGOs presented in Table 10.3.6-33 were based on the LWA risk for site residents or workers. Hazard-based RGOs were based on either the hypothetical child resident or the adult site worker, as noted in each corresponding table. The lowest residential-based RGOs for arsenic, benzene, carbon tetrachloride, chloroform, 1,4-dichlorobenzene, 1,2-DCA, 1,1-DCE, bis(2-ethylhexyl)phthalate, heptachlor epoxide, methylene chloride, pentachlorophenol, PCE, TCE, and vinyl chloride equal a risk of 1E-06. The lowest RGOs for barium, 2-butanone, cadmium, chlorobenzene, chromium, 1,1-DCA, 1,2-DCE (cis), 1,2-DCE (total), iron, manganese, 4-methylphenol, and 1,1,1-TCA equal an HQ of 0.1. Except for benzene, carbon tetrachloride, heptachlor epoxide, methylene chloride, and trichloroethene, all of these RGOs are lower than the Florida soil cleanup goals.

Table 10.3.6-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 30

Location	Pesticide/PCB	Semivolatile Organic	Volatile Organic	Metals
0004	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0005	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0006	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0010	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0011	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0012	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0016	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0017	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0018	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0020	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0053	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0059	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0061	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0101	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0102	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0103	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0104	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0105	1 to 2'	1 to 2'	1 to 2'	1 to 2'
0106	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0108	0 to 2	0 to 2	0 to 2'	0 to 2'
0109	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0110	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0111	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0112	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0113	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0114	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0115	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0116	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0117	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0118	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0120	0 to 1'	0 to 1'	0 to 1'	0 to 1'

Table 10.3.6-1
Samples and Analytical Methods Used for Risk Assessment
Surface Soil at Site 30

Location	Pesticide/PCB	Semivolatile Organic	Volatile Organic	Metals
0121	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0122	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0123	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0124	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0125	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0126	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0127	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0128	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0129	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0130	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0134	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0135	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0137	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0138	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0139	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0140	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0141	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0142	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0143	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0144	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0145	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0147	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0148	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0149	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0150	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0151	0 to 1'	0 to 1'	0 to 1'	0 to 1'
0153	0 to 2'	0 to 2'	0 to 2'	0 to 2'
0053	7	7	7	7

Notes:
Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides, Method 8080
Volatile Organic Analysis, Method 8240
Semivolatile Organic Analysis, Method 8720

Table 10.3.6-2
Samples and Analytical Methods Used for Risk Assessment
Groundwater at Site 30

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
Intermediate	I007	1	1	1	1
	I009	1	1	1	1
	I019	1	1	1	1
	I032	1	1	1, 2	1
	I058	1	1	1	1
	I060	1	1	1, 2	1, 2
	I111	1	1, 2	1, 2	1
	I113	1	1	1	1
	I126	1	1	1	1, 2
	I164	1, 2	1	1	1
	I170	1	1	1	1
	I32A	1	1	1	1
Shallow	S003	1	1	1	1
	S005	1	1	1	1
	S006	1	1, 2	1, 2	1, 2
	S011	1	1	1	1
	S012	1	1, 2	1, 2	1
	S015	1	1	1	1
	S016	1	1	1	1
	S018	1	1	1, 2	1
	S020	1	1	1, 2	1
	S022	1	1, 2	1, 2	1, 2
	S024	1	1	1	1
	S026	1	1	1, 2	1
	S027	1	1	1, 2	1, 2
	S028	1	1	1, 2	1, 2
	S029	1	1	1	1

Table 10.3.6-2
Samples and Analytical Methods Used for Risk Assessment
Groundwater at Site 30

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
	S033	1	1	1, 2	1
	S043	1	1	1	1
	S044	1	1	1	1
	S046	1	1, 2	1, 2	1
	S048			2	
	S049	1	1	1	1
	S050	1	1	1	1
	S051	1	1, 2	1	1
	S052	1	1	1	1
	S056	1	1	1	1
	S057	1	1	1	1
	S059	1	1	1, 2	1
	S062	1	1	1	1, 2
	S101	1	1	1	1
	S103	1	1	1	1, 2
	S105	1	1	1	1
	S108	1	1	1	1
	S111	1	1, 2	1, 2	1, 2
	S113	1	1	1	1
	S118	1	1	1	1
	S123	1, 2	1	1	1
	S126	1	1	1	1, 2
	S146	1	1	1	1
	S154	1	1	1	1
	S156	1	1	1	1
	S157	1	1	1	1
	S160	1	1	1	1

Table 10.3.6-2
Samples and Analytical Methods Used for Risk Assessment
Groundwater at Site 30

Depth	Location	Pesticide/PCB	Semivolatile Organic Analysis	Volatile Organic Analysis	Metals
	S161	1	1	1, 2	1
	S162	1	1	1	1
	S164	1	1	1	1
	S165	1	1	1	1
	S166	1	1	1, 2	1
	S168	1	1	1	1
	S170	1	1	1	1
	S171	1, 2	1, 2	1, 2	1, 2
	S172	1, 2	1, 2	1, 2	1, 2
	S173	1, 2	1, 2	1, 2	1, 2

Notes:
1 = Sample collected during Phase I
2 = Sample collected during Phase II

Metals: TAL (Target Analyte List) Method 6000/7000
Pesticide/PCB, Chlorinated Pesticides, Method 8080
Volatile Organic Analysis, Method 8240
Semivolatile Organic Analysis, Method 8720

Table 10.3.6-3
Chemicals Present in Site Samples
Site 30, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter	Frequency of Detection			Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration Soil to air RBC		SSL		Reference	Units	Number Exceeding RBC	Ref.
Carcinogenic PAHs																
Benzo(a)pyrene Equivalents	C	14	59	0.42	29230	2980	762.63	5084.2	88	a	NA		NA	ug/kg	9	
Benzo(a)anthracene	C	7	59	94	22000	3830	330	2200	880	a	NA		NA	ug/kg	3	
Benzo(b)fluoranthene	C	12	59	49	16000	2000	330	2200	880	a	NA		NA	ug/kg	3	
Chrysene	N	8	59	43	20000	3080	330	2200	88000	a	NA		NA	ug/kg		
Dibenz(a,h)anthracene	C	4	59	70	5900	2160	330	2200	88	a	NA		NA	ug/kg	3	
Indeno(1,2,3-cd)pyrene	C	6	59	46	13000	3370	330	2200	880	a	NA		NA	ug/kg	3	
Benzo(k)fluoranthene	C	11	59	42	21000	2520	330	2200	8800	a	NA		NA	ug/kg	1	
Benzo(a)pyrene	C	10	59	50	18000	2570	330	2200	88	a	NA		NA	ug/kg	7	
Inorganics																
Aluminum (Al)	C	58	58	76.7	19300	3360	NA	NA	7800	a	NA		3833.36	mg/kg	8	7
Antimony (Sb)	N	1	58	7.6	7.6	7.6	5.2	7.9	3.1	a	NA		9.49	mg/kg	1	
Arsenic (As)	C	29	58	0.41	4.8	1.48	0.32	2.1	0.43	a	750	c	1.56	mg/kg	27	7
Barium (Ba)	N	26	58	0.79	158	13.3	0.41	10.4	550	a	690000	c	4.63	mg/kg		12
Beryllium (Be)	C	9	58	0.21	1.3	0.43	0.17	0.26	0.15	a	1300	c	0.41	mg/kg	9	2
Cadmium (Cd)	C	19	58	1.1	35.9	6.12	0.87	7.5	3.9	a	1800	c	1	mg/kg	16	17
Calcium (Ca)	N	19	58	316	39200	9880	30.1	1920	NA		NA		912.37	mg/kg		12
Chromium (Cr)	C	50	58	2.1	395	36.3	1.9	2.1	39	a	270	c	6.13	mg/kg	10	28
Cobalt (Co)	N	5	58	4.1	18.7	11.5	3.5	5.3	470	a	NA		1.87	mg/kg		5
Copper (Cu)	N	35	58	2	109	17.1	1.7	2.2	310	a	NA		5.74	mg/kg		16
Cyanide (CN)	N	1	58	1.1	1.1	1.1	0.01	3.2	160	a	NA		0.52	mg/kg		1
Iron (Fe)	U	57	58	116	16100	2450	178	178	2300	a	NA		2745	mg/kg	14	10
Lead (Pb)	N	43	58	1.5	334	48.4	0.39	44.7	400	b	NA		7.32	mg/kg		25
Magnesium (Mg)	N	28	58	12.9	6330	534	12.5	419	NA		NA		133.33	mg/kg		8
Manganese (Mn)	C	39	58	0.6	266	32.4	1.2	14.4	180	a	NA		21.36	mg/kg	1	16
Mercury (Hg)	N	6	58	0.14	0.58	0.33	0.02	0.12	2.3	a	NA		0.1	mg/kg		6
Molybdenum (Mo)	N	2	9	2	6.3	4.15	2.4	3.1	39000	a	NA		NA	mg/kg		
Nickel (Ni)	N	4	58	4.3	48.5	17.1	3.5	5.3	160	a	13000	c	6.38	mg/kg		2
Potassium (K)	N	2	58	242	327	285	174	1010	NA		NA		460.67	mg/kg		
Selenium (Se)	N	5	58	0.49	0.94	0.73	0.32	0.52	39	a	NA		0.62	mg/kg		3
Silver (Ag)	N	1	58	1.2	1.2	1.2	0.87	3.3	39	a	NA		2.07	mg/kg		
Sodium (Na)	N	10	58	0.34	182	78.9	34.9	158	NA		NA		107.85	mg/kg		2
Thallium (Tl)	N	1	58	0.43	0.43	0.43	0.32	0.53	0.63	a	NA		0.82	mg/kg		
Vanadium (V)	N	42	58	2	33.8	7.88	1.7	2.2	55	a	NA		5.83	mg/kg		13
Zinc (Zn)	N	18	58	3.4	428	43.9	1	41.5	2300	a	NA		16.87	mg/kg		7
Pesticides and PCBs																
Aldrin	N	1	59	2.3	2.3	2.3	1.7	36	38	a	3000	c	NA	ug/kg		
Aroclor-1016	N	1	59	11	11	11	32	69	83	a	NA		NA	ug/kg		
Aroclor-1242	C	1	59	10000	10000	10000	32	44	83	a	NA		NA	ug/kg	1	
Aroclor-1254	C	3	59	69	1800	650	32	44	83	a	NA		NA	ug/kg	1	
Aroclor-1260	C	11	59	45	580	184	32	44	83	a	NA		NA	ug/kg	7	
alpha-Chlordane	N	6	59	1.9	4.1	2.73	1.7	3.6	470	a	20000	c	NA	ug/kg		
gamma-Chlordane	N	6	59	2	14	5.97	1.7	20	470	a	20000	c	NA	ug/kg		
4,4'-DDD	N	8	59	3.4	17	8.51	3.3	20	2700	a	NA		NA	ug/kg		
4,4'-DDE	N	16	59	3.6	120	22.3	3.3	4.4	1900	a	NA		NA	ug/kg		
4,4'-DDT	N	16	59	5.7	87	20.2	3.3	6.9	1900	a	NA		NA	ug/kg		
Dieldrin	C	14	59	3.8	64	16.8	3.2	6.9	40	a	1000	c	NA	ug/kg	1	
Endosulfan II	N	3	59	4	8.5	6.77	3.2	6.9	47000	a	NA		NA	ug/kg		
Endrin	N	1	59	3.8	3.8	3.8	3.2	6.9	2300	a	NA		NA	ug/kg		
Heptachlor	N	1	59	3.7	3.7	3.7	1.7	4	140	a	100	c	NA	ug/kg		
Heptachlor epoxide	N	1	59	4.9	4.9	4.9	1.7	3.6	70	a	5000	c	NA	ug/kg		
Semivolatile Organics																
Acenaphthylene	N	5	59	35	9700	2970	330	2200	310000	a	NA		NA	ug/kg		
Anthracene	N	4	59	41	7600	2850	330	2200	2300000	a	NA		NA	ug/kg		
Benzo(g,h,i)perylene	N	7	59	50	11000	2600	330	2200	310000	a	NA		NA	ug/kg		
Butylbenzylphthalate	N	3	59	55	480	210	47	6700	1600000	a	930000	c	NA	ug/kg		
Carbazole	N	1	59	1200	1200	1200	330	3700	32000	a	NA		NA	ug/kg		
Di-n-butylphthalate	N	1	59	1200	1200	1200	330	6700	780000	a	2300000	c	NA	ug/kg		
Diethylphthalate	N	1	59	63	63	63	330	6700	6300000	a	2000000	c	NA	ug/kg		
bis(2-Ethylhexyl)phthalate	N	17	59	39	2600	722	39	6700	46000	a	3.1E+07	c	NA	ug/kg		
Fluoranthene	N	13	59	36	44000	3900	330	2200	310000	a	NA		NA	ug/kg		
Phenanthrene	N	7	59	34	11000	1760	330	3700	310000	a	NA		NA	ug/kg		
Phenol	N	1	59	47	47	47	330	6700	4700000	a	NA		NA	ug/kg		
Pyrene	N	12	59	34	29000	2950	330	2200	230000	a	NA		NA	ug/kg		

Table 10.3.6-3
Chemicals Present in Site Samples
Site 30, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration Soil to air RBC		SSL		Reference	Units	Number Exceedir RBC	F
Volatile Organics																
Acetone	N	11	60	29	1900	489	10	3300	780000	a	1E+08	c	NA	ug/kg		
Benzene	N	6	60	1	5	2.33	10	1400	22000	a	800	c	NA	ug/kg		
2-Butanone (MEK)	N	2	60	2	11	6.5	10	1400	4700000	a	NA		NA	ug/kg		
Carbon tetrachloride	N	3	60	1	6	3.33	10	1400	4900	a	300	c	NA	ug/kg		
1,2-Dichloroethane	N	15	60	2	96	27.8	10	1400	7000	a	400	c	NA	ug/kg		
Ethylbenzene	N	3	60	1	2	1.67	10	1400	780000	a	400000	c	NA	ug/kg		
Methylene chloride	N	1	60	31	31	31	10	1400	85000	a	13000	c	NA	ug/kg		
Styrene	N	1	60	3	3	3	10	1400	1600000	a	1500000	c	NA	ug/kg		
Tetrachloroethene	N	1	60	2	2	2	10	1400	12000	a	11000	c	NA	ug/kg		
Toluene	N	22	60	1	43	13	10	1400	1600000	a	650000	c	NA	ug/kg		
1,1,1-Trichloroethane	N	3	60	1	4	2.33	10	1400	270000	a	1200000	c	NA	ug/kg		
Xylene (Total)	N	9	60	1	5	2.44	10	1400	16000000	a	410000	c	NA	ug/kg		

C - Selected as a COPC based on the screening process explained in Section 10.2.5
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5
U - Iron toxicity is qualitatively discussed in the uncertainty section.
PAHs - Polynuclear Aromatic Hydrocarbons
SQL - Sample Quatitation Limits
a - USEPA Region III residential risk-based concentration
b - USEPA's action level of lead in soil
c - USEPA Soil Screening Guidance

Table 10.3.6-4
Chemicals Present in Site Samples
Site 30, Groundwater, Phase I
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium (Ca)	N	62	64	2060	198000	21400	517	3840	NA	NA	17560	ug/L		26
Magnesium (Mg)	N	61	64	176	39300	3580	30	954	NA	NA	2872.6	ug/L		11
Potassium (K)	N	62	64	415	12900	2860	400	400	NA	NA	12167.6	ug/L		1
Sodium (Na)	N	62	64	1214	344000	17300	295	816	NA	NA	18345	ug/L		7
Inorganics														
Aluminum (Al)	C	38	64	68.4	23500	3830	20	177	3700	RBC	3882.8	ug/L	11	11
Arsenic (As)	C	17	64	2	19.7	6.27	2	2	0.045	RBC	2.8	ug/L	17	14
Barium (Ba)	C	7	64	15.8	581	173	2.4	79.8	260	RBC	13.2	ug/L	2	7
Beryllium (Be)	C	2	64	1	1.2	1.1	1	1	0.016	RBC	1.1	ug/L	2	1
Cadmium (Cd)	C	4	64	3.4	8.6	6.83	3	14.2	1.8	RBC	3.4	ug/L	4	4
Chromium (Cr)	C	16	64	4.6	1380	150	4	31.9	18	RBC	35	ug/L	9	4
Cobalt (Co)	B	2	64	4.6	5.2	4.9	3	4.1	220	RBC	4.1	ug/L		2
Copper (Cu)	B	1	64	38.1	38.1	38.1	4	20.5	150	RBC	16.2	ug/L		1
Iron (Fe)	U	50	64	225	17500	3490	20	241	1100	RBC	1707.8	ug/L	30	24
Lead (Pb)	C	45	64	2	96	9.64	2	2	15	TTAL	1.6	ug/L	7	45
Manganese (Mn)	C	34	64	20.9	457	96	2	35.6	84	RBC	22	ug/L	9	32
Mercury (Hg)	B	2	64	0.4	0.49	0.445	0.2	0.2	1.1	RBC	0.2	ug/L		2
Selenium (Se)	N	5	64	2	3.6	2.48	2	8.8	18	RBC	3.9	ug/L		
Silver (Ag)	C	1	64	43.4	43.4	43.4	4	5.1	18	RBC	4	ug/L	1	1
Thallium (Tl)	R	1	64	2	2	2	2	10	0.29	RBC	3.6	ug/L	1	
Vanadium (V)	C	6	64	3.2	61	27.3	3	64.2	26	RBC	9.6	ug/L	3	4
Zinc (Zn)	N	1	64	74.7	74.7	74.7	5	43.1	1100	RBC	153.2	ug/L		
Pesticides														
Heptachlor epoxide	C	1	64	0.029	0.029	0.029	0.048	0.059	0.0012	RBC	NA	ug/L	1	
Toxaphene	C	1	64	4.8	4.8	4.8	4.8	5.9	0.061	RBC	NA	ug/L	1	
Semivolatile Organics														
Acenaphthene	N	1	65	1	1	1	10	86000	220	RBC	NA	ug/L		
Acenaphthylene	N	1	65	2	2	2	10	86000	10	FDEP	NA	ug/L		
Carbazole	C	1	65	14	14	14	10	86000	3.4	RBC	NA	ug/L	1	
2-Chlorophenol	N	2	65	2	6	4	10	86000	18	RBC	NA	ug/L		
Dibenzofuran	N	1	65	1	1	1	10	86000	15	RBC	NA	ug/L		
1,2-Dichlorobenzene	C	6	65	3	79	22.7	10	86000	27	RBC	NA	ug/L	2	
1,3-Dichlorobenzene	N	4	65	1	37	13.3	10	86000	54	RBC	NA	ug/L		
1,4-Dichlorobenzene	C	6	65	0.9	180	42	10	86000	0.44	RBC	NA	ug/L	6	
2,4-Dichlorophenol	N	1	65	3	3	3	10	86000	11	RBC	NA	ug/L		
2,4-Dimethylphenol	N	3	65	1	5	3	10	86000	73	RBC	NA	ug/L		
Dimethyl phthalate	N	1	65	1	1	1	10	86000	37000	RBC	NA	ug/L		
bis(2-Ethylhexyl)phthalate	C	7	65	1	18000	2570	10	12	4.8	RBC	NA	ug/L	1	
Fluorene	N	1	65	1	1	1	10	86000	150	RBC	NA	ug/L		
2-Methylnaphthalene	N	7	65	1	35	8	10	86000	150	RBC	NA	ug/L		
2-Methylphenol	N	1	65	2	2	2	10	86000	180	RBC	NA	ug/L		
4-Methylphenol	C	5	65	1	21	9	10	86000	18	RBC	NA	ug/L	1	
Naphthalene	C	13	65	1	29000	2240	10	12	150	RBC	NA	ug/L	1	
Phenanthrene	N	1	65	3	3	3	10	86000	10	FDEP	NA	ug/L		
Phenol	N	16	65	3	54	15.4	10	86000	2200	RBC	NA	ug/L		
Volatile Organics														
Acetone	N	11	65	1	160	35.7	10	10000	370	RBC	NA	ug/L		
Benzene	C	7	65	1	250	37.3	10	10000	0.36	RBC	NA	ug/L	7	
Bromodichloromethane	C	1	65	1	1	1	10	10000	0.17	RBC	NA	ug/L	1	
Bromoform	N	1	65	1	1	1	10	10000	2.4	RBC	NA	ug/L		
2-Butanone (MEK)	C	5	65	4	890	216	10	10000	190	RBC	NA	ug/L	1	
Chlorobenzene	C	9	65	1	720	154	10	10000	3.9	RBC	NA	ug/L	5	
Chloroethane	C	4	65	2	140	39	10	10000	140	FDEP	NA	ug/L	1	
Chloroform	C	8	65	1	80	11.6	10	10000	0.15	RBC	NA	ug/L	8	
Chloromethane	N	1	65	1	1	1	10	10000	1.4	RBC	NA	ug/L		
Dibromochloromethane	C	1	65	2	2	2	10	10000	0.13	RBC	NA	ug/L	1	
1,1-Dichloroethane	C	31	65	1	900	82.8	10	10000	81	RBC	NA	ug/L	6	
1,2-Dichloroethane	C	2	65	1	6	3.5	10	10000	0.12	RBC	NA	ug/L	2	
1,1-Dichloroethene	C	21	65	1	510	77.2	10	10000	0.044	RBC	NA	ug/L	21	
1,2-Dichloroethene (total)	C	11	65	1	220	45.7	10	10000	5.5	RBC	NA	ug/L	8	

Table 10.3.6-4
Chemicals Present in Site Samples
Site 30, Groundwater, Phase I
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Ethylbenzene	C	12	65	1	380	34.3	10	10000	130	RBC	NA	ug/L	1	
2-Hexanone	N	1	65	1	1	1	10	10000	0	RBC	NA	ug/L		
Methylene chloride	C	3	65	2	12	8.33	10	10000	4.1	RBC	NA	ug/L	2	
Tetrachloroethene	C	18	65	1	310	31.3	10	10000	1.1	RBC	NA	ug/L	12	
Toluene	C	7	65	1	140	24.1	10	10000	75	RBC	NA	ug/L	1	
1,2,4-Trichlorobenzene	N	3	65	1	9	4	10	86000	19	RBC	NA	ug/L		
1,1,1-Trichloroethane	C	36	65	2	1400	184	10	10000	79	RBC	NA	ug/L	10	
Trichloroethene	C	15	65	1	36	7.8	10	10000	1.6	RBC	NA	ug/L	12	
Vinyl chloride	C	2	65	20	110	65	10	10000	0.019	RBC	NA	ug/L	2	
Xylene (Total)	C	22	65	1	29000	1380	10	100	1200	RBC	NA	ug/L	2	

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B - The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
U - Iron toxicity is qualitatively discussed in the uncertainty section.
SQL - Sample Quatitation Limits
RBC - USEPA Region III residential risk-based concentration
TTAL - Treatment technique action level
FDEP - Florida risk-based groundwater guidance concentration

Table 10.3.6-5
Chemicals Present in Site Samples
Site 30, Groundwater, Phase II
Naval Air Station Pensacola
Pensacola, Florida

Parameter		Frequency of Detection		Range of Detection		Average Detected Conc.	Range of SQL		Screening Concentration RBC	Source	Reference	Units	Number Exceeding RBC	Ref.
Nutrients														
Calcium (Ca)	N	13	13	2000	188000	23200	NA	NA	NA	NA	17560	ug/L		1
Magnesium (Mg)	N	13	13	280	15000	2790	NA	NA	NA	NA	2872.6	ug/L		4
Potassium (K)	N	13	13	702	7410	2820	NA	NA	NA	NA	12167.6	ug/L		
Sodium (Na)	N	13	13	4040	71300	16500	NA	NA	NA	NA	18345	ug/L		4
Inorganics														
Aluminum (Al)	N	8	13	158	2070	721	52.9	165	3700	RBC	3882.8	ug/L		
Antimony (Sb)	R	2	13	3	7.8	5.4	2.3	2.6	1.5	RBC	30.2	ug/L	2	
Arsenic (As)	C	5	13	1.5	19	7.52	1.5	1.5	0.045	RBC	2.8	ug/L	5	3
Barium (Ba)	C	5	13	6.4	328	80.4	6	18.8	260	RBC	13.2	ug/L	1	4
Beryllium (Be)	R	3	13	0.3	0.6	0.42	0.08	0.27	0.016	RBC	1.1	ug/L	3	
Cadmium (Cd)	C	4	13	0.59	108	33.9	0.19	1.4	1.8	RBC	3.4	ug/L	3	3
Chromium (Cr)	C	2	13	69.9	418	244	0.64	4.9	18	RBC	35	ug/L	2	2
Cobalt (Co)	N	4	13	0.63	1.2	0.897	0.38	0.69	220	RBC	4.1	ug/L		
Copper (Cu)	B	1	13	73	73	73	0.63	9.4	150	RBC	16.2	ug/L		1
Iron (Fe)	U	13	13	23.6	6970	1530	NA	NA	1100	RBC	1707.8	ug/L	4	3
Lead (Pb)	C	6	13	0.95	236	55.9	0.81	4.1	15	TTAL	1.6	ug/L	3	5
Manganese (Mn)	C	9	13	15.5	204	49.3	5.9	24.1	84	RBC	22	ug/L	2	4
Mercury (Hg)	N	5	13	0.06	0.09	0.068	0.05	0.09	1.1	RBC	0.2	ug/L		
Nickel (Ni)	N	1	13	11.2	11.2	11.2	0.74	17.1	73	RBC	39.9	ug/L		
Vanadium (V)	B	4	13	0.79	18.1	7.2	0.76	4.6	26	RBC	9.6	ug/L		1
Zinc (Zn)	N	3	13	20.4	45.8	36	4.1	23	1100	RBC	153.2	ug/L		
Pesticides														
gamma-BHC (Lindane)	N	1	5	0.0048	0.0048	0.0048	0.05	0.05	0.052	RBC	NA	ug/L		
Dieldrin	N	1	5	0.0025	0.0025	0.0025	0.1	0.1	0.0042	RBC	NA	ug/L		
Endrin	N	1	5	0.0076	0.0076	0.0076	0.1	0.1	1.1	RBC	NA	ug/L		
Semivolatile Organics														
Butylbenzylphthalate	N	3	10	1.2	1.2	1.2	10	10	730	RBC	NA	ug/L		
2-Chlorophenol	N	1	10	6.5	6.5	6.5	10	10	18	RBC	NA	ug/L		
Di-n-butylphthalate	N	2	10	0.45	0.48	0.465	7.5	10	370	RBC	NA	ug/L		
1,2-Dichlorobenzene	C	4	22	1.6	130	44.7	1	200	27	RBC	NA	ug/L	2	
1,3-Dichlorobenzene	N	5	22	1.5	37	9.76	1	10	54	RBC	NA	ug/L		
1,4-Dichlorobenzene	C	6	22	1	140	30.4	1	10	0.44	RBC	NA	ug/L	6	
2,4-Dichlorophenol	N	1	10	3.2	3.2	3.2	4	4	11	RBC	NA	ug/L		
bis(2-Ethylhexyl)phthalate	C	4	10	1.5	13	8.63	10	10	4.8	RBC	NA	ug/L	3	
2-Methylnaphthalene	N	3	10	1.1	6.7	3.03	10	10	150	RBC	NA	ug/L		
3-Methylphenol/4-Methylphenol	N	2	10	2.8	9.2	6	10	10	0	RBC	NA	ug/L		
Naphthalene	N	6	10	0.91	15	6.72	6.8	6.8	150	RBC	NA	ug/L		
2-Nitroaniline	N	1	10	0.13	0.13	0.13	7.5	7.5	0.22	RBC	NA	ug/L		
4-Nitrophenol	N	1	10	1.5	1.5	1.5	15	15	15	FDEP	NA	ug/L		
Pentachlorophenol	C	1	10	1.4	1.4	1.4	1	1	0.56	RBC	NA	ug/L	1	
Phenol	N	1	10	6.9	6.9	6.9	10	10	2200	RBC	NA	ug/L		
Volatile Organics														
Benzene	C	2	21	2	7	4.5	1	1	0.36	RBC	NA	ug/L	2	
Carbon tetrachloride	C	1	21	2	2	2	1	1	0.16	RBC	NA	ug/L	1	
Chlorobenzene	C	2	21	3	19	11	1	830	3.9	RBC	NA	ug/L	1	
Chloroethane	C	4	21	110	580	348	1	1	140	FDEP	NA	ug/L	3	
Chloroform	C	7	21	0.3	5	2.37	1	1	0.15	RBC	NA	ug/L	7	
1,1-Dichloroethane	C	11	21	2	4300	977	1	1	81	RBC	NA	ug/L	4	
1,2-Dichloroethane	C	3	21	2	220	141	1	1	0.12	RBC	NA	ug/L	3	
1,1-Dichloroethene	C	10	21	0.3	240	62.7	1	1	0.044	RBC	NA	ug/L	10	
cis-1,2-Dichloroethene	C	7	21	1	190	49.3	1	200	6.1	RBC	NA	ug/L	4	
Ethylbenzene	N	1	21	9	9	9	1	1	130	RBC	NA	ug/L		
Methylene chloride	N	3	21	0.8	3	1.6	2	6	4.1	RBC	NA	ug/L		
Tetrachloroethene	C	13	21	0.2	1100	88.9	1	1	1.1	RBC	NA	ug/L	7	
Toluene	N	4	21	0.1	1	0.475	1	1	75	RBC	NA	ug/L		
1,2,4-Trichlorobenzene	N	1	10	5.6	5.6	5.6	10	10	19	RBC	NA	ug/L		
1,1,1-Trichloroethane	C	13	21	0.2	2100	511	1	1	79	RBC	NA	ug/L	4	
Trichloroethene	C	8	21	0.2	58	9.53	1	1	1.6	RBC	NA	ug/L	6	
Vinyl chloride	C	4	21	0.2	15	4.18	1	1	0.019	RBC	NA	ug/L	4	
Xylene (Total)	N	6	21	0.8	10	5.85	1	1	1200	RBC	NA	ug/L		

C - Selected as a COPC based on the screening process explained in Section 10.2.5.
N - Eliminated from further consideration in the HHRA based on the screening process explained in Section 10.2.5.
R - The maximum concentration exceeds the RBC; eliminated based on comparison to reference concentration.
B - The maximum concentration exceeds the reference concentration; eliminated based on comparison to RBC.
U - Iron toxicity is qualitatively discussed in the uncertainty section.
SQL - Sample Quatitation Limits
RBC - USEPA Region III residential risk-based concentration
TTAL - Treatment technique action level
FDEP - Florida risk-based groundwater guidance concentration

Table 10.3.6-6
Comparison of Phase I and II Groundwater Data
Site 30, Monitoring Wells West of Murray Road
Naval Air Station Pensacola
Pensacola, Florida

Parameter	Phase I (continued)																Phase II units are in ug/L		
	GS028	GS029	GS033	GS037	GS039	GS043	GS044	GS046	GS049	GS050	GS051	GS052	GS056	GS057	GS059	GS062	GI032	GI060	GS006
Arsenic (As)	1	1	1	1	1	1	1	1	1	1	1	1	1	4.8	1	8		0.75	1.5
Barium (Ba)	3.1	7.1	4.8	7.7	4.35	4.15	17.85	7.3	10.45	6.85	11.75	10.75	4.5	27.9	15.8	55.7		4.65	9.35
Benzene	25	3	1	5	5	5	5	10	5	5	5	5	5	5	5	5	0.5	0.5	2
Cadmium (Cd)	7.8	7.1	2.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		0.11	0.165
Chloroethane	25	5	5	140	5	5	5	10	5	5	5	5	5	5	5	5	0.5	0.5	0.5
Chloroform	25	5	5	5	5	5	5	10	5	5	5	5	5	5	5	80	0.3	0.5	0.5
Chromium (Cr)	715	2.15	2	2	6.7	2	4.8	2	5.4	2	2	8.3	12.1	10.4	6.05	33.6		0.75	0.37
1,2-Dichlorobenzene	79	5	5	5	5	5	5	5	5	5	5	6	5.5	5	6	6	0.5	0.5	2.5
1,3-Dichlorobenzene	9	5	5	5	5	5	5	5	5	5	5	6	5.5	5	6	6	0.5	0.5	2.5
1,4-Dichlorobenzene	26	5	5	5	5	5	5	2	5	5	5	6	5.5	5	6	6	0.5	0.5	2.5
1,1-Dichloroethane	380	5.5	110	200	5	5	5	18	8	5	10	5	4	5	5	5	9	0.5	0.5
1,2-Dichloroethane	6	5	5	5	5	5	5	10	5	5	5	5	5	5	5	5	0.5	0.5	0.5
1,1-Dichloroethene	220	2	12	11	5	5	5	10	5	5	5	5	3	5	5	5	0.8	0.5	0.5
1,2-Dichloroethene (cis)																	1	0.5	2
1,2-Dichloroethene (total)	210	5	5	5	5	5	5	220	8	5	5	5	5	5	5	5			
bis(2-Ethylhexyl)phthalat	5	5	5	5	5	5	5	5	5	5	5	6	5.5	5	6	6			5
Lead (Pb)	1	3.6	1	2	2.4	2.3	2.2	4	2.8	1	2	4.4	2	96	7.5	17		0.6	3.4
Manganese (Mn)	53	57.8	128	5.75	2.35	3.25	2	1.65	1.05	1	1	5.05	3.65	107	24.8	88.4		15.5	10.75
4-Methylphenol	5	5	5	4	5	5	5	21	5	5	15	6	5.5	5	6	6			2.5
Naphthalene	5	5	4	9	5	5	5	7	2	5	5	6	5.5	5	6	6			0.91
Pentachlorophenol	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7			0.5
Tetrachloroethene	310	1	2	5	5	5	5	200	10.5	5	5	5	5	5	5	5	0.5	0.5	2
1,1,1-Trichloroethane	1300	26	130	46	10	4	5	220	30	6	4	2	12	5	5	5	16	0.5	1
Trichloroethene	36	1	2	5	5	5	5	4	2	4	2	2	5	5	5	5	0.5	0.5	0.2
Vinyl chloride	25	5	5	5	5	5	5	10	5	5	5	5	5	5	5	5	0.5	0.5	0.5

Shaded = detected concentration

Table 10.3.6-6
Comparison of Phase I and II Groundwater Data
Site 30, Monitoring Wells West of Murray Road
Naval Air Station Pensacola
Pensacola, Florida

Parameter	Phase II (continued)												
	GS012	GS018	GS020	GS022	GS026	GS027	GS028	GS033	GS046	GS048	GS051	GS059	GS062
Arsenic (As)				0.75		0.75	0.75						0.75
Barium (Ba)				6.7		4	3.05						33.7
Benzene	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5	
Cadmium (Cd)				0.2		0.445	108						0.7
Chloroethane	0.5	0.5	0.5	110	180	520	580	0.5	0.5	0.5		0.5	
Chloroform	0.5	0.5	0.5	5	3	0.5	0.5	0.5	0.5	0.5		0.5	
Chromium (Cr)				1		69.9	418						0.32
1,2-Dichlorobenzene	2.5	0.5	0.5	2.5	0.5	200	130	0.5	1.6	0.5	2.5	0.5	
1,3-Dichlorobenzene	2.5	0.5	0.5	2.5	0.5	2	4	0.5	4.3	0.5	2.5	0.5	
1,4-Dichlorobenzene	2.5	0.5	0.5	2.5	0.5	17	16	0.5	6.3	0.5	2.5	0.5	
1,1-Dichloroethane	0.5	0.5	0.5	1400	2600	4300	2400	2	8	0.5		0.5	
1,2-Dichloroethane	0.5	0.5	0.5	0.5	0.5	200	220	2	0.5	0.5		0.5	
1,1-Dichloroethene	0.5	0.5	0.5	68	140	240	130	0.3	0.5	0.5		0.5	
1,2-Dichloroethene (cis)	0.5	0.5	0.5	7	22	100	120	0.5	190	0.5		0.5	
1,2-Dichloroethene (total)													
bis(2-Ethylhexyl)phthalat	1.5			11					9		13		
Lead (Pb)				56.2		2	2.05						0.405
Manganese (Mn)				2.95		23.2	19.6						5.2
4-Methylphenol	2.5			2.5					9.2		2.8		
Naphthalene	1.3			14					5.6		15		
Pentachlorophenol	1.4			0.5					0.5		0.5		
Tetrachloroethene	0.5	0.5	0.5	13	12	12	10	1	1100	0.5		0.5	
1,1,1-Trichloroethane	0.5	0.5	0.5	2100	740	1700	2000	14	49	0.5		0.2	
Trichloroethene	0.5	0.5	0.5	3	3	3	5	1	58	0.5		0.5	
Vinyl chloride	0.5	0.5	0.5	0.5	1	0.5	0.2	0.5	0.5	0.5		0.5	

Shaded = detected concentration

Table 10.3.6-7
Comparison of Phase I and II Groundwater Data
Site 30, Monitoring Wells East of Murray Road
Naval Air Station Pensacola
Pensacola, Florida

	Phase I units are in micrograms per liter (ug/L)																				
Parameter	GI111	GI113	GI126	GI164	GI179	GS101	GS103	GS105	GS108	GS111	GS113	GS118	GS123	GS126	GS146	GS154	GS156	GS157	GS160	GS161	GS162
Arsenic (As)	11.4	8.2	1	3.8	5.7	1	3	1	1	1	1	1	1	1	1	1	2.7	3.6	1	1	3.3
Barium (Ba)	39.9	20.7	11.85	4.75	9.1	5.35	458	3.15	4.65	2.6	6.7	11.55	3.65	3.2	3.4	5.2	581	6.35	11.05	5.25	12.5
Benzene	2	5	5	50	5	1	5	25	5	50	5	5	5	5	5	5	5	5	5	5	25
2-Butanone (MEK)	5	5	5	50	5	5	5	890	5	50	5	5	5	5	5	5	5	5	5	5	25
Cadmium (Cd)	1.5	1.5	1.5	1.5	3.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	8.6	1.5	1.5	1.5
Carbon tetrachloride	5	5	5	50	5	5	5	25	5	50	5	5	5	5	5	5	5	5	5	5	25
Chlorobenzene	620	5	1	50	5	5	10	25	5	720	3	2	25	3	5	5	5	5	5	5	25
Chloroform	5	5	5	50	5	5	5	25	5	50	5	5	5	5	2	5	5	5	5	5	25
Chromium (Cr)	2.9	2	5.9	2.2	10.25	2	2	2	2	2.85	2	2	3.7	5.85	2	2.5	4.6	20.1	2	2.8	3.8
1,2-Dichlorobenzene	39	5	5	5.5	6	5	5	5.5	6	3	5	5.5	5	5.5	5	5.5	5	5	5	5.5	5.5
1,3-Dichlorobenzene	37	5	5	5.5	6	5	5	5.5	6	6	5	5.5	5	5.5	5	5.5	5	5	5	5.5	5.5
1,4-Dichlorobenzene	180	5	5	5.5	6	5	5	5.5	6	41	0.9	5.5	5	5.5	5	5.5	5	5	5	5.5	5.5
1,1-Dichloroethane	4	5	5	320	1	5	5	25	5	50	5	5	5	5	5	9	7	19	5	5	28
1,2-Dichloroethane	5	5	5	50	5	5	5	25	5	50	5	5	5	5	5	5	5	5	5	5	25
1,1-Dichloroethene	5	5	5	410	5	5	5	25	5	100	5	5	5	5	5	5	5	5	5	5	50
1,2-Dichloroethene (cis)																					
1,2-Dichloroethene (total	5	5	5	50	3	5	5	25	5	50	5	5	5	5	5	5	5	5	5	5	25
Heptachlor epoxide	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.029	0.0145	0.0145	0.0145	0.0145
Lead (Pb)	1	1	1	27.3	5	2.2	10.2	1	4.6	4.7	9.4	1	3.2	4.2	1	1	1	2.2	1	2	4.8
Manganese (Mn)	76.8	64.1	23	264	28.6	43.9	457	1.5	2.2	31	6.3	422	24.3	24.4	1.35	60.2	168	373	6.15	6.45	33.2
Methylene chloride	5	5	2	11	5	5	5	25	5	50	5	5	5	5	5	5	5	5	5	5	25
Naphthalene	6	5	5	2	6	5	5	5.5	6	5	5	5.5	5	5.5	5	19	5	5	5	5.5	5.5
Tetrachloroethene	5	5	5	50	3	5	5	25	5	50	5	5	5	5	5	5	1	5	5	5	25
1,1,1-Trichloroethane	5	5	5	950	2	5	5	25	5	50	5	5	5	5	2	3	2	5	5	5	260
Trichloroethene	5	5	5	50	34	5	5	25	5	50	5	5	5	5	1	5	1	2	5	5	25
Vinyl chloride	20	5	5	50	5	5	5	25	5	50	5	5	5	5	5	110	5	5	5	5	25

Shaded = detected concentration

ıle 10.3.6-7
Com[illegible]on o[illegible]e I and II Groundwater Data
Site 30, Monitoring Wells East of Murray Road
Naval Air Station Pensacola
Pensacola, Florida

Parameter	Phase I (continued)								Phase II units are in micrograms per liter (ug/L)											
	GS164	GS165	GS166	GS168	GS170	GS171	GS172	GS173	GI111	GI126	GI164	GS103	GS111	GS123	GS126	GS162	GS166	GS171	GS172	GS173
Arsenic (As)	1	1	1	1	1	1	1	1		2.2		0.75	0.75		0.75			3.7	19	11.2
Barium (Ba)	3.1	3.65	5.15	4.9	5.05	4	4.25	4.3		9.4		328	3		7.4			20.5	13.3	6.4
Benzene	5	5	5	5	2	2	5	5	7				0.5			0.5	0.5	0.5	0.5	0.5
2-Butanone (MEK)	5	5	5	5	5	5	5	5	2.5				2.5			2.5	2.5	2.5	2.5	2.5
Cadmium (Cd)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		0.11		5.1	0.59		10.9			0.36	0.095	0.095
Carbon tetrachloride	5	5	5	5	5	5	5	5	0.5				0.5			0.5	0.5	0.5	2	0.5
Chlorobenzene	5	5	5	5	5	5	5	5					19			0.5	0.5	0.5	3	0.5
Chloroform	5	2	2	5	1	5	5	5	0.5				0.5			2	5	0.5	0.8	0.5
Chromium (Cr)	2	2	2	6.6	6.1	2	5.65	65.3		0.32		0.75	1.5		2.45			0.385	1.25	0.6
1,2-Dichlorobenzene	5	5	5	5.5	5	5	5	5	42				2.5			0.5	0.5	2.5	2.5	2.5
1,3-Dichlorobenzene	5	5	5	5.5	5	5	5	5	37				1.5			0.5	0.5	2.5	2.5	2.5
1,4-Dichlorobenzene	5	5	5	5.5	5	5	5	5	140				2.3			0.5	0.5	2.5	2.5	2.5
1,1-Dichloroethane	26	76	30	19	9	5	34	8	5				0.5			8	2	0.5	15	0.5
1,2-Dichloroethane	1	5	5	5	5	5	5	5	0.5				0.5			0.5	0.5	0.5	0.5	0.5
1,1-Dichloroethene	99	11	9	4	7	6	10	3	0.5				0.5			0.7	0.8	0.6	46	0.5
1,2-Dichloroethene (cis)									0.5				0.5			0.5	0.5	0.5	3	0.5
1,2-Dichloroethene (total)	5	5	5	7	5	1	6	14												
Heptachlor epoxide	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145	0.0145			0.0145			0.0145				0.0145	0.0145	0.0145
Lead (Pb)	2.2	1	1	3	5	1	1	1		0.405		37.1	1.8		236			0.465	0.465	0.95
Manganese (Mn)	20.9	3.15	6.8	9.55	21.1	56	50.1	8.1		12.05		204	15.9		35.1			95.4	16.8	18.1
Methylene chloride	5	5	5	5	5	5	5	5	1				1			1	1	1	0.8	1
Naphthalene	5	5	5	5.5	5	5	5	1	1.75				3.4					3.4	3.4	3.4
Tetrachloroethene	2	2	1	0.5	5	5	2	2	0.4				0.7			0.3	0.2	0.6	3	0.5
1,1,1-Trichloroethane	290	35	19	10	33	28	24	10	0.5				0.5			3	1	0.5	13	0.4
Trichloroethene	5	5	5	5	2	2	5	5	0.5				0.5			0.5	0.5	0.5	3	0.5
Vinyl chloride	5	5	5	5	5	5	5	5	15				0.5			0.5	0.5	0.5	0.5	0.5

Shaded = detected concentration

Table 10.3.6-8
Exposure Pathways Summary — Site 30

Medium and Exposure Pathway	Resident	Worker	Trespasser	Reason for Selection or Exclusion
Air: Inhalation of volatile contaminants emanating from soil	No	No	No	Fate and transport screening determined this to be an insignificant pathway.
Air: Inhalation of chemicals entrained in fugitive dust	Yes	Yes	Yes	Fate and transport screening determined this to be a significant pathway for chromium.
Groundwater: Ingestion of contaminants during potable or general use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Groundwater: Inhalation of volatilized contaminants during domestic use	Yes	Yes	No	COPCs were identified in groundwater based on the screening process described in Section 10.2.5. Groundwater is not considered an exposure medium for the trespasser scenario.
Soil: Incidental ingestion	Yes	Yes	Yes	COPCs were identified from risk-based and background screening comparisons.
Soil: Dermal contact	Yes	Yes	Yes	COPCs were identified from risk-based and background screening comparisons.
Wild game or domestic animals: Ingestion of tissue impacted by media contamination	No	No	No	Hunting/taking of game and/or raising livestock is prohibited at NAS Pensacola.
Fruits and vegetables: Ingestion of plant tissues grown in media	No	No	No	The potential for significant exposure via this pathway is low relative to that of other exposure pathways assessed.

Table 10.3.6-9
Statistical Analysis of COPCs
Surface Soils at Site 30
Naval Air Station Pensacola
Pensacola, Florida

COPC	n	Natural Log Transformed mean	SD	H-stat	UCL (mg/kg)	MAX (mg/kg)	EPC (mg/kg)	
Aluminum	58	7.580	1.144	2.464	5469	25500	5469	UCL Used
Aroclor-1242	59	-3.940	0.828	2.139	0.035	10	0.035	UCL Used
Aroclor-1254	59	-3.919	0.656	1.990	0.029	1.8	0.029	UCL Used
Aroclor-1260	59	-3.675	0.866	2.174	0.047	0.58	0.047	UCL Used
Arsenic	58	-0.647	0.975	2.281	1.1	4.9	1.1	UCL Used
Benzo(a)pyrene Equiv.	59	-0.409	0.925	2.231	1.3	29.23	1.3	UCL Used
Beryllium	58	-2.068	0.502	1.877	0.16	1.3	0.16	UCL Used
Cadmium	58	0.016	1.107	2.432	2.7	35.9	2.7	UCL Used
Chromium	58	2.267	1.515	2.901	54	395	54	UCL Used
Dieldrin	59	-5.891	0.903	2.209	0.0054	0.064	0.0054	UCL Used
Manganese	58	2.244	1.458	2.831	47	266	47	UCL Used

Notes:

mean Arithmetic mean of the logtransformed data
n Number of samples analyzed
SD Standard deviation for a sample of data
H-stat "H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA Not applicable
EPC Exposure point concentration
UCL 95 percentile upper confidence level mean
MAX Maximum reported concentration

Table 10.3.6-10
Statistical Analysis of COPCs
Groundwater at Site 30, West of Murray Road
Naval Air Station, Pensacola
Pensacola, Florida

COPC	Number of Detects	Number of Samples	Average ln(a)	Sample Standard Deviation sd(a)	H Statistic	Arithmetic Mean Detected Concentration (mg/L)	95% UCL (mg/L)	Maximum Detected Conc. (mg/L)	EPC (mg/L)	
Arsenic (As)	9	41	0.341	0.819	2.177	0.0072	0.0026	0.020	0.0072	Mean
Barium (Ba)	6	41	2.000	0.900	2.258	0.035	0.015	0.056	0.035	Mean
Benzene	4	49	1.190	1.411	2.792	0.064	0.016	0.25	0.064	Mean
Cadmium (Cd)	4	41	0.446	1.058	2.432	0.032	0.0041	0.11	0.032	Mean
Chloroethane	6	49	1.738	1.781	3.266	0.26	0.064	0.58	0.26	Mean
Chloroform	8	49	1.240	1.390	2.767	0.012	0.016	0.080	0.016	UCL
Chromium (Cr)	15	41	1.821	1.854	3.466	0.19	0.095	1.4	0.19	Mean
1,2-Dichlorobenzene	6	50	1.376	1.241	2.578	0.038	0.014	0.13	0.038	Mean
1,3-Dichlorobenzene	5	50	1.163	0.885	2.197	0.004	0.0063	0.0090	0.0063	UCL
1,4-Dichlorobenzene	6	50	1.260	0.966	2.278	0.012	0.0077	0.03	0.012	Mean
1,1-Dichloroethane	23	49	2.354	2.372	4.085	0.55	0.71	4.3	0.71	UCL
1,2-Dichloroethane	4	49	1.418	1.474	2.869	0.11	0.023	0.22	0.11	Mean
1,1-Dichloroethene	17	49	1.709	1.821	3.319	0.091	0.069	0.51	0.091	Mean
1,2-Dichloroethene (cis)	6	14	1.108	2.348	5.413	0.057	1.6	0.19	0.057	Mean
1,2-Dichloroethene (total)	6	35	1.972	1.047	2.457	0.079	0.019	0.22	0.079	Mean
bis(2-Ethylhexyl)phthalate	4	40	1.687	0.316	1.788	0.0086	0.0062	0.013	0.0086	Mean
Lead (Pb)	32	41	1.427	1.237	2.643	0.013	0.015	0.096	0.015	UCL
Manganese (Mn)	18	41	2.357	1.602	3.117	0.060	0.084	0.14	0.084	UCL
4-Methylphenol	6	40	1.641	0.381	1.825	0.0093	0.0062	0.021	0.0093	Mean
Naphthalene	14	40	1.670	0.712	2.078	0.012	0.0087	0.076	0.012	Mean
Pentachlorophenol	1	40	-0.373	0.354	1.714	NA	0.00073	0.0014	0.0014	Max
Tetrachloroethene	17	49	1.605	1.610	3.043	0.10	0.037	1.1	0.10	Mean
1,1,1-Trichloroethane	31	49	2.642	2.458	4.204	0.37	1.3	2.1	1.3	UCL
Trichloroethene	16	49	1.328	1.320	2.681	0.0093	0.015	0.058	0.015	UCL
Vinyl chloride	3	49	1.168	1.358	2.728	0.00057	0.014	0.0010	0.00057	Mean

NOTES:

mean	arithmetic mean of the logtransformed data
n	number of samples analyzed
SD	standard deviation for a sample of data
H-stat	"H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA	not applicable
ND	not determined
TEF	toxic equivalency factor
EPC	exposure point concentration
UCL	95 percentile upper confidence level mean
MAX	maximum reported concentration

Table 1(
Statistica[illegible]s of COPCs
Groundwater at Site 30, East of Murray Road
Naval Air Station, Pensacola
Pensacola, Florida

COPC	Number of Detects	Number of Samples	Average ln(a)	Sample Standard Deviation sd(a)	H Statistic	Arithmetic Mean Detected Concentration (mg/L)	95% UCL (mg/L)	Maximum Detected Conc. (mg/L)	EPC (mg/L)
Arsenic (As)	12	36	0.522	0.390	2.273	0.0065	0.0035	0.0190	0.0065 Mean
Barium (Ba)	6	36	2.196	1.344	2.822	0.23	0.042	0.58	0.23 Mean
Benzene	5	36	1.331	1.196	2.632	0.0028	0.013	0.0070	0.0028 Mean
2-Butanone (MEK)	1	36	1.791	1.098	2.513	NA	0.017	0.89	0.89 Max
Cadmium (Cd)	3	36	0.288	0.995	2.388	0.0048	0.0033	0.0086	0.0048 Mean
Carbon tetrachloride	1	36	1.418	1.160	2.589	NA	0.013	0.0020	0.0020 Max
Chlorobenzene	10	35	1.772	1.607	3.188	0.14	0.051	0.72	0.14 Mean
Chloroform	7	36	1.374	1.325	2.546	0.0021	0.012	0.0050	0.0021 Mean
Chromium (Cr)	3	36	0.976	0.987	2.379	0.030	0.0064	0.065	0.030 Mean
1,2-Dichlorobenzene	3	36	1.538	0.784	2.164	0.028	0.0084	0.042	0.028 Mean
1,3-Dichlorobenzene	4	36	1.538	0.784	2.164	0.020	0.0084	0.037	0.020 Mean
1,4-Dichlorobenzene	5	36	1.636	1.122	2.542	0.073	0.016	0.18	0.073 Mean
1,1-Dichloroethane	19	36	2.010	1.360	2.844	0.033	0.036	0.32	0.036 UCL
1,2-Dichloroethane	1	36	1.334	1.028	2.671	NA	0.014	0.0010	0.0010 Max
1,1-Dichloroethene	14	36	1.764	1.500	3.029	0.051	0.039	0.41	0.051 Mean
1,2-Dichloroethene (cis)	1	7	-0.437	0.677	NA	NA	NA	0.0030	0.0030 Max
1,2-Dichloroethene (total)	5	29	1.860	0.802	2.226	0.0062	0.012	0.014	0.012 UCL
Heptachlor epoxide	1	34	-4.213	0.119	1.706	NA	0.000015	0.000029	0.000029 Max
Lead (Pb)	19	36	0.824	1.325	2.797	0.019	0.010	0.24	0.019 Mean
Manganese (Mn)	25	36	3.274	1.521	3.057	0.11	0.18	0.46	0.18 UCL
Methylene chloride	4	36	1.440	0.923	2.309	0.0037	0.0093	0.011	0.0093 UCL
Naphthalene	3	34	1.531	0.456	1.889	0.0073	0.0060	0.019	0.0073 Mean
Tetrachloroethene	14	36	1.128	1.311	2.778	0.0013	0.013	0.003	0.0013 Mean
1,1,1-Trichloroethane	18	36	1.975	1.749	3.376	0.094	0.090	0.95	0.094 Mean
Trichloroethene	7	36	1.316	1.266	2.719	0.0064	0.015	0.034	0.015 UCL
Vinyl chloride	3	36	1.598	1.312	2.780	0.048	0.022	0.11	0.048 Mean

NOTES:

mean	arithmetic mean of the logtransformed data
n	number of samples analyzed
SD	standard deviation for a sample of data
H-stat	"H" statistic from Gilbert 1987; cuboidal interpolation was used to determine the value in accordance with USEPA Supplemental Guidance to RAGS, Calculating the Concentration Term
NA	not applicable
ND	not determined
TEF	toxic equivalency factor
EPC	exposure point concentration
UCL	95 percentile upper confidence level mean
MAX	maximum reported concentration

Table 10.3.6-12
Chronic Daily Intakes (CDI)
Incidental Ingestion of Surface Soil
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	FI *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	1	5469	7.49E-03	6.99E-02	8.56E-03	2.68E-03	9.56E-04	1.73E-03	2.47E-04
Aroclor-1242	1	0.035	4.74E-08	4.42E-07	5.42E-08	1.69E-08	6.04E-09	1.10E-08	1.56E-09
Aroclor-1254	1	0.029	4.01E-08	3.74E-07	4.58E-08	1.43E-08	5.11E-09	9.27E-09	1.32E-09
Aroclor-1260	1	0.047	6.47E-08	6.04E-07	7.40E-08	2.31E-08	8.26E-09	1.50E-08	2.14E-09
Arsenic	1	1.1	1.55E-06	1.45E-05	1.77E-06	5.54E-07	1.98E-07	3.59E-07	5.11E-08
Benzo(a)pyrene Equiv.	1	1.3	1.83E-06	1.71E-05	2.09E-06	6.54E-07	2.33E-07	4.23E-07	6.04E-08
Beryllium	1	0.16	2.23E-07	2.08E-06	2.54E-07	7.95E-08	2.84E-08	5.15E-08	7.34E-09
Cadmium	1	2.7	3.66E-06	3.42E-05	4.19E-06	1.31E-06	4.67E-07	8.47E-07	1.21E-07
Chromium	1	54	7.46E-05	6.96E-04	8.53E-05	2.66E-05	9.51E-06	1.73E-05	2.46E-06
Dieldrin	1	0.0054	7.44E-09	6.95E-08	8.50E-09	2.66E-09	9.49E-10	1.72E-09	2.46E-10
Manganese	1	47	6.46E-05	6.03E-04	7.38E-05	2.31E-05	8.24E-06	1.49E-05	2.13E-06

NOTES:

lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC

Table 1[illegible]
Chronic [illegible] akes (CDI)
Dermal Contact with Surface Soil
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/kg)	FC *	Dermal Absorption Factor (unitless)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Aluminum	5469	1	0.001	3.07E-04	1.01E-03	1.92E-04	2.19E-04	7.84E-05	7.11E-05	1.01E-05
Aroclor-1242	0.035	1	0.01	1.94E-08	6.41E-08	1.22E-08	1.39E-08	4.96E-09	4.50E-09	6.40E-10
Aroclor-1254	0.029	1	0.01	1.64E-08	5.42E-08	1.03E-08	1.17E-08	4.19E-09	3.80E-09	5.41E-10
Aroclor-1260	0.047	1	0.01	2.65E-08	8.76E-08	1.66E-08	1.90E-08	6.77E-09	6.14E-09	8.74E-10
Arsenic	1.1	1	0.001	6.35E-08	2.10E-07	3.98E-08	4.54E-08	1.62E-08	1.47E-08	2.09E-09
Benzo(a)pyrene Equiv.	1.3	1	0.01	7.50E-07	2.48E-06	4.70E-07	5.36E-07	1.91E-07	1.74E-07	2.47E-08
Beryllium	0.16	1	0.001	9.12E-09	3.01E-08	5.71E-09	6.52E-09	2.33E-09	2.11E-09	3.01E-10
Cadmium	2.7	1	0.001	1.50E-07	4.96E-07	9.40E-08	1.07E-07	3.83E-08	3.48E-08	4.95E-09
Chromium	54	1	0.001	3.06E-06	1.01E-05	1.91E-06	2.18E-06	7.80E-07	7.08E-07	1.01E-07
Dieldrin	0.0054	1	0.01	3.05E-09	1.01E-08	1.91E-09	2.18E-09	7.78E-10	7.06E-10	1.00E-10
Manganese	47	1	0.001	2.65E-06	8.74E-06	1.66E-06	1.89E-06	6.76E-07	6.13E-07	8.72E-08

NOTES:

CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
- The dermal absorption factor was applied to the exposure point concentration to reflect the different trans-dermal migration of inorganic versus organic chemicals
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10.3.6-14
Chronic Daily Intakes (CDI)
Inhalation of Surface Soil COPCs Resulting from Dust Emission
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Fraction Contacted from Contaminated Source *	Exposure Point Concentration (mg/kg)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Site Worker adult H-CDI (mg/kg-day)	Site Worker adult C-CDI (mg/kg-day)	Future Tresspasser H-CDI (mg/kg-day)	Future Tresspasser C-CDI (mg/kg-day)
Inorganics									
Chromium	1	54	1.13E-08	3.16E-08	6.58E-09	8.07E-09	2.88E-09	2.29E-09	3.27E-10

NOTES:

lwa Lifetime weighted average; used to calculate carcinogenic CDI, RAGS Parts A and B
CDI Chronic Daily Intake in mg/kg-day
H-CDI CDI for hazard quotient
C-CDI CDI for excess cancer risk
* Reflects the estimated fraction of the site impacted by the corresponding COPC.

Table 10
Chronic L. , .akes (CDI)
Ingestion of COPCs in Groundwater, West of Murray Road
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/liter)	Future Resident adult H-CDI (mg/kg-day)	Future Reside it child H-CDI (mg/k g-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Arsenic (As)	0.0072	2.0E-04	4.6E-04	1.1E-04	7.0E-05	3.4E-05
Barium (Ba)	0.035	9.5E-04	2.2E-03	5.2E-04	3.4E-04	1.7E-04
Benzene	0.064	1.8E-03	4.1E-03	9.6E-04	6.3E-04	3.1E-04
Cadmium (Cd)	0.032	8.7E-04	2.0E-03	4.8E-04	3.1E-04	1.5E-04
Chloroethane	0.26	7.0E-03	1.6E-02	3.8E-03	2.5E-03	1.2E-03
Chloroform	0.016	4.3E-04	1.0E-03	2.4E-04	1.5E-04	7.6E-05
Chromium (Cr)	0.19	5.1E-03	1.2E-02	2.8E-03	1.8E-03	9.0E-04
1,2-Dichlorobenzene	0.038	1.0E-03	2.4E-03	5.7E-04	3.7E-04	1.8E-04
1,3-Dichlorobenzene	0.0063	1.7E-04	4.0E-04	9.4E-05	6.1E-05	3.0E-05
1,4-Dichlorobenzene	0.012	3.2E-04	7.4E-04	1.7E-04	1.1E-04	5.6E-05
1,1-Dichloroethane	0.71	1.9E-02	4.5E-02	1.1E-02	7.0E-03	3.4E-03
1,2-Dichloroethane	0.11	2.9E-03	6.8E-03	1.6E-03	1.0E-03	5.2E-04
1,1-Dichloroethene	0.091	2.5E-03	5.8E-03	1.4E-03	8.9E-04	4.4E-04
1,2-Dichloroethene (cis)	0.057	1.6E-03	3.6E-03	8.6E-04	5.6E-04	2.7E-04
1,2-Dichloroethene (total)	0.079	2.2E-03	5.0E-03	1.2E-03	7.7E-04	3.8E-04
bis(2-Ethylhexyl)phthalate	0.0086	2.4E-04	5.5E-04	1.3E-04	8.4E-05	4.2E-05
Lead (Pb)	0.015	4.1E-04	9.6E-04	2.3E-04	1.5E-04	7.2E-05
Manganese (Mn)	0.084	2.3E-03	5.4E-03	1.3E-03	8.2E-04	4.0E-04
4-Methylphenol	0.0093	2.6E-04	6.0E-04	1.4E-04	9.1E-05	4.5E-05
Naphthalene	0.012	3.3E-04	7.6E-04	1.8E-04	1.2E-04	5.7E-05
Pentachlorophenol	0.0014	3.8E-05	8.9E-05	2.1E-05	1.4E-05	6.7E-06
Tetrachloroethene	0.10	2.7E-03	6.4E-03	1.5E-03	9.8E-04	4.8E-04
1,1,1-Trichloroethane	1.3	3.5E-02	8.2E-02	1.9E-02	1.3E-02	6.2E-03
Trichloroethene	0.015	4.1E-04	9.6E-04	2.3E-04	1.5E-04	7.2E-05
Vinyl chloride	0.00057	1.6E-05	3.6E-05	8.5E-06	5.5E-06	2.7E-06

NOTES:

lwa Lifetime weighted average
CDI Chronic Daily Intake
H-CDI Non-carcinogenic hazard based Chronic Daily Intake
C-CDI Carcinogenic risk based Chronic Daily Intake

Table 10.3.6-16
Chronic Daily Intakes (CDI)
Ingestion of COPCs in Groundwater, East of Murray Road
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Exposure Point Concentration (mg/liter)	Future Resident adult H-CDI (mg/kg-day)	Future Resident child H-CDI (mg/kg-day)	Future Resident lwa C-CDI (mg/kg-day)	Future Worker adult H-CDI (mg/kg-day)	Future Worker adult C-CDI (mg/kg-day)
Arsenic (As)	0.0065	1.8E-04	4.1E-04	9.8E-05	6.3E-05	3.1E-05
Barium (Ba)	0.23	6.4E-03	1.5E-02	3.5E-03	2.3E-03	1.1E-03
Benzene	0.0028	7.7E-05	1.8E-04	4.2E-05	2.7E-05	1.3E-05
2-Butanone (MEK)	0.89	2.4E-02	5.7E-02	1.3E-02	8.7E-03	4.3E-03
Cadmium (Cd)	0.0048	1.3E-04	3.0E-04	7.2E-05	4.7E-05	2.3E-05
Carbon tetrachloride	0.0020	5.5E-05	1.3E-04	3.0E-05	2.0E-05	9.6E-06
Chlorobenzene	0.14	3.9E-03	9.0E-03	2.1E-03	1.4E-03	6.8E-04
Chloroform	0.0021	5.8E-05	1.4E-04	3.2E-05	2.1E-05	1.0E-05
Chromium (Cr)	0.030	8.2E-04	1.9E-03	4.5E-04	2.9E-04	1.4E-04
1,2-Dichlorobenzene	0.028	7.7E-04	1.8E-03	4.2E-04	2.7E-04	1.3E-04
1,3-Dichlorobenzene	0.020	5.6E-04	1.3E-03	3.1E-04	2.0E-04	9.8E-05
1,4-Dichlorobenzene	0.073	2.0E-03	4.7E-03	1.1E-03	7.1E-04	3.5E-04
1,1-Dichloroethane	0.036	9.9E-04	2.3E-03	5.5E-04	3.5E-04	1.7E-04
1,2-Dichloroethane	0.0010	2.7E-05	6.4E-05	1.5E-05	9.8E-06	4.8E-06
1,1-Dichloroethene	0.051	1.4E-03	3.2E-03	7.6E-04	4.9E-04	2.4E-04
1,2-Dichloroethene (cis)	0.0030	8.2E-05	1.9E-04	4.5E-05	2.9E-05	1.4E-05
1,2-Dichloroethene (total)	0.012	3.4E-04	7.9E-04	1.9E-04	1.2E-04	6.0E-05
Heptachlor epoxide	0.000029	7.9E-07	1.9E-06	4.4E-07	2.8E-07	1.4E-07
Lead (Pb)	0.019	5.3E-04	1.2E-03	2.9E-04	1.9E-04	9.3E-05
Manganese (Mn)	0.18	5.0E-03	1.2E-02	2.8E-03	1.8E-03	8.9E-04
Methylene chloride	0.0093	2.5E-04	5.9E-04	1.4E-04	9.1E-05	4.5E-05
Naphthalene	0.0073	2.0E-04	4.7E-04	1.1E-04	7.2E-05	3.5E-05
Tetrachloroethene	0.0013	3.7E-05	8.5E-05	2.0E-05	1.3E-05	6.4E-06
1,1,1-Trichloroethane	0.094	2.6E-03	6.0E-03	1.4E-03	9.2E-04	4.5E-04
Trichloroethene	0.015	4.1E-04	9.5E-04	2.2E-04	1.5E-04	7.2E-05
Vinyl chloride	0.048	1.3E-03	3.1E-03	7.3E-04	4.7E-04	2.3E-04

NOTES:

lwa Lifetime weighted average
CDI Chronic Daily Intake
H-CDI Non-carcinogenic hazard based Chronic Daily Intake
C-CDI Carcinogenic risk based Chronic Daily Intake

Table 7
Hazard Quotients and Incremental Lifetime Cancer Risks
Incidental Surface Soil Ingestion
Site 30
Naval Air Station, Pensacola

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	1	NA	0.0075	0.070	ND	0.0027	ND	0.0017	ND
Aroclor-1242	NA	2	ND	ND	1.1E-07	ND	1.2E-08	ND	3.1E-09
Aroclor-1254	2E-05	2	0.0020	0.019	9.2E-08	0.00072	1.0E-08	0.00046	2.6E-09
Aroclor-1260	NA	2	ND	ND	1.5E-07	ND	1.7E-08	ND	4.3E-09
Arsenic	0.0003	1.5	0.0052	0.048	2.7E-06	0.0018	3.0E-07	0.0012	7.7E-08
Benzo(a)pyrene Equiv.	NA	7.3	ND	ND	1.5E-05	ND	1.7E-06	ND	4.4E-07
Beryllium	0.005	4.3	0.000045	0.00042	1.1E-06	0.000016	1.2E-07	0.000010	3.2E-08
Cadmium	0.001	NA	0.0037	0.034	ND	0.0013	ND	0.00085	ND
Chromium	0.005	NA	0.015	0.14	ND	0.0053	ND	0.0035	ND
Dieldrin	5E-05	16	0.00015	0.0014	1.4E-07	0.000053	1.5E-08	0.000034	3.9E-09
Manganese	0.047	NA	0.0014	0.013	ND	0.0005	ND	0.00032	ND
SUM Hazard Index/ILCR			0.03	0.3	2E-05	0.01	2E-06	0.008	6E-07

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.6-18
Hazard Quotients and Incremental Lifetime Cancer Risks
Dermal Contact With Surface Soil
Site 30
Naval Air Station, Pensacola

Chemical	ABS	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Aluminum	0.2	0.2	NA	0.0015	0.0051	ND	0.0011	ND	0.00036	ND
Aroclor-1242	0.5	NA	4	ND	ND	4.9E-08	ND	2.0E-08	ND	2.6E-09
Aroclor-1254	0.5	1E-05	4	0.0016	0.0054	4.1E-08	0.0012	1.7E-08	0.00038	2.2E-09
Aroclor-1260	0.5	NA	4	ND	ND	6.6E-08	ND	2.7E-08	ND	3.5E-09
Arsenic	0.2	6E-05	7.5	0.0011	0.0035	3.0E-07	0.00076	1.2E-07	0.00025	1.6E-08
Benzo(a)pyrene Equiv.	0.5	NA	14.6	ND	ND	6.9E-06	ND	2.8E-06	ND	3.6E-07
Beryllium	0.2	0.001	21.5	0.0000091	0.000030	1.2E-07	0.0000065	5.0E-08	0.0000021	6.5E-09
Cadmium	0.2	0.0002	NA	0.00075	0.0025	ND	0.00054	ND	0.00017	ND
Chromium	0.2	0.001	NA	0.0031	0.010	ND	0.0022	ND	0.00071	ND
Dieldrin	0.5	2.5E-05	32	0.00012	0.00040	6.1E-08	0.000087	2.5E-08	0.000028	3.2E-09
Manganese	0.2	0.0094	NA	0.00028	0.0009	ND	0.00020	ND	0.00007	ND
SUM Hazard Index/ILCR				0.008	0.03	7E-06	0.006	3E-06	0.002	4E-07

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average, used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime excess Cancer Risk
ABS Dermal to absorbed dose adjustment factor is applied to adjust for Oral SF and RfD (i.e., the oral RfD is based on oral absorption efficiency which should not be applied to dermal exposure and dermal CDI)
* Using the FDEP recommending RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.1-19
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Surface Soil COPCs Resulting from Dust Emission
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation RfD Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Site Worker adult Hazard Quotient	Site Worker adult ILCR	Future Tresspasser Hazard Quotient	Future Tresspasser ILCR
Inorganics									
Chromium	ND	42	ND	ND	2.8E-07	ND	1.2E-07	ND	1.4E-08
SUM Hazard Index/ILCR			ND	ND	3E-07	ND	1E-07	ND	1E-08

NOTES:
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk

Table 10.3.6-20
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 30
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Volatiles (μg/kg)				
1,1,1-Trichloroethane	5/201	1.0 - 8.0	3.80	3200000
1,1-Dichloroethane	1/201	4.0 - 4.0	4.00	2200000
1,1-Dichloroethene	1/201	2.0 - 2.0	2.00	7000
1,2,4-Trichlorobenzene	1/199	62.0 - 62.0	62.00	4600000
1,2-Dichloroethane	18/201	3.0 - 25.0	9.11	36000
1,2-Dichloroethene (total)	1/201	7.0 - 7.0	7.00	190000
2-Butanone (MEK)	3/201	1.0 - 190.0	68.33	2100000
Acetone	44/201	32.0 - 5600.0	493.36	64000000
Benzene	8/201	1.0 - 10.0	3.25	30000
Carbon disulfide	3/201	1.0 - 2.0	1.67	1500000
Carbon tetrachloride	3/201	1.0 - 2.0	1.67	8000
Chlorobenzene	1/201	2.0 - 2.0	2.00	230000
Chloromethane	2/201	10.0 - 10.0	10.00	120000
Ethylbenzene	4/201	2.0 - 25.0	7.75	8800000
Methylene chloride	5/201	11.0 - 31.00	24.00	1300000
Tetrachloroethene	4/201	1.0 - 3.0	2.25	34000
Toluene	22/201	1.0 - 41.0	8.68	2900000
Trichloroethene	1/201	1.0 - 1.0	1.00	110000
Xylene (Total)	8/201	1.0 - 200.0	26.75	1000000000
Semivolatiles (μg/kg)				
1,4-Dichlorobenzene	1/199	52.0 - 52.0	52.00	3200000
2-Methylnaphthalene	2/199	57.0 - 270.0	163.50	22000000
3,3'-Dichlorobenzidine	1/199	1400.0 - 1400.0	1400.00	170000
4-Nitrophenol	2/199	820.0 - 1700.0	1260.00	4300000
Acenaphthene	3/199	37.0 - 160.0	79.67	32000000

Table 10.3.6-20
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 30
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Semivolatiles (μg/kg) (Continued)				
Acenaphthylene	2/199	190.0 - 240.0	215.00	16000000
Anthracene	7/199	41.0 - 450.0	195.71	160000000
Benzo(a)anthracene	13/199	51.0 - 1700.0	363.61	100000
Benzo(a)pyrene	15/199	45.0 - 1900.0	277.40	10000
Benzo(b)fluoranthene	19/199	49.0 - 2000.0	297.68	100000
Benzo(g,h,i)perylene	14/199	39.0 - 1300.0	227.21	16000000
Benzo(k)fluoranthene	19/199	36.0 - 1500.0	237.21	1000000
bis(2-ethylhexyl)phthalate (BEHP)	56/199	46 - 58000	1654.45	5400000
Butylbenzylphthalate	3/199	69.0 - 680.0	281.33	110000000
Carbazole	2/199	39.0 - 51.0	45.00	3800000
Chrysene	16/199	37.0 - 1600.0	283.44	10000000
Dibenz(a,h)anthracene	6/199	40.0 - 680.0	256.17	10000
Dibenzofuran	1/199	180.0 - 180.0	180.00	2200000
Di-n-octyl phthalate	3/199	53.0 - 350.0	153.67	11000000
Fluoranthene	17/199	36.0 - 2600.0	498.71	22000000
Fluorene	3/199	36.0 - 460.0	208.67	22000000
Hexachlorobutadiene	1/199	350.0 - 350.0	350.00	110000
Indeno(1,2,3-cd)pyrene	14/199	36.0 - 1300.0	202.57	100000
Naphthalene	1/199	150.0 - 150.0	150.00	22000000
Phenanthrene	10/199	51.0 - 1600.0	476.80	16000000
Phenol	1/199	39.0 - 39.0	39.00	320000000
Pyrene	16/199	42.0 - 2300.0	478.63	22000000

Table 10.3.6-20
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 30
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Pesticides/PCBs (μg/kg)				
4,4'-DDD	2/199	5.4 - 17.0	11.20	320000
4,4'-DDE	6/199	3.0 - 120.0	26.45	220000
4,4'-DDT	8/199	3.9 - 87.0	19.80	220000
alpha-Chlordane	1/199	2.8 - 2.8	2.80	220000
Aroclor-1016	1/199	11.0 - 11.0	11.00	38000
Aroclor-1260	5/199	45.0 - 250.0	128.20	38000
Dieldrin	12/199	4.4 - 85.0	27.97	4700
Endosulfan II	1/199	7.8 - 7.8	7.80	3200000
Endrin ketone	1/199	13.0 - 13.0	13.00	160000
gamma-Chlordane	2/199	6.2 - 14.0	10.10	220000
Heptachlor	1/199	3.7 - 3.7	3.70	13000
Heptachlor epoxide	2/199	1.9 - 4.9	3.40	7900
Inorganics (mg/kg)				
Aluminum (Al)	190/199	12.0 - 19300.0	1532.15	790000
Antimony (Sb)	1/199	7.6 - 7.6	7.60	310
Arsenic (As)	52/199	0.41 - 8.1	0.95	73
Barium (Ba)	73/199	0.41 - 53.0	5.38	52000
Beryllium (Be)	11/199	0.21 - 0.62	0.33	26
Cadmium (Cd)	13/199	1.1 - 27.6	5.21	780
Calcium (Ca)	25/199	42.2 - 39200.0	5118.12	NA
Chromium (Cr) total	124/199	2.0 - 89.6	9.34	3800
Copper (Cu)	37/199	2.0 - 96.4	8.28	1000000
Iron (Fe)	188/199	59.6 - 14400.0	1107.20	NA
Lead (Pb)	115/199	0.42 - 284.0	10.66	1000
Magnesium (Mg)	75/199	8.1 - 6330.0	188.17	NA

Table 10.3.6-20
Summary of Subsurface Soil (2' to the water table)
Comparison to Construction Worker PRGs
OU2 — Site 30
NAS Pensacola, Pensacola, Florida

Chemical	Frequency of Detection	Range of Detection	Average Detected Concentration	PRG Reference*
Inorganics (mg/kg) (Continued)				
Manganese (Mn)	133/199	0.42 - 1820.0	25.54	27000
Mercury (Hg)	8/199	0.02 - 0.8	0.25	240
Molybdenum (Mo)	2/16	2.5 - 2.7	2.60	NA
Nickel (Ni)	4/199	4.1 - 21.2	9.28	16000
Potassium (K)	2/199	210.0 - 250.0	230.00	NA
Sodium (Na)	12/199	43.1 - 241.0	70.34	NA
Thallium (Tl)	15/199	0.41 - 0.43	0.42	63
Vanadium (V)	62/199	2.0 - 30.0	4.92	5500
Zinc (Zn)	48/199	1.0 - 88.2	16.50	240000

Note:
* = Preliminary remediation goal based on the lesser of a hazard-based assessment using a hazard quotient of 1.0 or a risk-based assessment using a cancer risk of 1E-06.

Table 10.3.6-21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0004	Aluminum (Al)	3840	mg/kg	0.0527	NA
0004	Arsenic (As)	0.76	mg/kg	0.0347	1.9851
0004	Chromium (Cr)	2.9	mg/kg	0.0080	NA
0004	Manganese (Mn)	15	mg/kg	0.0044	NA
	Total			0.0997	1.9851
0005	Aluminum (Al)	2150	mg/kg	0.0295	NA
0005	Arsenic (As)	0.52	mg/kg	0.0238	1.3582
0005	Chromium (Cr)	3.7	mg/kg	0.0101	NA
0005	Dieldrin	39	ug/kg	0.0129	1.4156
0005	Manganese (Mn)	8.7	mg/kg	0.0025	NA
	Total			0.0788	2.7738
0006	Aluminum (Al)	2740	mg/kg	0.0376	NA
0006	Arsenic (As)	0.53	mg/kg	0.0242	1.3844
0006	Chromium (Cr)	5	mg/kg	0.0137	NA
0006	Manganese (Mn)	4.7	mg/kg	0.0014	NA
	Total			0.0769	1.3844
0009	Aluminum (Al)	6960	mg/kg	0.0954	NA
0009	Arsenic (As)	1.1	mg/kg	0.0503	2.8732
0009	B(a)P Equiv.	5.42	ug/kg	NA	0.0898
0009	Beryllium (Be)	0.34	mg/kg	0.0009	2.5458
0009	Chromium (Cr)	5.9	mg/kg	0.0162	NA
0009	Manganese (Mn)	98.3	mg/kg	0.0287	NA
	Total			0.1915	5.5088
0010	Aluminum (Al)	1960	mg/kg	0.0269	NA
0010	Arsenic (As)	0.58	mg/kg	0.0265	1.5150
0010	Manganese (Mn)	8.1	mg/kg	0.0024	NA
	Total			0.0558	1.5150
0011	Aluminum (Al)	3820	mg/kg	0.0524	NA
0011	Arsenic (As)	0.78	mg/kg	0.0357	2.0374
0011	B(a)P Equiv.	0.42	ug/kg	NA	0.0070
0011	Chromium (Cr)	9.6	mg/kg	0.0263	NA
0011	Manganese (Mn)	19.9	mg/kg	0.0058	NA
	Total			0.1202	2.0443
0012	Aluminum (Al)	5170	mg/kg	0.0709	NA
0012	Aroclor-1260	120	ug/kg	NA	0.5444
0012	Arsenic (As)	3.4	mg/kg	0.1554	8.8808
0012	B(a)P Equiv.	223.78	ug/kg	NA	3.7059
0012	Chromium (Cr)	7.2	mg/kg	0.0197	NA
0012	Manganese (Mn)	28.2	mg/kg	0.0082	NA
	Total			0.2542	13.1311
0016	Aluminum (Al)	959	mg/kg	0.0132	NA
0016	Chromium (Cr)	3.5	mg/kg	0.0096	NA
0016	Manganese (Mn)	4.1	mg/kg	0.0012	NA
	Total			0.0239	NA
0017	Aluminum (Al)	1070	mg/kg	0.0147	NA
0017	Manganese (Mn)	7.3	mg/kg	0.0021	NA
	Total			0.0168	NA
0018	Aluminum (Al)	76.7	mg/kg	0.0011	NA
0018	Manganese (Mn)	0.6	mg/kg	0.0002	NA
	Total			0.0013	NA
0020	Aluminum (Al)	1030	mg/kg	0.0141	NA
0020	Aroclor-1260	250	ug/kg	0.0000	1.1343
0020	Arsenic (As)	0.41	mg/kg	0.0187	1.0709
0020	B(a)P Equiv.	357.44	ug/kg	0.0000	5.9193
0020	Manganese (Mn)	17	mg/kg	0.0050	NA
	Total			0.0379	8.1245
0053	Aluminum (Al)	1590	mg/kg	0.0218	NA
0053	Chromium (Cr)	2.5	mg/kg	0.0069	NA
0053	Manganese (Mn)	4.6	mg/kg	0.0013	NA
	Total			0.0300	NA
0059	Aluminum (Al)	2830	mg/kg	0.0388	NA
0059	Arsenic (As)	0.71	mg/kg	0.0325	1.8545
0059	Chromium (Cr)	3.5	mg/kg	0.0096	NA

Table 10.3.6-21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0059	Manganese (Mn)	26.2	mg/kg	0.0076	NA
	Total			0.0885	1.8545
0061	Aluminum (Al)	2510	mg/kg	0.0344	NA
0061	Arsenic (As)	0.5	mg/kg	0.0229	1.3060
0061	Chromium (Cr)	4.1	mg/kg	0.0112	NA
0061	Manganese (Mn)	7.2	mg/kg	0.0021	NA
	Total			0.0706	1.3060
0101	Aluminum (Al)	451	mg/kg	0.0062	NA
0101	B(a)P Equiv.	60.503	ug/kg	0.0000	1.0019
0101	Chromium (Cr)	2.5	mg/kg	0.0069	NA
	Total			0.0130	1.0019
0102	Aluminum (Al)	12800	mg/kg	0.1755	NA
0102	Arsenic (As)	3.4	mg/kg	0.1554	8.8808
0102	B(a)P Equiv.	2996.6	ug/kg	NA	49.6246
0102	Beryllium (Be)	0.21	mg/kg	0.0006	1.5724
0102	Cadmium (Cd)	14.3	mg/kg	0.1964	NA
0102	Chromium (Cr)	23.1	mg/kg	0.0634	NA
0102	Manganese (Mn)	55.2	mg/kg	0.0161	NA
	Total			0.6074	60.0779
0103	Aluminum (Al)	9380	mg/kg	0.1286	NA
0103	Arsenic (As)	1.8	mg/kg	0.0823	4.7016
0103	Beryllium (Be)	0.42	mg/kg	0.0012	3.1448
0103	Chromium (Cr)	19.1	mg/kg	0.0524	NA
	Total			0.2644	7.8465
0104	Aluminum (Al)	3030	mg/kg	0.0415	NA
0104	B(a)P Equiv.	104.1	ug/kg	NA	1.7239
0104	Cadmium (Cd)	4	mg/kg	0.0549	NA
0104	Chromium (Cr)	8.5	mg/kg	0.0233	NA
0104	Manganese (Mn)	35	mg/kg	0.0102	NA
	Total			0.1300	1.7239
0105	Aluminum (Al)	1680	mg/kg	0.0230	NA
0105	Arsenic (As)	0.69	mg/kg	0.0315	1.8023
0105	Chromium (Cr)	13.5	mg/kg	0.0370	NA
0105	Manganese (Mn)	17.4	mg/kg	0.0051	NA
	Total			0.0967	1.8023
0106	Aluminum (Al)	2650	mg/kg	0.0363	NA
0106	Aroclor-1260	93	ug/kg	NA	0.4219
0106	Arsenic (As)	0.82	mg/kg	0.0375	2.1418
0106	Beryllium (Be)	0.22	mg/kg	0.0006	1.6473
0106	Cadmium (Cd)	1.7	mg/kg	0.0235	NA
0106	Chromium (Cr)	13.6	mg/kg	0.0373	NA
0106	Dieldrin	15	ug/kg	0.0049	0.5444
0106	Manganese (Mn)	36.8	mg/kg	0.0107	NA
	Total			0.1509	4.7555
0108	Aluminum (Al)	137	mg/kg	0.0019	NA
0108	Chromium (Cr)	5.7	mg/kg	0.0156	NA
	Total			0.0175	NA
0109	Aluminum (Al)	2130	mg/kg	0.0292	NA
0109	Arsenic (As)	0.77	mg/kg	0.0352	2.0112
0109	Chromium (Cr)	5	mg/kg	0.0137	NA
0109	Manganese (Mn)	18	mg/kg	0.0053	NA
	Total			0.0834	2.0112
0110	Aluminum (Al)	608	mg/kg	0.0083	NA
0110	Arsenic (As)	0.43	mg/kg	0.0197	1.1232
0110	Cadmium (Cd)	2.5	mg/kg	0.0346	NA
0110	Chromium (Cr)	155	mg/kg	0.4251	NA
0110	Dieldrin	3.8	ug/kg	0.0013	0.1379
	Total			0.4889	1.2611
0111	Aluminum (Al)	521	mg/kg	0.0071	NA
0111	Cadmium (Cd)	2.1	mg/kg	0.0290	NA
0111	Chromium (Cr)	89.6	mg/kg	0.2457	NA
	Total			0.2819	NA
0112	Aluminum (Al)	1460	mg/kg	0.0200	NA
0112	Chromium (Cr)	39.8	mg/kg	0.1092	NA

Table 10.3.6-21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
	Total			0.1292	NA
0113	Aluminum (Al)	562	mg/kg	0.0077	NA
0113	Beryllium (Be)	0.23	mg/kg	0.0006	1.7222
0113	Chromium (Cr)	2.1	mg/kg	0.0058	NA
	Total			0.0141	1.7222
0114	Aluminum (Al)	753	mg/kg	0.0103	NA
0114	Chromium (Cr)	2.9	mg/kg	0.0080	NA
0114	Manganese (Mn)	9.5	mg/kg	0.0028	NA
	Total			0.0211	NA
0115	Aluminum (Al)	800	mg/kg	0.0110	NA
	Total			0.0110	NA
0116	B(a)P Equiv.	157.72	ug/kg	NA	2.6119
	Total			NA	2.6119
0117	Aluminum (Al)	2290	mg/kg	0.0314	NA
0117	Chromium (Cr)	5.7	mg/kg	0.0156	NA
0117	Manganese (Mn)	22.4	mg/kg	0.0065	NA
	Total			0.0535	NA
0118	Aluminum (Al)	8050	mg/kg	0.1104	NA
0118	Chromium (Cr)	11.5	mg/kg	0.0315	NA
0118	Manganese (Mn)	66.7	mg/kg	0.0195	NA
	Total			0.1614	NA
0120	Aluminum (Al)	885	mg/kg	0.0121	NA
0120	Arsenic (As)	0.41	mg/kg	0.0187	1.0709
0120	Chromium (Cr)	17.4	mg/kg	0.0477	NA
0120	Dieldrin	6	ug/kg	0.0020	0.2178
	Total			0.0806	1.2887
0121	Aluminum (Al)	389	mg/kg	0.0053	NA
0121	Chromium (Cr)	15.5	mg/kg	0.0425	NA
	Total			0.0478	NA
0122	Aluminum (Al)	797	mg/kg	0.0109	NA
0122	Cadmium (Cd)	1.1	mg/kg	0.0152	NA
0122	Chromium (Cr)	33.4	mg/kg	0.0916	NA
0122	Dieldrin	10	ug/kg	0.0033	0.3630
0122	Manganese (Mn)	16.5	mg/kg	0.0048	NA
	Total			0.1258	0.3630
0123	Aluminum (Al)	1630	mg/kg	0.0224	NA
0123	Beryllium (Be)	0.34	mg/kg	0.0000	2.5458
0123	Cadmium (Cd)	9.7	mg/kg	0.1342	NA
0123	Chromium (Cr)	204	mg/kg	0.5595	NA
0123	Dieldrin	14	ug/kg	0.0046	0.5082
0123	Manganese (Mn)	18.8	mg/kg	0.0055	NA
	Total			0.7271	3.0540
0124	Aluminum (Al)	1480	mg/kg	0.0203	NA
0124	Aroclor-1260	82	ug/kg	NA	0.3720
0124	Chromium (Cr)	181	mg/kg	0.4964	NA
0124	Dieldrin	18	ug/kg	0.0059	0.6533
	Total			0.5226	1.0254
0125	Aluminum (Al)	2650	mg/kg	0.0363	NA
0125	Aroclor-1260	240	ug/kg	NA	1.0889
0125	Cadmium (Cd)	15.1	mg/kg	0.2089	NA
0125	Chromium (Cr)	395	mg/kg	1.0833	NA
0125	Dieldrin	32	ug/kg	0.0106	1.1615
0125	Manganese (Mn)	15.5	mg/kg	0.0045	NA
	Total			1.3436	2.2504
0126	Aluminum (Al)	542	mg/kg	0.0074	NA
0126	Cadmium (Cd)	3.1	mg/kg	0.0429	NA
0126	Chromium (Cr)	74.2	mg/kg	0.2035	NA
	Total			0.2538	NA
0127	Aluminum (Al)	1450	mg/kg	0.0199	NA
0127	Aroclor-1254	82	ug/kg	0.0676	0.3720
0127	Aroclor-1260	75	ug/kg	NA	0.3403
0127	B(a)P Equiv.	5.3	ug/kg	NA	0.0878

Table 10.3.6-21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
0127	Cadmium (Cd)	2.1	mg/kg	0.0290	NA
0127	Chromium (Cr)	68.7	mg/kg	0.1884	NA
0127	Dieldrin	11	ug/kg	0.0036	0.3993
	Total			0.3085	1.1994
0128	Aluminum (Al)	1500	mg/kg	0.0206	NA
0128	Aroclor-1254	69	ug/kg	0.0569	0.3131
0128	Arsenic (As)	0.57	mg/kg	0.0261	1.4888
0128	Cadmium (Cd)	2	mg/kg	0.0277	NA
0128	Chromium (Cr)	57.5	mg/kg	0.1577	NA
0128	Dieldrin	6	ug/kg	0.0020	0.2178
	Total			0.2909	2.0197
0129	Aluminum (Al)	1750	mg/kg	0.0240	NA
0129	Cadmium (Cd)	1.6	mg/kg	0.0221	NA
0129	Chromium (Cr)	23.1	mg/kg	0.0634	NA
0129	Dieldrin	4.2	ug/kg	0.0014	0.1524
0129	Manganese (Mn)	17.1	mg/kg	0.0050	NA
	Total			0.1158	0.1524
0130	Aluminum (Al)	2700	mg/kg	0.0370	NA
0130	Arsenic (As)	0.76	mg/kg	0.0347	1.9851
0130	B(a)P Equiv.	14	ug/kg	NA	0.2318
0130	Chromium (Cr)	5.6	mg/kg	0.0154	NA
0130	Manganese (Mn)	41.2	mg/kg	0.0120	NA
	Total			0.0991	2.2170
0134	Aluminum (Al)	2830	mg/kg	0.0388	NA
0134	Cadmium (Cd)	4.2	mg/kg	0.0581	NA
0134	Chromium (Cr)	37.3	mg/kg	0.1023	NA
0134	Manganese (Mn)	7.6	mg/kg	0.0022	NA
	Total			0.2014	NA
0135	Aluminum (Al)	1170	mg/kg	0.0160	NA
0135	Chromium (Cr)	4.6	mg/kg	0.0126	NA
	Total			0.0287	NA
0137	Aluminum (Al)	12400	mg/kg	0.1700	NA
0137	Aroclor-1260	410	ug/kg	NA	1.8602
0137	Arsenic (As)	4.7	mg/kg	0.2148	12.2764
0137	B(a)P Equiv.	8414.3	ug/kg	NA	139.3434
0137	Beryllium (Be)	1.3	mg/kg	0.0036	9.7341
0137	Cadmium (Cd)	35.9	mg/kg	0.4965	NA
0137	Chromium (Cr)	116	mg/kg	0.3181	NA
0137	Dieldrin	5.6	ug/kg	0.0018	0.2033
0137	Manganese (Mn)	266	mg/kg	0.0776	NA
	Total			1.2825	163.4174
0138	Aluminum (Al)	2500	mg/kg	0.0343	NA
0138	Aroclor-1242	10000	ug/kg	NA	45.3707
0138	Aroclor-1254	1800	ug/kg	1.4844	8.1667
0138	Aroclor-1260	580	ug/kg	NA	2.6315
0138	Cadmium (Cd)	3.5	mg/kg	0.0484	NA
0138	Chromium (Cr)	9.8	mg/kg	0.0269	NA
	Total			1.5939	56.1690
0139	Aluminum (Al)	3000	mg/kg	0.0411	NA
0139	Arsenic (As)	0.63	mg/kg	0.0288	1.6456
0139	B(a)P Equiv.	113.425	ug/kg	NA	1.8784
0139	Cadmium (Cd)	4.8	mg/kg	0.0664	NA
0139	Chromium (Cr)	15.1	mg/kg	0.0414	NA
0139	Manganese (Mn)	27.3	mg/kg	0.0080	NA
	Total			0.1857	3.5239
0140	Aluminum (Al)	9880	mg/kg	0.1355	NA
0140	Arsenic (As)	1.5	mg/kg	0.0686	3.9180
0140	B(a)P Equiv.	29230	ug/kg	NA	484.0579
0140	Cadmium (Cd)	6	mg/kg	0.0830	NA
0140	Chromium (Cr)	12	mg/kg	0.0329	NA
0140	Manganese (Mn)	64	mg/kg	0.0187	NA
	Total			0.3386	487.9759
0141	Aluminum (Al)	273	mg/kg	0.0037	NA
	Total			0.0037	NA
0142	Aluminum (Al)	1010	mg/kg	0.0138	NA

Table 10.3.6-21
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Surface Soil
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
	Total			0.0138	NA
0143	Aluminum (Al)	15900	mg/kg	0.2180	NA
0143	Arsenic (As)	3.6	mg/kg	0.1645	9.4032
0143	Chromium (Cr)	14	mg/kg	0.0384	NA
0143	Manganese (Mn)	14.2	mg/kg	0.0041	NA
	Total			0.4251	9.4032
0144	Aluminum (Al)	2000	mg/kg	0.0274	NA
0144	Cadmium (Cd)	1.3	mg/kg	0.0180	NA
0144	Chromium (Cr)	3.6	mg/kg	0.0099	NA
0144	Manganese (Mn)	13.1	mg/kg	0.0038	NA
	Total			0.0591	NA
0145	Aluminum (Al)	1560	mg/kg	0.0214	NA
0145	Arsenic (As)	0.65	mg/kg	0.0297	1.6978
	Total			0.0511	1.6978
0147	Aluminum (Al)	1920	mg/kg	0.0263	NA
0147	Arsenic (As)	4.8	mg/kg	0.2194	12.5376
0147	Chromium (Cr)	9.6	mg/kg	0.0263	NA
0147	Manganese (Mn)	21.7	mg/kg	0.0063	NA
	Total			0.2784	12.5376
0149	Aluminum (Al)	2890	mg/kg	0.0396	NA
0149	Chromium (Cr)	4.4	mg/kg	0.0121	NA
0149	Manganese (Mn)	26.8	mg/kg	0.0078	NA
	Total			0.0595	NA
0150	Aluminum (Al)	2940	mg/kg	0.0403	NA
0150	Aroclor-1260	47	ug/kg	NA	0.2132
0150	Arsenic (As)	0.7	mg/kg	0.0320	1.8284
0150	Chromium (Cr)	7.2	mg/kg	0.0197	NA
0150	Manganese (Mn)	37.8	mg/kg	0.0110	NA
	Total			0.1031	2.0416
0151	Aluminum (Al)	11500	mg/kg	0.1577	NA
0151	Aroclor-1260	84	ug/kg	NA	0.3811
0151	Arsenic (As)	3.6	mg/kg	0.1645	9.4032
0151	B(a)P Equiv.	88.1	ug/kg	NA	1.4590
0151	Cadmium (Cd)	1.2	mg/kg	0.0166	NA
0151	Chromium (Cr)	19	mg/kg	0.0521	NA
0151	Dieldrin	5.9	ug/kg	0.0019	0.2141
0151	Manganese (Mn)	66.2	mg/kg	0.0190	NA
	Total			0.4119	11.4574
0153	Aluminum (Al)	10300	mg/kg	0.2646	NA
0153	Antimony (Sb)	7.6	mg/kg	0.2605	NA
0153	Arsenic (As)	2.5	mg/kg	0.1143	6.5300
0153	Beryllium (Be)	0.48	mg/kg	0.0013	3.5941
0153	Chromium (Cr)	16	mg/kg	0.0439	NA
0153	Manganese (Mn)	46.8	mg/kg	0.0137	NA
	Total			0.6983	10.1241
0154	Aluminum (Al)	4270	mg/kg	0.0586	NA
0154	Aroclor-1260	45	ug/kg	NA	0.2042
0154	Arsenic (As)	1.3	mg/kg	0.0594	3.3956
0154	Beryllium (Be)	0.31	mg/kg	0.0009	2.3212
0154	Chromium (Cr)	27.1	mg/kg	0.0743	NA
0154	Dieldrin	64	ug/kg	0.0211	2.3230
0154	Manganese (Mn)	51	mg/kg	0.0149	NA
	Total			0.2292	8.2439

Table 2
Hazard Quotients and Incremental Lifetime Cancer Risks
Groundwater Ingestion, West of Murray Road
Site 30
Naval Air Station, Pensacola

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Arsenic (As)	0.0003	1.5	0.65	1.5	1.6E-04	0.23	5.2E-05
Barium (Ba)	0.07	NA	0.014	0.032	ND	0.0048	ND
Benzene	NA	0.029	ND	ND	2.8E-05	ND	8.9E-06
Cadmium (Cd)	0.0005	NA	1.7	4.0	ND	0.62	ND
Chloroethane	0.4	NA	0.017	0.041	ND	0.0062	ND
Chloroform	0.01	0.0061	0.043	0.10	1.5E-06	0.015	4.6E-07
Chromium (Cr)	0.005	NA	1.0	2.4	ND	0.36	ND
1,2-Dichlorobenzene	0.09	NA	0.011	0.027	ND	0.0041	ND
1,3-Dichlorobenzene	0.089	NA	0.0019	0.0045	ND	0.00069	ND
1,4-Dichlorobenzene	NA	0.024	ND	ND	4.2E-06	ND	1.3E-06
1,1-Dichloroethane	0.1	NA	0.19	0.45	ND	0.070	ND
1,2-Dichloroethane	NA	0.091	ND	ND	1.5E-04	ND	4.7E-05
1,1-Dichloroethene	0.009	0.6	0.28	0.64	8.2E-04	0.10	2.6E-04
1,2-Dichloroethene (cis)	0.01	NA	0.16	0.36	ND	0.056	ND
1,2-Dichloroethene (total)	0.009	NA	0.24	0.56	ND	0.086	ND
bis(2-Ethylhexyl)phthalate	0.02	0.014	0.012	0.028	1.8E-06	0.0042	5.8E-07
Lead (Pb)	NA	NA	ND	ND	ND	ND	ND
Manganese (Mn)*	0.047	NA	0.05	0.11	ND	0.017	ND
4-Methylphenol	0.005	NA	0.051	0.12	ND	0.018	ND
Naphthalene	0.04	NA	0.0082	0.019	ND	0.0029	ND
Pentachlorophenol	0.03	0.12	0.0013	0.0030	2.5E-06	0.00046	8.1E-07
Tetrachloroethene	0.01	0.052	0.27	0.64	7.8E-05	0.10	2.5E-05
1,1,1-Trichloroethane	0.035	NA	1.0	2.3	ND	0.36	ND
Trichloroethene	0.006	0.011	0.069	0.16	2.5E-06	0.025	8.0E-07
Vinyl chloride	NA	.9	ND	ND	1.6E-05	ND	5.2E-06
SUM Hazard Index/ILCR			6	14	1E-03	2	4E-04

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.6-23
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Contaminants in Groundwater due to Domestic Use, West of Murray Road
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation Rf Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Benzene	0.00171	0.029	1.0	2.4	2.8E-05	0.37	8.9E-06
Chloroethane	2.86	NA	0.0024	0.0057	ND	0.00087	ND
Chloroform	0.01	0.0805	0.043	0.10	1.9E-05	0.015	6.1E-06
1,2-Dichlorobenzene	0.04	NA	0.026	0.060	ND	0.0092	ND
1,3-Dichlorobenzene	0.089	NA	0.0019	0.0045	ND	0.00069	ND
1,4-Dichlorobenzene	0.229	NA	0.0014	0.0032	ND	0.00049	ND
1,1-Dichloroethane	0.143	NA	0.14	0.32	ND	0.049	ND
1,2-Dichloroethane	0.00286	0.091	1.0	2.4	1.5E-04	0.37	4.7E-05
1,1-Dichloroethene	0.009	0.175	0.28	0.64	2.4E-04	0.10	7.6E-05
1,2-Dichloroethene (cis)	0.01	NA	0.16	0.36	ND	0.056	ND
1,2-Dichloroethene (total)	0.009	NA	0.24	0.56	ND	0.086	ND
Tetrachloroethene	0.01	0.00203	0.27	0.64	3.1E-06	0.10	9.8E-07
1,1,1-Trichloroethane	0.286	NA	0.12	0.29	ND	0.044	ND
Trichloroethene	0.006	0.006	0.069	0.16	1.4E-06	0.025	4.3E-07
Vinyl chloride	NA	0.3	ND	ND	2.6E-06	ND	8.2E-07
SUM Hazard Index/ILCR			3	8	4E-04	1	1E-04

NOTES:
NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
Oral RfDs have been cross-assigned as Inhalation RfDs

Table 4
Hazard Quotients and Incremental Lifetime Cancer Risks
Groundwater Ingestion, East of Murrary Road
Site 30
Naval Air Station, Pensacola

Chemical	Oral RfD Used (mg/kg-day)	Oral SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Arsenic (As)	0.0003	1.5	0.59	1.4	1.5E-04	0.21	4.7E-05
Barium (Ba)	0.07	NA	0.092	0.21	ND	0.033	ND
Benzene	NA	0.029	ND	ND	1.2E-06	ND	3.9E-07
2-Butanone (MEK)	0.6	NA	0.041	0.095	ND	0.015	ND
Cadmium (Cd)	0.0005	NA	0.26	0.61	ND	0.093	ND
Carbon tetrachloride	0.0007	0.13	0.078	0.18	3.9E-06	0.028	1.3E-06
Chlorobenzene	0.02	NA	0.19	0.45	ND	0.069	ND
Chloroform	0.01	0.0061	0.0058	0.014	1.9E-07	0.0021	6.2E-08
Chromium (Cr)	0.005	NA	0.16	0.38	ND	0.059	ND
1,2-Dichlorobenzene	0.09	NA	0.0085	0.020	ND	0.0030	ND
1,3-Dichlorobenzene	0.089	NA	0.0063	0.0146	ND	0.0022	ND
1,4-Dichlorobenzene	NA	0.024	ND	ND	2.6E-05	ND	8.4E-06
1,1-Dichloroethane	0.1	NA	0.010	0.023	ND	0.0035	ND
1,2-Dichloroethane	NA	0.091	ND	ND	1.4E-06	ND	4.4E-07
1,1-Dichloroethene	0.009	0.6	0.15	0.36	4.6E-04	0.055	1.5E-04
1,2-Dichloroethene (cis)	0.01	NA	0.0082	0.019	ND	0.0029	ND
1,2-Dichloroethene (total)	0.009	NA	0.038	0.088	ND	0.013	ND
Heptachlor epoxide	1.3E-05	9.1	0.061	0.14	4.0E-06	0.022	1.3E-06
Lead (Pb)	NA	NA	ND	ND	ND	ND	ND
Manganese (Mn)	0.047	NA	0.11	0.25	ND	0.038	ND
Methylene chloride	0.06	0.0075	0.0042	0.0099	1.0E-06	0.0015	3.3E-07
Naphthalene	0.04	NA	0.0050	0.012	ND	0.0018	ND
Tetrachloroethene	0.01	0.052	0.0037	0.0085	1.0E-06	0.0013	3.3E-07
1,1,1-Trichloroethane	0.035	NA	0.073	0.17	ND	0.026	ND
Trichloroethene	0.006	0.011	0.068	0.16	2.5E-06	0.024	7.9E-07
Vinyl chloride	NA	1.9	ND	ND	1.4E-03	ND	4.4E-04
SUM Hazard Index/ILCR			2	5	2E-03	1	6E-04

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its hazard quotient.

Table 10.3.6-25
Hazard Quotients and Incremental Lifetime Cancer Risks
Inhalation of Contaminants in Groundwater due to Domestic Use, East of Murray Road
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Chemical	Inhalation RfD Used (mg/kg-day)	Inhalation SF Used (mg/kg-day)-1	Future Resident adult Hazard Quotient	Future Resident child Hazard Quotient	Future Resident lwa ILCR	Future Worker adult Hazard Quotient	Future Worker adult ILCR
Benzene	0.00171	0.029	0.045	0.10	1.2E-06	0.016	3.9E-07
2-Butanone (MEK)	0.286	NA	0.085	0.20	ND	0.030	ND
Carbon tetrachloride	0.000571	0.0525	0.096	0.22	1.6E-06	0.034	5.1E-07
Chlorobenzene	0.00571	NA	0.67	1.6	ND	0.24	ND
Chloroform	0.01	0.0805	0.0058	0.014	2.6E-06	0.0021	8.2E-07
1,2-Dichlorobenzene	0.04	NA	0.019	0.045	ND	0.0068	ND
1,3-Dichlorobenzene	0.089	NA	0.0063	0.015	ND	0.0022	ND
1,4-Dichlorobenzene	0.229	NA	0.0087	0.020	ND	0.0031	ND
1,1-Dichloroethane	0.143	NA	0.0069	0.016	ND	0.0025	ND
1,2-Dichloroethane	0.00283	0.091	0.0097	0.0226	1.4E-06	0.0035	4.4E-07
1,1-Dichloroethene	0.009	0.175	0.15	0.36	1.3E-04	0.055	4.3E-05
1,2-Dichloroethene (cis)	0.01	NA	0.0082	0.019	ND	0.0029	ND
1,2-Dichloroethene (total)	0.009	NA	0.038	0.088	ND	0.013	ND
Methylene chloride	0.857	0.00164	0.00000093	0.0000022	7.2E-10	0.00000033	2.3E-10
Tetrachloroethene	0.01	0.00203	0.0037	0.0085	4.1E-08	0.0013	1.3E-08
1,1,1-Trichloroethane	0.286	NA	0.0090	0.021	ND	0.0032	ND
Trichloroethene	0.006	0.006	0.068	0.16	1.3E-06	0.024	4.3E-07
Vinyl chloride	NA	0.3	ND	ND	2.2E-04	ND	7.0E-05
SUM Hazard Index/ILCR			1	3	4E-04	0.4	1E-04

NOTES:

NA Not available
ND Not Determined due to lack of available information
lwa Lifetime weighted average; used to calculate excess carcinogenic risk derived from RAGS Part A
ILCR Incremental Lifetime Cancer Risk
Oral RfDs have been cross-assigned as Inhalation RfDs

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
Summary of Risk and Hazard resulting from Maximum Concentration						
S022	02	1,1,1-Trichloroethane	2100	ug/L	1.961	NA
S027	02	1,1-Dichloroethane	4300	ug/L	4.671	NA
S027	01	1,1-Dichloroethene	510	ug/L	7.245	5878.5
S028	02	1,2-Dichlorobenzene	130	ug/L	0.300	NA
S028	02	1,2-Dichloroethane	220	ug/L	9.835	595.5
S046	01	1,2-Dichloroethene (total)	220	ug/L	3.125	NA
I111	01	1,4-Dichlorobenzene	180	ug/L	0.100	128.5
I060	01	Bromodichloromethane	1	ug/L	0.006	1.8
S105	01	2-Butanone (MEK)	890	ug/L	0.294	NA
S046	01	4-Methylphenol (p-Cresol)	21	ug/L	0.268	NA
S062	01	Aluminum (Al)	23500	ug/L	1.502	NA
I009	01	Arsenic (As)	19.7	ug/L	4.198	439.5
S156	01	Barium (Ba)	581	ug/L	0.531	NA
S006	01	Benzene	250	ug/L	18.692	215.7
I060	01	Beryllium (Be)	1.2	ug/L	0.015	76.7
S028	02	Cadmium (Cd)	108	ug/L	13.846	NA
S006	01	Carbazole	14	ug/L	NA	4.2
S172	02	Carbon tetrachloride	2	ug/L	0.407	5.4
S111	01	Chlorobenzene	720	ug/L	10.362	NA
S028	02	Chloroethane	580	ug/L	0.106	NA
S062	01	Chloroform	80	ug/L	1.023	103.0
S027	01	Chromium (Cr)	1380	ug/L	17.644	NA
I060	01	Dibromochloromethane	2	ug/L	0.013	5.0
S006	01	Ethylbenzene	380	ug/L	0.328	NA
S156	01	Heptachlor epoxide	0.029	ug/L	0.285	7.8
S126	02	Lead (Pb)	236	ug/L	NA	NA
S103	01	Manganese (Mn)	457	ug/L	1.270	NA
S006	01	Methylene chloride	12	ug/L	0.014	1.6
S012	01	Naphthalene	29000	ug/L	46.347	NA
S012	02	Pentachlorophenol	1.4	ug/L	0.003	2.5
I058	01	Silver (Ag)	43.4	ug/L	0.555	NA
S046	02	Tetrachloroethene	1100	ug/L	14.064	883.9
S006	01	Toluene	140	ug/L	0.123	NA
S123	01	Toxaphene	4.8	ug/L	NA	78.5
S046	02	Trichloroethene	58	ug/L	1.236	14.7
I060	01	Vanadium (V)	61	ug/L	0.557	NA
S154	01	Vinyl chloride	110	ug/L	NA	3599.2
S012	01	Xylene (Total)	29000	ug/L	1.854	NA
S012	01	bis(2-Ethylhexyl)phthalate	18000	ug/L	57.534	3747.9
		Total			220	15790
Point Estimates of Risk and Hazard						
I007	01	Aluminum (Al)	2050	ug/L	0.1311	NA
I007	01	Arsenic (As)	4.4	ug/L	0.9376	98.1605
I007	01	Lead (Pb)	6.4	ug/L	NA	NA
I007	01	Manganese (Mn)	56.5	ug/L	0.1570	NA
		Total			1.2257	98.1605
I009	01	Aluminum (Al)	7180	ug/L	0.4590	NA
I009	01	Arsenic (As)	19.7	ug/L	4.1979	439.4912
I009	01	Chlorobenzene	6	ug/L	0.0864	NA
I009	01	Ethylbenzene	1	ug/L	0.0009	NA
I009	01	Lead (Pb)	11.1	ug/L	NA	NA
I009	01	Manganese (Mn)	40.5	ug/L	0.1126	NA
I009	01	Xylene (Total)	4	ug/L	0.0003	NA
		Total			4.8569	439.4912
I019	01	Iron (Fe)	356	ug/L	0.0759	NA
I019	01	Lead (Pb)	2.2	ug/L	NA	NA
I019	01	Manganese (Mn)	54.8	ug/L	0.1523	NA
I019	01	Trichloroethene	22	ug/L	0.4688	5.5624
		Total			0.6970	5.5624
I032	01	1,1,1-Trichloroethane	2	ug/L	0.0019	NA
I032	01	Cadmium (Cd)	7.5	ug/L	0.9615	NA
		Total			0.9634	NA
I032	02	1,1,1-Trichloroethane	16	ug/L	0.0149	NA
I032	02	1,1-Dichloroethane	9	ug/L	0.0098	NA
I032	02	1,1-Dichloroethene	0.8	ug/L	0.0114	9.2211
I032	02	Chloroform	0.3	ug/L	0.0038	0.3864
I032	02	cis-1,2-Dichloroethene	1	ug/L	0.0128	NA
		Total			0.0527	9.6075

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
I058	01	Aluminum (Al)	6680	ug/L	0.4270	NA
I058	01	Arsenic (As)	7.9	ug/L	1.6834	176.2427
I058	01	Barium (Ba)	37.4	ug/L	0.0342	NA
I058	01	Beryllium (Be)	1	ug/L	0.0128	63.9530
I058	01	Lead (Pb)	15	ug/L	NA	NA
I058	01	Manganese (Mn)	42	ug/L	0.1167	NA
I058	01	Silver (Ag)	43.4	ug/L	0.5549	NA
I058	01	Vanadium (V)	43.4	ug/L	0.3963	NA
		Total			3.2254	240.1957
I060	01	Aluminum (Al)	12300	ug/L	0.7863	NA
I060	01	Arsenic (As)	11	ug/L	2.3440	245.4012
I060	01	Barium (Ba)	37.3	ug/L	0.0341	NA
I060	01	Beryllium (Be)	1.2	ug/L	0.0153	76.7436
I060	01	Bromodichloromethane	1	ug/L	0.0064	1.8442
I060	01	Chloroform	1	ug/L	0.0128	1.2880
I060	01	Dibromochloromethane	2	ug/L	0.0128	4.9973
I060	01	Lead (Pb)	13.3	ug/L	NA	NA
I060	01	Manganese (Mn)	50.8	ug/L	0.1412	NA
I060	01	Vanadium (V)	61	ug/L	0.5571	NA
		Total			3.9099	330.2743
I060	02	Aluminum (Al)	804	ug/L	0.0514	NA
I060	02	Manganese (Mn)	15.5	ug/L	0.0431	NA
		Total			0.0945	NA
I111	01	1,1-Dichloroethane	4	ug/L	0.0043	NA
I111	01	1,2-Dichlorobenzene	39	ug/L	0.0900	NA
I111	01	1,4-Dichlorobenzene	180	ug/L	0.1005	128.5010
I111	01	Aluminum (Al)	724	ug/L	0.0463	NA
I111	01	Arsenic (As)	11.4	ug/L	2.4292	254.3249
I111	01	Benzene	2	ug/L	0.1495	1.7252
I111	01	Chlorobenzene	620	ug/L	8.9230	NA
I111	01	Chloroethane	5	ug/L	0.0009	NA
I111	01	Ethylbenzene	1	ug/L	0.0009	NA
I111	01	Manganese (Mn)	76.8	ug/L	0.2135	NA
I111	01	Toluene	1	ug/L	0.0009	NA
I111	01	Vinyl chloride	20	ug/L	NA	654.4031
I111	01	Xylene (Total)	6	ug/L	0.0004	NA
		Total			11.9594	1038.9542
I111	02	1,1-Dichloroethane	5	ug/L	0.0054	NA
I111	02	1,2-Dichlorobenzene	42	ug/L	0.0970	NA
I111	02	1,4-Dichlorobenzene	140	ug/L	0.0782	99.9452
I111	02	Benzene	7	ug/L	0.5234	6.0384
I111	02	Naphthalene	3.5	ug/L	0.0056	NA
I111	02	Tetrachloroethene	0.4	ug/L	0.0051	0.3214
I111	02	Toluene	1	ug/L	0.0009	NA
I111	02	Vinyl chloride	15	ug/L	NA	490.8024
		Total			0.7155	597.1073
I113	01	Arsenic (As)	8.2	ug/L	1.7473	182.9354
I113	01	Manganese (Mn)	64.1	ug/L	0.1782	NA
I113	01	bis(2-Ethylhexyl)phthalate	2	ug/L	0.0064	0.4164
		Total			1.9319	183.3519
I126	01	Aluminum (Al)	5270	ug/L	0.3369	NA
I126	01	Chlorobenzene	1	ug/L	0.0144	NA
I126	01	Manganese (Mn)	23	ug/L	0.0639	NA
I126	01	Methylene chloride	2	ug/L	0.0023	0.2719
I126	01	Toluene	1	ug/L	0.0009	NA
I126	01	Xylene (Total)	3	ug/L	0.0002	NA
		Total			0.4186	0.2719
I126	02	Arsenic (As)	2.2	ug/L	0.4688	49.0802
		Total			0.4688	49.0802
I164	01	1,1,1-Trichloroethane	950	ug/L	0.8871	NA
I164	01	1,1-Dichloroethane	320	ug/L	0.3476	NA
I164	01	1,1-Dichloroethene	410	ug/L	5.8245	4725.8317
I164	01	Aluminum (Al)	1640	ug/L	0.1048	NA
I164	01	Arsenic (As)	3.8	ug/L	0.8097	84.7750
I164	01	Lead (Pb)	27.3	ug/L	NA	NA
I164	01	Manganese (Mn)	264	ug/L	0.7338	NA
I164	01	Methylene chloride	11	ug/L	0.0125	1.4953

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
I164	01	Naphthalene	2	ug/L	0.0032	NA
		Total			8.7233	4812.1020
I170	01	1,1,1-Trichloroethane	2	ug/L	0.0019	NA
I170	01	1,1-Dichloroethane	1	ug/L	0.0011	NA
I170	01	1,2-Dichloroethene (total)	3	ug/L	0.0426	NA
I170	01	Aluminum (Al)	6200	ug/L	0.3963	NA
I170	01	Arsenic (As)	5.7	ug/L	1.2146	127.1624
I170	01	Lead (Pb)	5	ug/L	NA	NA
I170	01	Manganese (Mn)	28.6	ug/L	0.0795	NA
I170	01	Tetrachloroethene	3	ug/L	0.0384	2.4107
I170	01	Trichloroethene	34	ug/L	0.7245	8.5965
		Total			2.4989	138.1696
I32A	01	1,1,1-Trichloroethane	300	ug/L	0.2801	NA
I32A	01	1,1-Dichloroethane	60	ug/L	0.0652	NA
I32A	01	1,1-Dichloroethene	14	ug/L	0.1989	161.3699
I32A	01	2-Butanone (MEK)	70	ug/L	0.0231	NA
I32A	01	Lead (Pb)	4.3	ug/L	NA	NA
I32A	01	Manganese (Mn)	75.2	ug/L	0.2090	NA
		Total			0.7763	161.3699
S003	01	1,1,1-Trichloroethane	14	ug/L	0.0131	NA
S003	01	1,1-Dichloroethane	2	ug/L	0.0022	NA
S003	01	1,1-Dichloroethene	1	ug/L	0.0142	11.5264
S003	01	Tetrachloroethene	7	ug/L	0.0895	5.6250
		Total			0.1189	17.1515
S005	01	Aluminum (Al)	18500	ug/L	1.1826	NA
S005	01	Arsenic (As)	2.5	ug/L	0.5327	55.7730
S005	01	Chromium (Cr)	59.4	ug/L	0.7595	NA
S005	01	Lead (Pb)	10.6	ug/L	NA	NA
		Total			2.4748	55.7730
S006	01	1,1,1-Trichloroethane	13	ug/L	0.0121	NA
S006	01	1,1-Dichloroethane	15	ug/L	0.0163	NA
S006	01	1,2-Dichlorobenzene	3	ug/L	0.0069	NA
S006	01	1,2-Dichloroethene (total)	18	ug/L	0.2557	NA
S006	01	2-Butanone (MEK)	80	ug/L	0.0264	NA
S006	01	4-Methylphenol (p-Cresol)	4	ug/L	0.0511	NA
S006	01	Aluminum (Al)	977	ug/L	0.0625	NA
S006	01	Benzene	250	ug/L	18.6921	215.6556
S006	01	Carbazole	14	ug/L	NA	4.1644
S006	01	Ethylbenzene	380	ug/L	0.3279	NA
S006	01	Lead (Pb)	34.8	ug/L	NA	NA
S006	01	Manganese (Mn)	41.5	ug/L	0.1153	NA
S006	01	Methylene chloride	12	ug/L	0.0137	1.6312
S006	01	Naphthalene	76	ug/L	0.1215	NA
S006	01	Toluene	140	ug/L	0.1233	NA
S006	01	Xylene (Total)	1200	ug/L	0.0767	NA
		Total			19.9015	221.4512
S006	02	1,1,1-Trichloroethane	1	ug/L	0.0009	NA
S006	02	Benzene	2	ug/L	0.1495	1.7252
S006	02	Ethylbenzene	9	ug/L	0.0078	NA
S006	02	Lead (Pb)	3.4	ug/L	NA	NA
S006	02	Naphthalene	0.91	ug/L	0.0015	NA
S006	02	Tetrachloroethene	2	ug/L	0.0256	1.6072
S006	02	Toluene	0.6	ug/L	0.0005	NA
S006	02	Trichloroethene	0.2	ug/L	0.0043	0.0506
S006	02	Xylene (Total)	9	ug/L	0.0006	NA
S006	02	cis-1,2-Dichloroethene	2	ug/L	0.0256	NA
		Total			0.2162	3.3830
S011	01	1,1-Dichloroethane	1	ug/L	0.0011	NA
S011	01	Ethylbenzene	1	ug/L	0.0009	NA
S011	01	Lead (Pb)	3	ug/L	NA	NA
S011	01	Manganese (Mn)	140	ug/L	0.3891	NA
S011	01	Naphthalene	2	ug/L	0.0032	NA
S011	01	Xylene (Total)	3	ug/L	0.0002	NA
		Total			0.3945	NA
S012	01	Naphthalene	29000	ug/L	46.3470	NA
S012	01	Xylene (Total)	29000	ug/L	1.8539	NA
S012	01	bis(2-Ethylhexyl)phthalate	18000	ug/L	57.5342	3747.9452
		Total			105.7352	3747.9452

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S012	02	Naphthalene	1.3	ug/L	0.0021	NA
S012	02	Pentachlorophenol	1.4	ug/L	0.0030	2.4986
S012	02	bis(2-Ethylhexyl)phthalate	1.5	ug/L	0.0048	0.3123
		Total			0.0099	2.8110
S015	01	1,1,1-Trichloroethane	4	ug/L	0.0037	NA
S015	01	Lead (Pb)	4.5	ug/L	NA	NA
		Total			0.0037	NA
S016	01	Aluminum (Al)	1890	ug/L	0.1208	NA
S016	01	Chromium (Cr)	21.6	ug/L	0.2762	NA
S016	01	Lead (Pb)	3.1	ug/L	NA	NA
S016	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
		Total			0.4098	0.8036
S018	01	Aluminum (Al)	2730	ug/L	0.1745	NA
S018	01	Arsenic (As)	4.6	ug/L	0.9802	102.6223
S018	01	Chromium (Cr)	20.9	ug/L	0.2672	NA
S018	01	Lead (Pb)	2.6	ug/L	NA	NA
S018	01	Manganese (Mn)	60.9	ug/L	0.1693	NA
		Total			1.5912	102.6223
S020	01	Aluminum (Al)	4580	ug/L	0.2928	NA
S020	01	Chloroform	3	ug/L	0.0384	3.8640
S020	01	Chromium (Cr)	30.2	ug/L	0.3861	NA
S020	01	Lead (Pb)	3.6	ug/L	NA	NA
		Total			0.7173	3.8640
S022	01	1,1,1-Trichloroethane	1400	ug/L	1.3073	NA
S022	01	1,1-Dichloroethane	900	ug/L	0.9777	NA
S022	01	1,1-Dichloroethene	170	ug/L	2.4150	1959.4912
S022	01	Aluminum (Al)	68.4	ug/L	0.0044	NA
S022	01	Lead (Pb)	52.5	ug/L	NA	NA
S022	01	Naphthalene	23	ug/L	0.0368	NA
S022	01	Tetrachloroethene	10	ug/L	0.1279	8.0358
		Total			4.8690	1967.5270
S022	02	1,1,1-Trichloroethane	2100	ug/L	1.9610	NA
S022	02	1,1-Dichloroethane	1400	ug/L	1.5208	NA
S022	02	1,1-Dichloroethene	68	ug/L	0.9660	783.7965
S022	02	Chloroethane	110	ug/L	0.0200	NA
S022	02	Chloroform	5	ug/L	0.0639	6.4399
S022	02	Lead (Pb)	56.2	ug/L	NA	NA
S022	02	Naphthalene	14	ug/L	0.0224	NA
S022	02	Tetrachloroethene	13	ug/L	0.1662	10.4465
S022	02	Trichloroethene	3	ug/L	0.0639	0.7585
S022	02	Xylene (Total)	8	ug/L	0.0005	NA
S022	02	bis(2-Ethylhexyl)phthalate	11	ug/L	0.0352	2.2904
S022	02	cis-1,2-Dichloroethene	7	ug/L	0.0895	NA
		Total			4.9095	803.7318
S024	01	1,1,1-Trichloroethane	28	ug/L	0.0261	NA
S024	01	1,1-Dichloroethane	49	ug/L	0.0532	NA
S024	01	1,1-Dichloroethene	2	ug/L	0.0284	23.0528
S024	01	Aluminum (Al)	612	ug/L	0.0391	NA
S024	01	Chloroform	2	ug/L	0.0256	2.5760
S024	01	Lead (Pb)	15	ug/L	NA	NA
S024	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
S024	01	Xylene (Total)	3	ug/L	0.0002	NA
		Total			0.1855	26.4324
S026	01	1,1,1-Trichloroethane	110	ug/L	0.1027	NA
S026	01	1,1-Dichloroethane	160	ug/L	0.1738	NA
S026	01	1,1-Dichloroethene	17	ug/L	0.2415	195.9491
S026	01	1,2-Dichlorobenzene	4	ug/L	0.0092	NA
S026	01	1,2-Dichloroethene (total)	1	ug/L	0.0142	NA
S026	01	Chloroethane	2	ug/L	0.0004	NA
S026	01	Chromium (Cr)	9.8	ug/L	0.1253	NA
S026	01	Lead (Pb)	8.4	ug/L	0.0000	NA
S026	01	Naphthalene	2	ug/L	0.0032	NA
S026	01	Tetrachloroethene	7	ug/L	0.0895	5.6250
S026	01	Xylene (Total)	2	ug/L	0.0001	NA
		Total			0.7600	201.5742
S026	02	1,1,1-Trichloroethane	740	ug/L	0.6910	NA

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S026	02	1,1-Dichloroethane	2600	ug/L	2.8244	NA
S026	02	1,1-Dichloroethene	140	ug/L	1.9888	1613.6986
S026	02	Chloroethane	180	ug/L	0.0328	NA
S026	02	Chloroform	3	ug/L	0.0384	3.8640
S026	02	Tetrachloroethene	12	ug/L	0.1534	9.6429
S026	02	Trichloroethene	3	ug/L	0.0639	0.7585
S026	02	Vinyl chloride	1	ug/L	NA	32.7202
S026	02	Xylene (Total)	3	ug/L	0.0002	NA
S026	02	cis-1,2-Dichloroethene	22	ug/L	0.2813	NA
		Total			6.0742	1660.6842
S027	01	1,1,1-Trichloroethane	1300	ug/L	1.2140	NA
S027	01	1,1-Dichloroethane	45	ug/L	0.0489	NA
S027	01	1,1-Dichloroethene	510	ug/L	7.2451	5878.4736
S027	01	1,2-Dichlorobenzene	8	ug/L	0.0185	NA
S027	01	1,2-Dichloroethene (total)	15	ug/L	0.2131	NA
S027	01	1,4-Dichlorobenzene	2	ug/L	0.0011	1.4278
S027	01	Aluminum (Al)	235	ug/L	0.0150	NA
S027	01	Arsenic (As)	2	ug/L	0.4262	44.6184
S027	01	Cadmium (Cd)	3.4	ug/L	0.4359	NA
S027	01	Chromium (Cr)	1380	ug/L	17.6438	NA
S027	01	Lead (Pb)	5	ug/L	NA	NA
S027	01	Tetrachloroethene	11	ug/L	0.1406	8.8394
		Total			27.4022	5933.3591
S027	02	1,1,1-Trichloroethane	1700	ug/L	1.5875	NA
S027	02	1,1-Dichloroethane	4300	ug/L	4.6711	NA
S027	02	1,1-Dichloroethene	240	ug/L	3.4094	2766.3405
S027	02	1,2-Dichloroethane	200	ug/L	8.9408	541.3699
S027	02	1,4-Dichlorobenzene	17	ug/L	0.0095	12.1362
S027	02	Aluminum (Al)	327	ug/L	0.0209	NA
S027	02	Chloroethane	520	ug/L	0.0947	NA
S027	02	Chromium (Cr)	69.9	ug/L	0.8937	NA
S027	02	Manganese (Mn)	23.2	ug/L	0.0645	NA
S027	02	Methylene chloride	3	ug/L	0.0034	0.4078
S027	02	Tetrachloroethene	12	ug/L	0.1534	9.6429
S027	02	Trichloroethene	3	ug/L	0.0639	0.7585
S027	02	Vanadium (V)	1.2	ug/L	0.0110	NA
S027	02	Vinyl chloride	0.5	ug/L	NA	16.3601
S027	02	Xylene (Total)	0.8	ug/L	0.0001	NA
		Total			19.9240	3347.0159
S028	01	1,1,1-Trichloroethane	1300	ug/L	1.2140	NA
S028	01	1,1-Dichloroethane	380	ug/L	0.4128	NA
S028	01	1,1-Dichloroethene	220	ug/L	3.1253	2535.8121
S028	01	1,2-Dichlorobenzene	79	ug/L	0.1824	NA
S028	01	1,2-Dichloroethane	6	ug/L	0.2682	16.2411
S028	01	1,2-Dichloroethene (total)	210	ug/L	2.9833	NA
S028	01	1,4-Dichlorobenzene	26	ug/L	0.0145	18.5613
S028	01	Cadmium (Cd)	7.8	ug/L	1.0000	NA
S028	01	Chromium (Cr)	715	ug/L	9.1416	NA
S028	01	Manganese (Mn)	53	ug/L	0.1473	NA
S028	01	Tetrachloroethene	310	ug/L	3.9635	249.1090
S028	01	Trichloroethene	36	ug/L	0.7671	9.1022
		Total			23.2199	2828.8256
S028	02	1,1,1-Trichloroethane	2000	ug/L	1.8676	NA
S028	02	1,1-Dichloroethane	2400	ug/L	2.6071	NA
S028	02	1,1-Dichloroethene	130	ug/L	1.8468	1498.4344
S028	02	1,2-Dichlorobenzene	130	ug/L	0.3001	NA
S028	02	1,2-Dichloroethane	220	ug/L	9.8349	595.5069
S028	02	1,4-Dichlorobenzene	16	ug/L	0.0089	11.4223
S028	02	Aluminum (Al)	784	ug/L	0.0501	NA
S028	02	Cadmium (Cd)	108	ug/L	13.8462	NA
S028	02	Chloroethane	580	ug/L	0.1057	NA
S028	02	Chromium (Cr)	418	ug/L	5.3443	NA
S028	02	Manganese (Mn)	19.6	ug/L	0.0545	NA
S028	02	Tetrachloroethene	10	ug/L	0.1279	8.0358
S028	02	Toluene	0.2	ug/L	0.0002	NA
S028	02	Trichloroethene	5	ug/L	0.1065	1.2642
S028	02	Vanadium (V)	8.7	ug/L	0.0795	NA
S028	02	Vinyl chloride	0.2	ug/L	NA	6.5440
S028	02	cis-1,2-Dichloroethene	120	ug/L	1.5342	NA
		Total			37.7145	2121.2076
S029	01	1,1,1-Trichloroethane	26	ug/L	0.0243	NA

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S029	01	1,1-Dichloroethane	11	ug/L	0.0119	NA
S029	01	1,1-Dichloroethene	2	ug/L	0.0284	23.0528
S029	01	Benzene	3	ug/L	0.2243	2.5879
S029	01	Lead (Pb)	3.6	ug/L	NA	NA
S029	01	Manganese (Mn)	57.8	ug/L	0.1607	NA
S029	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
S029	01	Trichloroethene	1	ug/L	0.0213	0.2528
		Total			0.4837	26.6971
S033	01	1,1,1-Trichloroethane	130	ug/L	0.1214	NA
S033	01	1,1-Dichloroethane	110	ug/L	0.1195	NA
S033	01	1,1-Dichloroethene	12	ug/L	0.1705	138.3170
S033	01	Benzene	1	ug/L	0.0748	0.8626
S033	01	Ethylbenzene	3	ug/L	0.0026	NA
S033	01	Manganese (Mn)	128	ug/L	0.3558	NA
S033	01	Naphthalene	4	ug/L	0.0064	NA
S033	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
S033	01	Trichloroethene	2	ug/L	0.0426	0.5057
S033	01	Xylene (Total)	1	ug/L	0.0001	NA
		Total			0.9191	141.2925
S033	02	1,1,1-Trichloroethane	14	ug/L	0.0131	NA
S033	02	1,1-Dichloroethane	2	ug/L	0.0022	NA
S033	02	1,1-Dichloroethene	0.3	ug/L	0.0043	3.4579
S033	02	1,2-Dichloroethane	2	ug/L	0.0894	5.4137
S033	02	Chloroform	0.5	ug/L	0.0064	0.6440
S033	02	Tetrachloroethene	1	ug/L	0.0128	0.8036
S033	02	Trichloroethene	1	ug/L	0.0213	0.2528
		Total			0.1494	10.5720
S037	01	1,1,1-Trichloroethane	46	ug/L	0.0430	NA
S037	01	1,1-Dichloroethane	200	ug/L	0.2173	NA
S037	01	1,1-Dichloroethene	11	ug/L	0.1563	126.7906
S037	01	2-Butanone (MEK)	34	ug/L	0.0112	NA
S037	01	4-Methylphenol (p-Cresol)	4	ug/L	0.0511	NA
S037	01	Aluminum (Al)	640	ug/L	0.0409	NA
S037	01	Chloroethane	140	ug/L	0.0255	NA
S037	01	Ethylbenzene	5	ug/L	0.0043	NA
S037	01	Lead (Pb)	2	ug/L	NA	NA
S037	01	Naphthalene	9	ug/L	0.0144	NA
S037	01	Toluene	5	ug/L	0.0044	NA
S037	01	Xylene (Total)	76	ug/L	0.0049	NA
		Total			0.5732	126.7906
S039	01	1,1,1-Trichloroethane	10	ug/L	0.0093	NA
S039	01	2-Butanone (MEK)	4	ug/L	0.0013	NA
S039	01	Aluminum (Al)	1000	ug/L	0.0858	NA
S039	01	Chromium (Cr)	6.7	ug/L	0.0857	NA
S039	01	Lead (Pb)	2.4	ug/L	NA	NA
		Total			0.1622	NA
S043	01	1,1,1-Trichloroethane	4	ug/L	0.0037	NA
S043	01	Aluminum (Al)	1780	ug/L	0.1138	NA
S043	01	Lead (Pb)	2.3	ug/L	NA	NA
		Total			0.1175	NA
S044	01	1,1,1-Trichloroethane	5	ug/L	0.0047	NA
S044	01	Aluminum (Al)	1180	ug/L	0.0754	NA
S044	01	Chromium (Cr)	4.8	ug/L	0.0614	NA
S044	01	Lead (Pb)	2.2	ug/L	NA	NA
		Total			0.1415	NA
S046	01	1,1,1-Trichloroethane	220	ug/L	0.2054	NA
S046	01	1,1-Dichloroethane	18	ug/L	0.0196	NA
S046	01	1,2-Dichloroethene (total)	220	ug/L	3.1253	NA
S046	01	1,4-Dichlorobenzene	2	ug/L	0.0011	1.4278
S046	01	4-Methylphenol (p-Cresol)	21	ug/L	0.2685	NA
S046	01	Lead (Pb)	4	ug/L	NA	NA
S046	01	Naphthalene	7	ug/L	0.0112	NA
S046	01	Tetrachloroethene	200	ug/L	2.5571	160.7155
S046	01	Trichloroethene	4	ug/L	0.0852	1.0114
S046	01	Xylene (Total)	6	ug/L	0.0004	NA
		Total			6.2738	163.1546
S046	02	1,1,1-Trichloroethane	49	ug/L	0.0458	NA
S046	02	1,1-Dichloroethane	8	ug/L	0.0087	NA

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S046	02	1,2-Dichlorobenzene	1.6	ug/L	0.0037	NA
S046	02	1,4-Dichlorobenzene	6.3	ug/L	0.0035	4.4975
S046	02	Naphthalene	5.6	ug/L	0.0089	NA
S046	02	Tetrachloroethene	1100	ug/L	14.0639	883.9350
S046	02	Trichloroethene	58	ug/L	1.2359	14.6646
S046	02	bis(2-Ethylhexyl)phthalate	9	ug/L	0.0288	1.8740
S046	02	cis-1,2-Dichloroethene	190	ug/L	2.4292	NA
		Total			17.8284	904.9711
S049	01	1,1,1-Trichloroethane	30	ug/L	0.0280	NA
S049	01	1,1-Dichloroethane	8	ug/L	0.0087	NA
S049	01	1,2-Dichloroethene (total)	8	ug/L	0.1136	NA
S049	01	Chromium (Cr)	5.4	ug/L	0.0690	NA
S049	01	Lead (Pb)	2.8	ug/L	NA	NA
S049	01	Naphthalene	2	ug/L	0.0032	NA
S049	01	Trichloroethene	2	ug/L	0.0426	0.5057
S049	01	Xylene (Total)	5	ug/L	0.0003	NA
		Total			0.2655	0.5057
S050	01	1,1,1-Trichloroethane	6	ug/L	0.0056	NA
S050	01	Trichloroethene	4	ug/L	0.0852	1.0114
		Total			0.0908	1.0114
S051	01	1,1,1-Trichloroethane	4	ug/L	0.0037	NA
S051	01	1,1-Dichloroethane	5	ug/L	0.0054	NA
S051	01	4-Methylphenol (p-Cresol)	15	ug/L	0.1918	NA
S051	01	Lead (Pb)	2	ug/L	NA	NA
S051	01	Naphthalene	5	ug/L	0.0080	NA
S051	01	Trichloroethene	2	ug/L	0.0426	0.5057
		Total			0.2516	0.5057
S051	02	Naphthalene	15	ug/L	0.0240	NA
S051	02	bis(2-Ethylhexyl)phthalate	13	ug/L	0.0416	2.7068
		Total			0.0655	2.7068
S052	01	1,1,1-Trichloroethane	2	ug/L	0.0019	NA
S052	01	Aluminum (Al)	5260	ug/L	0.3363	NA
S052	01	Chromium (Cr)	8.3	ug/L	0.1061	NA
S052	01	Lead (Pb)	4.4	ug/L	NA	NA
S052	01	Trichloroethene	2	ug/L	0.0426	0.5057
		Total			0.4869	0.5057
S056	01	1,1,1-Trichloroethane	12	ug/L	0.0112	NA
S056	01	1,1-Dichloroethane	4	ug/L	0.0043	NA
S056	01	1,1-Dichloroethene	3	ug/L	0.0426	34.5793
S056	01	Aluminum (Al)	266	ug/L	0.0170	NA
S056	01	Chromium (Cr)	12.1	ug/L	0.1547	NA
S056	01	Lead (Pb)	2	ug/L	NA	NA
		Total			0.2299	34.5793
S057	01	Aluminum (Al)	20000	ug/L	1.2785	NA
S057	01	Arsenic (As)	4.8	ug/L	1.0228	107.0841
S057	01	Barium (Ba)	27.9	ug/L	0.0255	NA
S057	01	Lead (Pb)	96	ug/L	NA	NA
S057	01	Manganese (Mn)	107	ug/L	0.2974	NA
S057	01	Vanadium (V)	20	ug/L	0.1826	NA
		Total			2.8069	107.0841
S059	01	Aluminum (Al)	2710	ug/L	0.1732	NA
S059	01	Barium (Ba)	15.8	ug/L	0.0144	NA
S059	01	Lead (Pb)	7.5	ug/L	NA	NA
S059	01	Manganese (Mn)	24.8	ug/L	0.0689	NA
S059	01	Vanadium (V)	6.4	ug/L	0.0584	NA
		Total			0.3150	NA
S059	02	1,1,1-Trichloroethane	0.2	ug/L	0.0002	NA
		Total			0.0002	NA
S062	01	Aluminum (Al)	23500	ug/L	1.5023	NA
S062	01	Arsenic (As)	8	ug/L	1.7047	178.4736
S062	01	Barium (Ba)	55.7	ug/L	0.0509	NA
S062	01	Chloroform	80	ug/L	1.0228	103.0387
S062	01	Chromium (Cr)	33.6	ug/L	0.4296	NA
S062	01	Lead (Pb)	17	ug/L	NA	NA
S062	01	Manganese (Mn)	88.4	ug/L	0.2457	NA
S062	01	Vanadium (V)	29.8	ug/L	0.2721	NA

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
		Total			5.2281	281.5123
S062	02	Barium (Ba)	33.7	ug/L	0.0308	NA
		Total			0.0308	NA
S101	01	Benzene	1	ug/L	0.0748	0.8626
S101	01	Ethylbenzene	5	ug/L	0.0043	NA
S101	01	Lead (Pb)	2.2	ug/L	NA	NA
S101	01	Manganese (Mn)	43.9	ug/L	0.1220	NA
S101	01	Toluene	2	ug/L	0.0018	NA
S101	01	Xylene (Total)	21	ug/L	0.0013	NA
		Total			0.2042	0.8626
S103	01	Arsenic (As)	3	ug/L	0.6393	66.9276
S103	01	Barium (Ba)	458	ug/L	0.4183	NA
S103	01	Chlorobenzene	10	ug/L	0.1439	NA
S103	01	Lead (Pb)	10.2	ug/L	NA	NA
S103	01	Manganese (Mn)	457	ug/L	1.2702	NA
		Total			2.4717	66.9276
S103	02	Arsenic (As)	1.5	ug/L	0.3196	33.4638
S103	02	Barium (Ba)	328	ug/L	0.2995	NA
S103	02	Cadmium (Cd)	5.1	ug/L	0.6538	NA
S103	02	Lead (Pb)	37.1	ug/L	NA	NA
S103	02	Manganese (Mn)	204	ug/L	0.5670	NA
S103	02	Vanadium (V)	0.79	ug/L	0.0072	NA
		Total			1.8472	33.4638
S105	01	2-Butanone (MEK)	890	ug/L	0.2938	NA
S105	01	Toluene	14	ug/L	0.0123	NA
S105	01	Xylene (Total)	10	ug/L	0.0006	NA
		Total			0.3067	NA
S108	01	Ethylbenzene	2	ug/L	0.0017	NA
S108	01	Lead (Pb)	4.6	ug/L	NA	NA
S108	01	Xylene (Total)	10	ug/L	0.0006	NA
		Total			0.0024	NA
S111	01	1,2-Dichlorobenzene	3	ug/L	0.0069	NA
S111	01	1,4-Dichlorobenzene	41	ug/L	0.0229	29.2697
S111	01	Aluminum (Al)	760	ug/L	0.0486	NA
S111	01	Chlorobenzene	720	ug/L	10.3622	NA
S111	01	Lead (Pb)	4.7	ug/L	NA	NA
S111	01	Manganese (Mn)	31	ug/L	0.0862	NA
		Total			10.5268	29.2697
S111	02	1,4-Dichlorobenzene	2.3	ug/L	0.0013	1.6420
S111	02	Aluminum (Al)	339	ug/L	0.0217	NA
S111	02	Cadmium (Cd)	0.59	ug/L	0.0756	NA
S111	02	Chlorobenzene	19	ug/L	0.2734	NA
S111	02	Lead (Pb)	1.8	ug/L	NA	NA
S111	02	Manganese (Mn)	15.9	ug/L	0.0442	NA
S111	02	Tetrachloroethene	0.7	ug/L	0.0089	0.5625
		Total			0.4252	2.2045
S113	01	1,4-Dichlorobenzene	0.9	ug/L	0.0005	0.6425
S113	01	Aluminum (Al)	402	ug/L	0.0257	NA
S113	01	Chlorobenzene	3	ug/L	0.0432	NA
S113	01	Ethylbenzene	1	ug/L	0.0009	NA
S113	01	Lead (Pb)	9.4	ug/L	NA	NA
S113	01	Xylene (Total)	6	ug/L	0.0004	NA
		Total			0.0706	0.6425
S118	01	Aluminum (Al)	905	ug/L	0.0579	NA
S118	01	Chlorobenzene	2	ug/L	0.0288	NA
S118	01	Ethylbenzene	1	ug/L	0.0009	NA
S118	01	Manganese (Mn)	422	ug/L	1.1729	NA
S118	01	Xylene (Total)	4	ug/L	0.0003	NA
		Total			1.2607	NA
S123	01	Aluminum (Al)	681	ug/L	0.0435	NA
S123	01	Chlorobenzene	25	ug/L	0.3598	NA
S123	01	Lead (Pb)	3.2	ug/L	NA	NA
S123	01	Manganese (Mn)	24.3	ug/L	0.0675	NA
S123	01	Toxaphene	4.8	ug/L	NA	78.5284
		Total			0.4709	78.5284

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S126	01	Aluminum (Al)	627	ug/L	0.0401	NA
S126	01	Chlorobenzene	3	ug/L	0.0432	NA
S126	01	Ethylbenzene	1	ug/L	0.0009	NA
S126	01	Lead (Pb)	4.2	ug/L	NA	NA
S126	01	Manganese (Mn)	24.4	ug/L	0.0678	NA
S126	01	Xylene (Total)	5	ug/L	0.0003	NA
		Total			0.1523	NA
S126	02	Aluminum (Al)	579	ug/L	0.0370	NA
S126	02	Cadmium (Cd)	21.8	ug/L	2.7949	NA
S126	02	Lead (Pb)	236	ug/L	NA	NA
S126	02	Manganese (Mn)	35.1	ug/L	0.0976	NA
		Total			2.9294	NA
S146	01	1,1,1-Trichloroethane	2	ug/L	0.0019	NA
S146	01	4-Methylphenol (p-Cresol)	1	ug/L	0.0128	NA
S146	01	Chloroform	2	ug/L	0.0256	2.5760
S146	01	Trichloroethene	1	ug/L	0.0213	0.2528
S146	01	Xylene (Total)	1	ug/L	0.0001	NA
S146	01	bis(2-Ethylhexyl)phthalate	1	ug/L	0.0032	0.2082
		Total			0.0648	3.0370
S154	01	1,1,1-Trichloroethane	3	ug/L	0.0028	NA
S154	01	1,1-Dichloroethane	9	ug/L	0.0098	NA
S154	01	Chloroethane	9	ug/L	0.0016	NA
S154	01	Ethylbenzene	10	ug/L	0.0086	NA
S154	01	Manganese (Mn)	60.2	ug/L	0.1673	NA
S154	01	Naphthalene	19	ug/L	0.0304	NA
S154	01	Toluene	6	ug/L	0.0053	NA
S154	01	Vinyl chloride	110	ug/L	NA	3599.2172
S154	01	Xylene (Total)	24	ug/L	0.0015	NA
S154	01	bis(2-Ethylhexyl)phthalate	1	ug/L	0.0032	0.2082
		Total			0.2305	3599.4255
S156	01	1,1,1-Trichloroethane	2	ug/L	0.0019	NA
S156	01	1,1-Dichloroethane	7	ug/L	0.0076	NA
S156	01	Aluminum (Al)	252	ug/L	0.0161	NA
S156	01	Arsenic (As)	2.7	ug/L	0.5753	60.2348
S156	01	Barium (Ba)	581	ug/L	0.5306	NA
S156	01	Chromium (Cr)	4.6	ug/L	0.0588	NA
S156	01	Heptachlor epoxide	0.029	ug/L	0.2852	7.8499
S156	01	Manganese (Mn)	168	ug/L	0.4669	NA
S156	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
S156	01	Trichloroethene	1	ug/L	0.0213	0.2528
S156	01	bis(2-Ethylhexyl)phthalate	2	ug/L	0.0064	0.4164
		Total			1.9830	69.5576
S157	01	1,1-Dichloroethane	19	ug/L	0.0206	NA
S157	01	Aluminum (Al)	2430	ug/L	0.1553	NA
S157	01	Arsenic (As)	3.6	ug/L	0.7671	80.3131
S157	01	Cadmium (Cd)	8.6	ug/L	1.1026	NA
S157	01	Chromium (Cr)	20.1	ug/L	0.2570	NA
S157	01	Lead (Pb)	2.2	ug/L	NA	NA
S157	01	Manganese (Mn)	373	ug/L	1.0367	NA
S157	01	Trichloroethene	2	ug/L	0.0426	0.5057
		Total			3.3820	80.8188
S160	01	Aluminum (Al)	513	ug/L	0.0328	NA
S160	01	bis(2-Ethylhexyl)phthalate	1	ug/L	0.0032	0.2082
		Total			0.0360	0.2082
S161	01	Aluminum (Al)	1700	ug/L	0.1087	NA
S161	01	Lead (Pb)	2	ug/L	NA	NA
S161	01	Vanadium (V)	3.2	ug/L	0.0292	NA
		Total			0.1379	NA
S162	01	1,1,1-Trichloroethane	260	ug/L	0.2428	NA
S162	01	1,1-Dichloroethane	28	ug/L	0.0304	NA
S162	01	1,1-Dichloroethene	100	ug/L	1.4206	1152.6419
S162	01	Aluminum (Al)	6120	ug/L	0.3912	NA
S162	01	Arsenic (As)	3.3	ug/L	0.7032	73.6204
S162	01	Lead (Pb)	4.8	ug/L	NA	NA
S162	01	Manganese (Mn)	33.2	ug/L	0.0923	NA
S162	01	bis(2-Ethylhexyl)phthalate	2	ug/L	0.0064	0.4164
		Total			2.8869	1226.6787

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S162	02	1,1,1-Trichloroethane	3	ug/L	0.0028	NA
S162	02	1,1-Dichloroethane	8	ug/L	0.0087	NA
S162	02	1,1-Dichloroethene	0.7	ug/L	0.0099	8.0685
S162	02	Chloroform	2	ug/L	0.0256	2.5760
S162	02	Methylene chloride	1	ug/L	0.0011	0.1359
S162	02	Tetrachloroethene	0.3	ug/L	0.0038	0.2411
		Total			0.0520	11.0215
S164	01	1,1,1-Trichloroethane	290	ug/L	0.2708	NA
S164	01	1,1-Dichloroethane	26	ug/L	0.0282	NA
S164	01	1,1-Dichloroethene	99	ug/L	1.4064	1141.1155
S164	01	1,2-Dichloroethane	1	ug/L	0.0447	2.7068
S164	01	Lead (Pb)	2.2	ug/L	NA	NA
S164	01	Manganese (Mn)	20.9	ug/L	0.0581	NA
S164	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
		Total			1.8338	1145.4295
S165	01	1,1,1-Trichloroethane	35	ug/L	0.0327	NA
S165	01	1,1-Dichloroethane	76	ug/L	0.0826	NA
S165	01	1,1-Dichloroethene	11	ug/L	0.1563	126.7906
S165	01	Aluminum (Al)	859	ug/L	0.0549	NA
S165	01	Chloroform	2	ug/L	0.0256	2.5760
S165	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
		Total			0.3776	130.9737
S166	01	1,1,1-Trichloroethane	19	ug/L	0.0177	NA
S166	01	1,1-Dichloroethane	30	ug/L	0.0326	NA
S166	01	1,1-Dichloroethene	9	ug/L	0.1279	103.7378
S166	01	Aluminum (Al)	1170	ug/L	0.0748	NA
S166	01	Chloroform	2	ug/L	0.0256	2.5760
S166	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
		Total			0.2913	107.1173
S166	02	1,1,1-Trichloroethane	1	ug/L	0.0009	NA
S166	02	1,1-Dichloroethane	2	ug/L	0.0022	NA
S166	02	1,1-Dichloroethene	0.8	ug/L	0.0114	9.2211
S166	02	Chloroform	5	ug/L	0.0639	6.4399
S166	02	Tetrachloroethene	0.2	ug/L	0.0026	0.1607
		Total			0.0810	15.8218
S168	01	1,1,1-Trichloroethane	10	ug/L	0.0093	NA
S168	01	1,1-Dichloroethane	19	ug/L	0.0206	NA
S168	01	1,1-Dichloroethene	4	ug/L	0.0568	46.1057
S168	01	1,2-Dichloroethene (total)	7	ug/L	0.0994	NA
S168	01	Lead (Pb)	3	ug/L	NA	NA
S168	01	Tetrachloroethene	1	ug/L	0.0128	0.8036
S168	01	Xylene (Total)	3	ug/L	0.0002	NA
		Total			0.1992	46.9093
S170	01	1,1,1-Trichloroethane	33	ug/L	0.0308	NA
S170	01	1,1-Dichloroethane	9	ug/L	0.0098	NA
S170	01	1,1-Dichloroethene	7	ug/L	0.0994	80.6849
S170	01	Aluminum (Al)	948	ug/L	0.0606	NA
S170	01	Benzene	2	ug/L	0.1495	1.7252
S170	01	Chloroform	1	ug/L	0.0128	1.2880
S170	01	Lead (Pb)	5	ug/L	NA	NA
S170	01	Manganese (Mn)	21.4	ug/L	0.0595	NA
S170	01	Trichloroethene	2	ug/L	0.0426	0.5057
		Total			0.4651	84.2038
S171	01	1,1,1-Trichloroethane	28	ug/L	0.0261	NA
S171	01	1,1-Dichloroethane	10	ug/L	0.0109	NA
S171	01	1,1-Dichloroethene	6	ug/L	0.0852	69.1585
S171	01	1,2-Dichloroethene (total)	1	ug/L	0.0142	NA
S171	01	Benzene	2	ug/L	0.1495	1.7252
S171	01	Manganese (Mn)	56	ug/L	0.1556	NA
S171	01	Trichloroethene	2	ug/L	0.0426	0.5057
		Total			0.4843	71.3894
S171	02	1,1-Dichloroethene	0.6	ug/L	0.0085	6.9159
S171	02	Aluminum (Al)	158	ug/L	0.0101	NA
S171	02	Arsenic (As)	3.7	ug/L	0.7884	82.5440
S171	02	Barium (Ba)	20.5	ug/L	0.0187	NA
S171	02	Beryllium (Be)	0.6	ug/L	0.0077	38.3718
S171	02	Manganese (Mn)	95.4	ug/L	0.2652	NA

Table 10.3.6-26
Sample Point Estimates of Risk and Hazard, Residential Scenario
Site 30, Groundwater
Naval Air Station Pensacola
Pensacola, Florida

Sample Location	Phase	Parameter	Concentration	Units	Hazard Quotient	Risk (E-06)
S171	02	Tetrachloroethene	0.6	ug/L	0.0077	0.4821
		Total			1.1063	128.3138
S172	01	1,1,1-Trichloroethane	24	ug/L	0.0224	NA
S172	01	1,1-Dichloroethane	34	ug/L	0.0369	NA
S172	01	1,1-Dichloroethene	10	ug/L	0.1421	115.2642
S172	01	1,2-Dichloroethene (total)	6	ug/L	0.0852	NA
S172	01	Manganese (Mn)	50.1	ug/L	0.1392	NA
S172	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
		Total			0.4515	116.8713
S172	02	1,1,1-Trichloroethane	13	ug/L	0.0121	NA
S172	02	1,1-Dichloroethane	15	ug/L	0.0163	NA
S172	02	1,1-Dichloroethene	46	ug/L	0.6535	530.2153
S172	02	1,2-Dichlorobenzene	5	ug/L	0.0115	NA
S172	02	1,4-Dichlorobenzene	1	ug/L	0.0006	0.7139
S172	02	Aluminum (Al)	2070	ug/L	0.1323	NA
S172	02	Arsenic (As)	19	ug/L	4.0487	423.8748
S172	02	Barium (Ba)	13.3	ug/L	0.0121	NA
S172	02	Beryllium (Be)	0.36	ug/L	0.0046	23.0231
S172	02	Carbon tetrachloride	2	ug/L	0.4066	5.4286
S172	02	Chlorobenzene	3	ug/L	0.0432	NA
S172	02	Chloroform	0.8	ug/L	0.0102	1.0304
S172	02	Manganese (Mn)	16.8	ug/L	0.0467	NA
S172	02	Methylene chloride	0.8	ug/L	0.0009	0.1087
S172	02	Tetrachloroethene	3	ug/L	0.0384	2.4107
S172	02	Toluene	0.1	ug/L	0.0001	NA
S172	02	Trichloroethene	3	ug/L	0.0639	0.7585
S172	02	Vanadium (V)	18.1	ug/L	0.1653	NA
S172	02	cis-1,2-Dichloroethene	3	ug/L	0.0384	NA
		Total			5.7054	987.5640
S173	01	1,1,1-Trichloroethane	10	ug/L	0.0093	NA
S173	01	1,1-Dichloroethane	8	ug/L	0.0087	NA
S173	01	1,1-Dichloroethene	3	ug/L	0.0426	34.5793
S173	01	1,2-Dichloroethene (total)	14	ug/L	0.1989	NA
S173	01	Chromium (Cr)	65.3	ug/L	0.8349	NA
S173	01	Naphthalene	1	ug/L	0.0016	NA
S173	01	Tetrachloroethene	2	ug/L	0.0256	1.6072
S173	01	Xylene (Total)	8	ug/L	0.0005	NA
		Total			1.1221	36.1864
S173	02	1,1,1-Trichloroethane	0.4	ug/L	0.0004	NA
S173	02	Aluminum (Al)	710	ug/L	0.0454	NA
S173	02	Arsenic (As)	11.2	ug/L	2.3866	249.8630
S173	02	Barium (Ba)	6.4	ug/L	0.0058	NA
S173	02	Beryllium (Be)	0.3	ug/L	0.0038	19.1859
S173	02	Lead (Pb)	0.95	ug/L	NA	NA
S173	02	Manganese (Mn)	18.1	ug/L	0.0503	NA
		Total			2.4924	269.0489

Table 10.3.6-27
Summary of Lead Model Results
Site 30
Naval Air Station Pensacola
Pensacola, Florida

Lead Model Default Inputs		Site Specific Inputs (East of Murray Rd.)		(West of Murray Rd.)
Air Concentration	0.1 ug Pb/m3	Soil	48.4 ug Pb/g	48.4 ug Pb/g
Paint Intake	0 ug Pb/day	House Dust	48.4 ug Pb/g	48.4 ug Pb/g
Maternal Contribution	2.5 ug Pb/dL	Drinking Water	19 ug Pb/L	15 ug Pb/L

Lead Model Results

East of Murray Road:		
Predicted Geometric Mean Blood Lead Level	3.2 ug Pb/dL	(micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/	0.73 %	
West of Murray Road:		
Predicted Geometric Mean Blood Lead Level	2.9 ug Pb/dL	(micrograms lead per deciliter of blood)
Probability of Blood Lead Levels Above 10 ug Pb/	0.41 %	

Table 1(
Summary . and Hazard-based Surface Soil COCs
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident Iwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Future Tresspasser Hazard Quotien	Future Tresspasser ILCR	Identification of COCs	
Surface Soil	Incidental Ingestion	Aluminum	0.0075	0.070	ND	0.0027	ND	0.0017	ND		
		Aroclor-1242	ND	ND	1.1E-07	ND	1.2E-08	ND	3.1E-09		
		Aroclor-1254	0.0020	0.019	9.2E-08	0.00072	1.0E-08	0.00046	2.6E-09		
		Aroclor-1260	ND	ND	1.5E-07	ND	1.7E-08	ND	4.3E-09		
		Arsenic	0.005	0.048	2.7E-06	0.0018	3.0E-07	0.0012	7.7E-08	2	
		Benzo(a)pyrene Equiv.	ND	ND	1.5E-05	ND	1.7E-06	ND	4.4E-07	2	4
		Beryllium	0.000045	0.00042	1.1E-06	0.000016	1.2E-07	0.000010	3.2E-08	2	
		Cadmium	0.0037	0.034	ND	0.0013	ND	0.00085	ND		
		Chromium	0.015	0.14	ND	0.0053	ND	0.0035	ND		
		Dieldrin	0.00015	0.0014	1.4E-07	0.000053	1.5E-08	0.000034	3.9E-09		
		Manganese	0.0028	0.026	ND	0.0010	ND	0.00065	ND		
	Dermal Contact	Aluminum	0.0015	0.0051	ND	0.0011	ND	0.00036	ND		
		Aroclor-1242	ND	ND	4.9E-08	ND	2.0E-08	ND	2.6E-09		
		Aroclor-1254	0.0016	0.0054	4.1E-08	0.0012	1.7E-08	0.00038	2.2E-09		
		Aroclor-1260	ND	ND	6.6E-08	ND	2.7E-08	ND	3.5E-09		
		Arsenic	0.0011	0.0035	3.0E-07	0.00076	1.2E-07	0.00025	1.6E-08		
		Benzo(a)pyrene Equiv.	ND	ND	6.9E-06	ND	2.8E-06	ND	3.6E-07	2	4
		Beryllium	0.0000091	0.000030	1.2E-07	0.0000065	5.0E-08	0.0000021	6.5E-09		
		Cadmium	0.00075	0.002	ND	0.00054	ND	0.00017	ND		
		Chromium	0.0031	0.010	ND	0.0022	ND	0.00071	ND		
		Dieldrin	0.00012	0.00040	6.1E-08	0.000087	2.5E-08	0.000028	3.2E-09		
		Manganese	0.00058	0.0019	ND	0.00041	ND	0.00013	ND		
	Inhalation	Chromium	ND	ND	2.8E-07	ND	1.2E-07	ND	1.4E-08		
Surface Soil Pathway Sum			0.04	0.4	3E-05	0.02	5E-06	0.01	1E-06		

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental excess lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.
5- Chemical is a COC by virtue of projected future adolescent trespasser noncarcinogenic hazard.
6- Chemical is a COC by virtue of projected future adolescent trespasser ILCR.

Table 10.3.6-29
Summary of Risk and Hazard-based Groundwater COCs, West of Murry Road
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident Iwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Identification of COCs			
Groundwater	Ingestion	Arsenic (As)	0.59	1.4	1.5E-04	0.21	4.7E-05	1	2	3	4
		Barium (Ba)	0.092	0.21	ND	0.033	ND	1			
		Benzene	ND	ND	1.2E-06	ND	3.9E-07		2		
		2-Butanone (MEK)	0.041	0.095	ND	0.015	ND				
		Cadmium (Cd)	0.26	0.61	ND	0.093	ND	1			
		Carbon tetrachloride	0.078	0.18	3.9E-06	0.028	1.3E-06	1	2		4
		Chlorobenzene	0.19	0.45	ND	0.069	ND	1			
		Chloroform	0.0058	0.014	1.9E-07	0.0021	6.2E-08				
		Chromium (Cr)	0.16	0.38	ND	0.059	ND	1			
		1,2-Dichlorobenzene	0.0085	0.020	ND	0.0030	ND				
		1,3-Dichlorobenzene	0.0063	0.0146	ND	0.0022	ND				
		1,4-Dichlorobenzene	ND	ND	2.6E-05	ND	8.4E-06		2		4
		1,1-Dichloroethane	0.010	0.023	ND	0.0035	ND				
		1,2-Dichloroethane	ND	ND	1.4E-06	ND	4.4E-07		2		
		1,1-Dichloroethene	0.15	0.36	4.6E-04	0.055	1.5E-04	1	2		4
		1,2-Dichloroethene (cis)	0.0082	0.019	ND	0.0029	ND				
		1,2-Dichloroethene (total)	0.038	0.088	ND	0.013	ND				
		Heptachlor epoxide	0.061	0.14	4.0E-06	0.022	1.3E-06	1	2		4
		Lead (Pb)	ND	ND	ND	ND	ND				
		Manganese (Mn)	0.22	0.51	ND	0.078	ND	1			
		Methylene chloride	0.0042	0.0099	1.0E-06	0.0015	3.3E-07		2		
		Naphthalene	0.0050	0.012	ND	0.0018	ND				
		Tetrachloroethene	0.0037	0.0085	1.0E-06	0.0013	3.3E-07		2		
		1,1,1-Trichloroethane	0.073	0.17	ND	0.026	ND	1			
		Trichloroethene	0.068	0.16	2.5E-06	0.024	7.9E-07	1	2		
		Vinyl chloride	ND	ND	1.4E-03	ND	4.4E-04		2		4
	Inhalation	Benzene	0.045	0.10	1.2E-06	0.016	3.9E-07	1	2		
		2-Butanone (MEK)	0.085	0.20	ND	0.030	ND	1			
		Carbon tetrachloride	0.096	0.22	1.6E-06	0.034	5.1E-07	1	2		
		Chlorobenzene	0.67	1.6	ND	0.24	ND	1		3	
		Chloroform	0.0058	0.014	2.6E-06	0.0021	8.2E-07		2		
		1,2-Dichlorobenzene	0.019	0.045	ND	0.0068	ND				
		1,3-Dichlorobenzene	0.0063	0.015	ND	0.0022	ND				
		1,4-Dichlorobenzene	0.0087	0.020	ND	0.0031	ND				
		1,1-Dichloroethane	0.0069	0.016	ND	0.0025	ND				
		1,2-Dichloroethane	0.0097	0.0226	1.4E-06	0.0035	4.4E-07		2		
		1,1-Dichloroethene	0.15	0.36	1.3E-04	0.055	4.3E-05	1	2		4
		1,2-Dichloroethene (cis)	0.0082	0.019	ND	0.0029	ND				
		1,2-Dichloroethene (total)	0.038	0.088	ND	0.013	ND				
		Methylene chloride	0.00000093	0.0000022	7.2E-10	0.00000033	2.3E-10				
		Tetrachloroethene	0.0037	0.0085	4.1E-08	0.0013	1.3E-08				
		1,1,1-Trichloroethane	0.0090	0.021	ND	0.0032	ND				
		Trichloroethene	0.068	0.16	1.3E-06	0.024	4.3E-07	1	2		
		Vinyl chloride	ND	ND	2.2E-04	ND	7.0E-05		2		4
Groundwater Pathway Sum			3	8	2E-03	1	8E-04				

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental excess lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.

Table 10.3.6-30
Summary of Risk and Hazard-based Groundwater COCs, East of Murry Road
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway		Future Resident Adult Hazard Quotient	Future Resident Child Hazard Quotient	Future Resident lwa ILCR	Site Worker Hazard Quotient	Site Worker ILCR	Identification of COCs			
Groundwater	Ingestion	Arsenic (As)	0.59	1.4	1.5E-04	0.21	4.7E-05	1	2	3	4
		Barium (Ba)	0.092	0.21	ND	0.033	ND	1			
		Benzene	ND	ND	1.2E-06	ND	3.9E-07		2		
		2-Butanone (MEK)	0.041	0.095	ND	0.015	ND				
		Cadmium (Cd)	0.26	0.61	ND	0.093	ND	1			
		Carbon tetrachloride	0.078	0.18	3.9E-06	0.028	1.3E-06	1	2		4
		Chlorobenzene	0.19	0.45	ND	0.069	ND	1			
		Chloroform	0.0058	0.014	1.9E-07	0.0021	6.2E-08				
		Chromium (Cr)	0.16	0.38	ND	0.059	ND	1			
		1,2-Dichlorobenzene	0.0085	0.020	ND	0.0030	ND				
		1,3-Dichlorobenzene	0.0063	0.0146	ND	0.0022	ND				
		1,4-Dichlorobenzene	ND	ND	2.6E-05	ND	8.4E-06		2		4
		1,1-Dichloroethane	0.010	0.023	ND	0.0035	ND				
		1,2-Dichloroethane	ND	ND	1.4E-06	ND	4.4E-07		2		
		1,1-Dichloroethene	0.15	0.36	4.6E-04	0.055	1.5E-04	1	2		4
		1,2-Dichloroethene (cis)	0.0082	0.019	ND	0.0029	ND				
		1,2-Dichloroethene (total)	0.038	0.088	ND	0.013	ND				
		Heptachlor epoxide	0.061	0.14	4.0E-06	0.022	1.3E-06	1	2		4
		Lead (Pb)	ND	ND	ND	ND	ND				
		Manganese (Mn)	0.22	0.51	ND	0.078	ND	1			
		Methylene chloride	0.0042	0.0099	1.0E-06	0.0015	3.3E-07		2		
		Naphthalene	0.0050	0.012	ND	0.0018	ND				
		Tetrachloroethene	0.0037	0.0085	1.0E-06	0.0013	3.3E-07		2		
		1,1,1-Trichloroethane	0.073	0.17	ND	0.026	ND	1			
		Trichloroethene	0.068	0.16	2.5E-06	0.024	7.9E-07	1	2		
		Vinyl chloride	ND	ND	1.4E-03	ND	4.4E-04		2		4
	Inhalation	Benzene	0.045	0.10	1.2E-06	0.016	3.9E-07	1	2		
		2-Butanone (MEK)	0.085	0.20	ND	0.030	ND	1			
		Carbon tetrachloride	0.096	0.22	1.6E-06	0.034	5.1E-07	1	2		
		Chlorobenzene	0.67	1.6	ND	0.24	ND	1		3	
		Chloroform	0.0058	0.014	2.6E-06	0.0021	8.2E-07		2		
		1,2-Dichlorobenzene	0.019	0.045	ND	0.0068	ND				
		1,3-Dichlorobenzene	0.0063	0.015	ND	0.0022	ND				
		1,4-Dichlorobenzene	0.0087	0.020	ND	0.0031	ND				
		1,1-Dichloroethane	0.0069	0.016	ND	0.0025	ND				
		1,2-Dichloroethane	0.0097	0.0226	1.4E-06	0.0035	4.4E-07		2		
		1,1-Dichloroethene	0.15	0.36	1.3E-04	0.055	4.3E-05	1	2		4
		1,2-Dichloroethene (cis)	0.0082	0.019	ND	0.0029	ND				
		1,2-Dichloroethene (total)	0.038	0.088	ND	0.013	ND				
		Methylene chloride	0.00000093	0.0000022	7.2E-10	0.00000033	2.3E-10				
		Tetrachloroethene	0.0037	0.0085	4.1E-08	0.0013	1.3E-08				
		1,1,1-Trichloroethane	0.0090	0.021	ND	0.0032	ND				
		Trichloroethene	0.068	0.16	1.3E-06	0.024	4.3E-07	1	2		
		Vinyl chloride	ND	ND	2.2E-04	ND	7.0E-05		2		4
Groundwater Pathway Sum			3	8	2E-03	1	8E-04				

Notes:
ND indicates not determined due to the lack of available risk information.
ILCR indicates incremental excess lifetime cancer risk
HI indicates hazard index
1- Chemical is a COC by virtue of projected child residence noncarcinogenic hazard.
2- Chemical is a COC by virtue of projected future resident lifetime ILCR.
3- Chemical is a COC by virtue of projected site worker noncarcinogenic hazard.
4- Chemical is a COC by virtue of projected site worker ILCR.

Table 10.3.6-31
Summary of Risk and Hazard
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Medium	Exposure Pathway	HI (Adult)	HI (Child)	ILCR (LWA)	HI (Worker)	ILCR (Worker)	HI (Tresspasser)	ILCR (Tresspasser)
Surface Soil	Incidental Ingestion	0.04	0.3	2E-05	0.01	2E-06	0.008	6E-07
	Dermal Contact	0.009	0.03	7E-06	0.006	3E-06	0.002	4E-07
	Inhalation	NA	NA	3E-07	NA	1E-07	NA	1E-08
Groundwater West of Murray Rd.	Ingestion	6	14	1E-03	2	4E-04	NA	NA
	Inhalation	3	8	4E-04	1	1E-04	NA	NA
Groundwater East of Murray Rd.	Ingestion	2	5	2E-03	1	6E-04	NA	NA
	Inhalation	1	3	4E-04	0.4	1E-04	NA	NA
Sum all Pathways		13	30	4E-03	5	1E-03	0.01	1E-06

Notes:
ILCR Indicates incremental lifetime cancer risk
HI Indicates hazard index
NA Not applicable or not available

Table 1(
Remedia[illegible]tions for Surface Soil
Site 30
Naval Air Station, Pensacola
Pensacola, Florida

Residential RGOs

Chemical	Slope Factor (mg/kg-day)-1	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Arsenic	1.5	0.0003	1.1	70	23	2.3	0.38	3.8	38	1.56	0.7
Benzo(a)pyrene Equiv.	7.3	NA	1.34	ND	ND	ND	0.060	0.60	6.0	NA	0.1
Beryllium	4.3	0.005	0.16	1173	391	39	0.13	1.3	13	0.41	0.2

Industrial RGOs

Chemical	Slope Factor (mg/kg-day)-1	Reference Dose (mg/kg-day)	EPC mg/kg	Hazard-Based Remedial Goal Options 3 mg/kg	1 mg/kg	0.1 mg/kg	Risk-Based Remedial Goal Options 1E-06 mg/kg	1E-05 mg/kg	1E-04 mg/kg	Background Concentration mg/kg	Florida Soil Cleanup Goal mg/kg
Benzo(a)pyrene Equiv.	7.3	NA	1.3	ND	ND	ND	0.30	3.0	30	NA	0.5

NOTES:

EPC Exposure point concentration
NA Not applicable
ND Not determined
- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinogens

Table 10.3.6-33

Remedial Goal Options Groundwater

Site 30

Naval Air Station, Pensacola

Pensacola, Florida

Residential RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options 0.1 mg/l	1.0 mg/l	3 mg/l	Risk-Based Remedial Goal Options 1E-06 mg/l	1E-05 mg/l	1E-04 mg/l	Background Concentration mg/l	ARAR mg/l
Arsenic (As)	1.5	0.0003	0.0072	0.00047	0.0047	0.014	0.000044	0.00044	0.0044	0.0028	0.05
Barium (Ba)	NA	0.07	0.035	0.11	1.1	3.3	ND	ND	ND	0.0132	2
Benzene	0.029	NA	0.064	0.0027	0.027	0.080	0.0011	0.011	0.11	NA	0.001
2-Butanone (MEK)	0.6	NA	0.89	0.30	3.0	9.1	ND	ND	ND	NA	4.2
Cadmium (Cd)	NA	0.0005	0.032	0.00078	0.0078	0.023	ND	ND	ND	0.0034	0.005
Carbon tetrachloride	0.0007	0.13	0.0020	0.00049	0.0049	0.015	0.00036	0.0036	0.036	NA	0.003
Chlorobenzene	0.02	NA	0.14	0.0069	0.069	0.21	ND	ND	ND	NA	NA
Chloroform	0.0061	0.01	0.016	0.0078	0.078	0.23	0.00077	0.0077	0.077	NA	0.006
Chromium (Cr)	NA	0.005	0.19	0.0078	0.078	0.23	ND	ND	ND	NA	0.1
1,4-Dichlorobenzene	0.024	NA	0.012	0.36	3.6	11	0.0028	0.028	0.28	NA	0.075
1,1-Dichloroethane	NA	0.1	0.71	0.092	0.92	2.8	ND	ND	ND	NA	0.7
1,2-Dichloroethane	0.091	NA	0.11	0.0045	0.045	0.13	0.00036	0.0036	0.036	NA	0.003
1,1-Dichloroethene	0.6	0.009	0.091	0.0070	0.070	0.21	0.000086	0.00086	0.0086	NA	0.007
1,2-Dichloroethene (cis)	NA	0.01	0.057	0.0078	0.078	0.23	ND	ND	ND	NA	0.07
1,2-Dichloroethene (total)	NA	0.009	0.079	0.0070	0.070	0.21	ND	ND	ND	NA	0.07
bis(2-Ethylhexyl)phthalate	0.014	0.02	0.0086	0.031	0.31	0.94	0.0047	0.047	0.47	NA	0.006
Heptachlor epoxide	1.3E-05	9.1	0.000029	0.000020	0.00020	0.00061	0.0000073	0.000073	0.00073	NA	0.0002
Lead (Pb)	NA	NA	0.015	ND	ND	ND	ND	ND	ND	0.0016	0.015
Manganese (Mn)*	NA	0.047	0.084	0.074	0.74	2.2	ND	ND	ND	0.022	0.05
Methylene chloride	0.06	0.0075	0.0093	0.094	0.94	2.8	0.0088	0.088	0.88	NA	0.0027
4-Methylphenol	NA	0.005	0.0093	0.0078	0.078	0.23	ND	ND	ND	NA	0.035
Pentachlorophenol	0.12	0.03	0.0014	0.047	0.47	1.4	0.00055	0.0055	0.055	NA	0.001
Tetrachloroethene	0.052	0.01	0.10	0.0078	0.078	0.23	0.0012	0.012	0.12	NA	0.003
1,1,1-Trichloroethane	NA	0.035	1.3	0.049	0.49	1.5	ND	ND	ND	NA	0.2
Trichloroethene	0.011	0.006	0.015	0.0047	0.047	0.14	0.0039	0.039	0.39	NA	0.003
Vinyl chloride	1.9	NA	0.00057	ND	ND	ND	0.000030	0.00030	0.0030	NA	0.001

Table 10.

Remedial Goal Options Groundwater

Site 30

Naval Air Station, Pensacola

Pensacola, Florida

Industrial RGOs

Chemical	Oral SF (mg/kg-day)-1	Oral RfD (mg/kg-day)	EPC mg/l	Hazard-Based Remedial Goal Options **0.1** mg/l	**1** mg/l	**3** mg/l	Risk-Based Remedial Goal Options **1E-06** mg/l	**1E-05** mg/l	**1E-04** mg/l	Background Concentration mg/l	ARAR mg/l
Arsenic (As)	1.5	0.0003	0.0072	0.0031	0.031	0.092	0.00014	0.0014	0.014	0.0028	0.05
Benzene	0.029	NA	0.064	0.017	0.17	0.52	0.0036	0.036	0.36	NA	0.001
Cadmium (Cd)	NA	0.0005	0.032	0.0051	0.051	0.15	ND	ND	ND	0.0034	0.005
Carbon tetrachloride	0.0007	0.13	0.002	0.00	0.0	0.1	0.0011	0.011	0.11	NA	0.003
Chlorobenzene	0.02	NA	0.14	0.045	0.45	1.4	ND	ND	ND	NA	NA
Chloroform	0.0061	0.01	0.016	0.051	0.51	1.5	0.0024	0.024	0.24	NA	0.006
Chromium (Cr)	NA	0.005	0.19	0.051	0.51	1.5	ND	ND	ND	NA	0.1
1,4-Dichlorobenzene	0.024	NA	0.012	2.3	23	70	0.0087	0.087	0.87	NA	0.075
1,2-Dichloroethane	0.091	NA	0.11	0.029	0.29	0.88	0.0011	0.011	0.11	NA	0.003
1,1-Dichloroethene	0.6	0.009	0.091	0.046	0.46	1.4	0.00027	0.0027	0.027	NA	0.007
Heptachlor epoxide	1.3E-05	9.1	0.000	0.00013	0.0013	0.0040	0.000023	0.00023	0.0023	NA	0.0002
Tetrachloroethene	0.052	0.01	0.10	0.051	0.51	1.5	0.0038	0.038	0.38	NA	0.003
1,1,1-Trichloroethane	NA	0.035	1.3	0.32	3.2	9.6	ND	ND	ND	NA	0.2
Vinyl chloride	1.9	NA	0.00057	ND	ND	ND	0.000094	0.00094	0.0094	NA	0.001

NOTES:

EPC Exposure point concentration

NA Not applicable

ND Not determined

- Remedial goal options were based on the residential lifetime weighted average for carcinogens and the child resident or site worker for noncarcinogens

* Using the FDEP recommended RfD (0.023 mg/kg-day) for manganese would effectively double its RGO.

10.4 Toxicity Profiles for COPCs

As required for BRAs by USEPA Region IV, brief toxicological profiles are included for all COPCs. Most information for the brief profiles below was gleaned from the IRIS as a primary source and the currently available HEAST. Table 10.4.1-1 summarizes the toxicological database information and is located at the end of this section. Another main source of information was Smith, R.L., *USEPA Region III Risk-Based Screening Concentrations Table* (USEPA, 1996a). Any additional references are noted specifically in the briefs below in parentheses. The profiles summarize adverse effects of COPCs and the associated amounts. The inhalation and area RfD (RfD_i, RfD_o), and the SF_i and SF_o are included in the discussion where applicable.

1,1-DCA is a mutagen (i.e., can cause gene mutations) and a carcinogen (i.e., can cause proliferation of mutated cells) in certain species which has historically been used as an insect fumigant for stored grain products. However, this compound is not listed as a human carcinogen by USEPA due to a paucity of applicable data (Group C classification). Chronic exposure to this compound could elicit an increase in certain enzymes. This change in enzyme activity could result in unexpected responses to other chemicals, such as inhibitory or synergistic effects. In more sensitive species such as mice, chronic exposure to this compound is cytotoxic (i.e., directly toxic to cells) (Dreisbach et al., 1987). 1,1-DCA is generally toxic to the nervous system, liver, kidneys, and heart. USEPA set the RfD_o and RfD_i to 0.1 and 0.143 mg/kg-day, respectively.

1,2-DCA is used as a solvent in the rubber, plastic, and insecticide industries. This compound is also used as a gasoline additive and is in some rubber and plastic cements for hobbies. Municipal water supplies commonly detect dichloroethane as a contaminant if the municipal water treatment facility uses chlorine in its water cleaning processes. Detected concentrations range from 0.2 to 6 μg/l (Klaasen et al., 1986), and the MCL is 5 μg/l. The fatal adult dose is approximately 5 ml of 1,2-DCA, and the time weighted average (TWA) exposure limit is 1 ppm for inhalation exposure. The inhalation exposure limit is below the odor threshold, 3 ppm.

Fatty liver, liver cell damage, and kidney damage are the primary noncancer toxic effects caused by dichloroethane. Because this compound is chemically transformed into a toxic metabolite by enzymes in the liver (biotransformation); toxic effects can be greatly enhanced (synergism) when the liver's enzymes are induced. Enzyme inducers such as ketones and alcohols can lead to synergistic toxic effects. An additional, secondary effect evident in canine studies is the clouding of corneal eye tissue. This effect was indirect, apparently occurring following biotransformation by liver enzymes, and was not caused by direct eye exposure to dichloroethane. Based on Region III's RBC Table (January 1996), USEPA determined the RfD_i to be 0.00286 mg/kg-day. No RfD_o is currently available.

This compound can react with DNA, which indicates a potential to cause cancer. Studies indicate this compound is a carcinogen if ingested (Klaasen et al., 1986), but the reference data do not indicate inhaling this compound would cause cancer. USEPA has classified dichloroethane as a B2 carcinogen and determined the SF to be 0.091 $(mg/kg\text{-}day)^{-1}$ for both ingestion and inhalation exposure. As listed in IRIS (search date 6/29/95), the classification is based on the induction of several tumor types in rats and mice treated by gavage and lung papillomas in mice after topical application.

1,1-DCE is a VOC, primarily toxic to the liver, central nervous system (CNS), and kidneys. The mucous membrane, skin, lung, and cornea (irritation) are also affected. 1,1-DCE is more toxic than 1,2-DCE. This chlorinated compound is a USEPA Group C carcinogen. The RfD_o is 0.009 mg/kg-day, and the SF_o and SF_i are 0.6 and 0.175 $(mg/kg\text{-}day)^{-1}$, respectively.

1,1,1-TCA has historically been used as a fumigant and a solvent in paint removers, typewriter correction fluid, crafts, cleaning and degreasing agents. This compound primarily depresses the CNS. This compound is not carcinogenic, but the resultant liver toxicity can be increased where exposure to 1,1,1-TCA also includes exposure to alcohols and/or ketones. USEPA set the RfD_o

and RfD_i to 0.09 and 0.286, respectively. These RfDs have been withdrawn from IRIS, but these values are currently used to determine screening concentrations for this compound.

1,1,2,2-Tetrachloroethane is VOC used in industry and is also found as a contaminant in many other solvents. The target organs of this solvent are CNS, system, the liver, and the kidneys. Chronic exposure causes congestion of the target organs, intoxication, tremor, and the alteration of nerve function. The effect on the liver can lead to jaundice. Acute exposure to this compound causes long-lasting narcosis with delayed onset. Additional effects are irritation of the mucous membranes, nausea, and headache, which can progress to coma. Simultaneous exposure to alcohols or ketones can exacerbate the toxic effects of this compound. The exposure limit for inhalation is 1 ppm. In addition to the noncarcinogenic effects of tetrachloroethane, it is classified as a class A-B carcinogen by USEPA. As listed in IRIS (search date 11/22/95), the basis for the C classification is increased incidence of hepatocellular carcinomas in mice. The USEPA set the SF_o and SF_i to 0.2 and 0.203 $(mg/kg\text{-}day)^{-1}$, respectively.

Chloroethane, a VOC, has been shown to produce toxic effects on reproduction due to chronic inhalation exposure. Reproductive effects were noted at concentrations that did not elicit maternal toxicity. The primary pathologic finding was malformed bones in fetuses. Based on this study, USEPA determined the RfD_i to be 2.86 mg/kg-day. A provisional RfD_o is available through USEPA ECAO of mg/kg-day. As listed in IRIS (search date 6/28/95), the critical effect of this chemical is delayed fetal ossification. The uncertainty factor was 300 and the modifying factor was 1. The IRIS RfC is 10 mg/m^3.

Chloroform, a halogenated hydrocarbon, has been used as a fumigant and an additive to suppress the fire hazard of carbon disulfide, as well as having a low capacity for insect control. Volatile and gaseous anesthetics such as chloroform are sometimes used to produce general anesthesia. This contaminant is the primary chlorinated hydrocarbon produced during chlorination of drinking

water, and is commonly present at low concentrations in most drinking water supplies. This compound depresses all function of the CNS in descending order from the cortex to the medulla. Additional target organs include the liver, heart, and kidney. Chloroform exposure to the heart sensitizes the muscle to arrhythmias, as do many halogenated hydrocarbons. This action could interfere with digitalis glycosides or a pacemaker in the form of premature or uncontrolled beats. Chloroform is a class B2 carcinogen, and USEPA set the SF_o and SF_i to 0.0061 and 0.0805 $(mg/kg\text{-}day)^{-1}$, respectively. As listed in IRIS (search date 11/22/95), the classification is based on increased incidence of several tumor types in rats and three strains of mice. The RfD_o is 0.01 mg/kg-day. The critical effect of this chemical is fatty cyst formation in the liver. The uncertainty factor was determined to be 1,000 and the modifying factor was 1.

Chloromethane is a colorless gas with an ethereal odor and sweet taste. It is slightly soluble in water and volatile. Acute poisoning is characterized by the narcotic effect. In addition, repeated exposure to low concentrations damages the CNS and less frequently the liver, kidneys, bone marrow, and cardiovascular system. Hemorrhages into the lungs and intestinal tract have also been reported. In exposures to high concentrations, dizziness, drowsiness, uncoordination, confusion, nausea, vomiting, abdominal pains, hiccoughs, diplopia, and dimness of vision followed by delirium, convulsions, and coma have been reported and death may be immediate. Death may occur several days later from degenerative changes in the heart, liver, and especially the kidneys.

4-Methylphenol and most compounds related to phenol are cellular toxicants. These compounds can cause bladder tumors, and might be carcinogens and/or sensitizers. USEPA has determined the RfD_o to be 0.005 mg/kg-day.

Pentachlorophenol and most compounds related to phenol are cellular toxicants. These compounds can cause bladder tumors, and might be carcinogens and/or sensitizers. USEPA has determined the RfD_o to be 0.03 mg/kg-day and the SF_o to be 0.12 $(mg/kg\text{-}day)^{-1}$, respectively.

Naphthalene, is obtained from coal tar and is used as moth repellant and a synthetic intermediate. The primary effect is on the kidneys due to this compound's effect on the blood. Naphthalene was determined to be a USEPA class D carcinogen (i.e., is not classified due to insufficient data). Data and inadequate data from animal bioassays also are inadequate. Subsequent to the verification of this cancer assessment in 1990, the National Toxicology Program (NTP) completed a two-year cancer bioassay (1991); its results suggest that naphthalene may be more appropriately classified as a possible human carcinogen (group C under current USEPA guidelines). The NTP concluded, "Under the conditions of these two-year studies, there is no evidence of carcinogenic activity of naphthalene in male B6C3F1 mice exposed by inhalation to concentrations of 10 or 30 ppm for six hours daily, five days per week, for 103 weeks. There was some evidence of carcinogenic activity of naphthalene in female B6C3F1 mice, as indicated by the increased incidences of pulmonary alveolar/bronchliar adenomas." USEPA determined the RfD_o to be 0.04 mg/kg-day, which was withdrawn from IRIS/HEAST. Toxicological data for naphthalene were used as surrogate information for 2-methylnaphthalene.

Heptachlor is an insecticide used to control flies, mosquitoes, and field insects. USEPA determined this compound to be a class B2 carcinogen, and determined the SF_o to be 4.5 $(mg/kg\text{-}day)^{-1}$. As listed in IRIS (search date 6/29/95), the classification is based on inadequate human data, but sufficient evidence exists from studies in which benign and malignant liver tumors were induced in three strains of mice of both sexes. Several structurally related compounds are liver carcinogens. The primary target organs for this pesticide are the liver and kidneys, and USEPA determined the RfD_o to be 0.0005 mg/kg-day. As listed in IRIS, the critical

effect of this chemical is liver weight increases in males. The uncertainty factor was 300 and the modifying factor was 1 (Dreisbach et al., 1987).

Heptachlor epoxide is the more toxic form of the insecticide heptachlor. USEPA determined this compound to be a class B2 carcinogen, and determined the SF_o to be 9.1 $(mg/kg\text{-}day)^{-1}$. The primary target organs for this pesticide are the liver and kidneys, and USEPA determined the RfD_o to be 1.3E-5 mg/kg-day (Dreisbach et al., 1987).

Methylene chloride, a common industrial solvent, has also been used in the post-harvest fumigation of strawberries and commodity fumigation of grains, with ethylene for degreening citrus fruits. This compound causes CNS depression and damages the lung and liver. The potential exists for synergistic hepatotoxic effects during corresponding exposure to enzyme inducers such as alcohols and ketones. Methylene chloride is a USEPA class B2 carcinogen, and the SF_o and SF_i have been set by USEPA to 0.0075 and 0.00164 $(mg/kg\text{-}day)^{-1}$, respectively. As listed in IRIS (search date 6/29/95), the classification is based on inadequate human data but sufficient evidence of carcinogenicity in animals, increased incidence of hepatocellular neoplasms and alveolar/bronchiolar neoplasms in male and female mice, increased incidence of benign mammary tumors in both sexes of rats, salivary gland sarcomas in male rats, and leukemia in female rats. This classification is supported by some positive genotoxicity data, although results in mammalian systems are generally negative. The RfD_o and RfD_i are 0.06 and 0.857 mg/kg-day, respectively. As listed in IRIS, the critical effect of this chemical is liver toxicity. The uncertainty factor was 100 and the modifying factor was 1 (Dreisbach et al., 1987).

PCE has been used as a solvent in industry and occurs as a volatile contaminant in other chlorinated hydrocarbons. PCE exposure can result in long-lasting narcosis with delayed onset and damage to the liver and kidneys. The principal manifestations of overexposure to this halogenated hydrocarbon are coma, jaundice, oliguria, and irritation of the eyes and nose followed

by headache and nausea. Cyanosis and CNS depression progressing to coma appear one to four hours after short-term exposure. Liver and kidney damage after apparent recovery or repeated exposures causes acute symptoms such as nausea, vomiting, abdominal pain, jaundice, oliguria and uremia. Exposure via the inhalation and/or skin absorption exposure pathways could result in headache, tremor, dizziness, peripheral paresthesia, hypesthesia, or anesthesia. PCE is a carcinogen, but is currently under review by USEPA; it is currently classified as a B2-C carcinogen. The RfD_o has been set to 0.01 mg/kg-day, and the SF_o and SF_i have been set to 0.052 and 0.00203 $(mg/kg\text{-}day)^{-1}$, respectively, by USEPA. As listed in IRIS (search date 11/22/95), the critical effects of this chemical are hepatotoxicity in mice, and weight gain in rats. The uncertainty factor was 1,000 and the modifying factor was 1 (Dreisbach et al., 1987).

TCE is a mobile, volatile liquid with the characteristic odor of chloroform. Inhalation, intravenous, and subcutaneous routes are all viable exposure pathways for this compound. TCE is a strong skin and eye irritant that is relatively less toxic if ingested. Inhalation of high concentrations causes narcosis and anesthesia. This compound targets the liver and other organs (Dreisbach et al., 1987). TCE is a B2 carcinogen, and the SF_o and SF_i have been set by USEPA to 0.011 and 0.006 $(mg/kg\text{-}day)^{-1}$, respectively. As listed in IRIS, the carcinogen assessment summary for this substance has been withdrawn following further review. A new carcinogen summary is in preparation. USEPA also set the RfD_o to 0.006 mg/kg-day.

Aluminum is one of the most abundant metals in the earth's crust (7% aluminum), and it is ubiquitous in air and water as well as soil. This metal is water-soluble, silvery, and ductile, which suggests its usefulness in many processes. Ingesting aluminum can affect the absorption of other elements within the gastrointestinal tract and can alter intestinal function. Aluminum can potentially interfere with the absorption of essential nutrients and cholesterol. Another effect on the gastrointestinal system is the inhibition of acetylcholine-induced contractions. These

contractions are part of the neuro-muscular system controlling bowel muscles. Aluminum dust is moderately flammable and explosive in heat. Inhaling this dust can cause fibrosis (aluminosis). No data are available on an applicable SF or the USEPA cancer group. The USEPA Region IV Office of Health Assessment suggested using the provisional oral RfD of 1.0 mg/kg-day. The aesthetic-based SMCL for drinking water is 50 to 200 μg/L.

Antimony belongs to the same periodic group as arsenic. This element is absorbed slowly through the gastrointestinal tract, which is the target of this element. Another target is the blood, where antimony concentrates. Due to frequent industrial use, the primary exposure route for antimony to the general population is food. Antimony is also a common air pollutant from industrial emissions. USEPA has not classified antimony as a carcinogen, and the RfD_o is 0.0004 mg/kg-day. As listed in IRIS (search date 6/28/95), the critical effect of this chemical is longevity, blood glucose, and cholesterol. The uncertainty factor was 1,000 and the modifying factor was 1.

Arsenic exposure via the ingestion route causes darkening and hardening of the skin in chronically exposed humans. Inhalation exposure to arsenic causes neurological deficits, anemia, and cardiovascular effects. USEPA set 0.3 μg/kg-day as the RfD for arsenic based on a no-observed adverse-affects-level (NOAEL) of 0.8 μg/kg-day in a human exposure study. Arsenic's effects on the nervous and cardiovascular systems are primarily associated with acute exposure to higher concentrations. Exposure to arsenic-containing materials causes cancer in humans. Inhaling these materials can lead to increased lung cancer risk, and ingesting these materials is associated with increased skin cancer rates. Arsenic has been classified as a group A carcinogen by USEPA, which set the 1.75 $(mg/kg\text{-}day)^{-1}$ SF for arsenic. As listed in IRIS (search date 9/1/95), the classification is based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an

increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic. Human milk contains about 3 μg/L arsenic. The RBC for arsenic in tap water is 0.038 μg/L. As listed in IRIS, the critical effects of this chemical are hyperpigmentation, keratosis, and possible vascular complications. The uncertainty factor was 3 and the modifying factor was 1.

Barium is used in various alloys, paints, soap, and manufacture processes. Barium sulfate is used to aid X-ray diagnosis. This element is relatively abundant in nature and is found in plant and animal tissue. Brazil nuts contain 3 to 4 mg per gram nuts. The fatal absorbed dose of barium is approximately 1,000 mg (for humans). Assuming an absorption efficiency of 5%for barium, 20,000 mg ingested barium could be fatal. Major toxic effects of this element are muscle stimulation, CNS effects, and effects on the heart. USEPA determined the RfD_o and RfD_i to be 0.07 and 1.43E-4 mg/kg-day, respectively. As listed in IRIS (search date 6/29/95), the critical effect of this chemical is increased blood pressure. The uncertainty factor was 3 and the modifying factor was 1.

Beryllium exposure via the inhalation route can inflame the lungs, a condition known as Acute Beryllium Disease, as a result of short-term exposure to high concentrations. Removal from exposure results reverse symptoms. Chronic exposure to much lower concentrations of beryllium or beryllium oxide by inhalation has been reported to cause Chronic Beryllium Disease, with symptoms including shortness of breath, scarring of the lungs, and berylliosis, which is noncancerous growths in the lungs of humans. Both forms of Beryllium Disease can be fatal, depending on the severity of the exposure. Additionally, a skin allergy may develop when soluble beryllium compounds come into contact with the skin of sensitized individuals. An RfD_o of 0.0054 mg/kg-day has been set for beryllium based on a chronic oral bioassay (rats were the study species) which determined no adverse effect occurs at 0.54 mg/kg-day. Beryllium has been classified by USEPA as a group B2 carcinogen based on animal studies. It has been shown to

induce lung cancer via inhalation in rats and monkeys, and to induce osteosarcomas in rabbits via intravenous or intramedullary injection. Human epidemiology studies of beryllium are considered inadequate. As listed in IRIS (search date 6/28/95), the classification is based on the animal studies cited above. An Sf_i of 8.4 $(mg/kg\text{-}day)^{-1}$ and an SF_o of 4.3 $(mg/kg\text{-}day)^{-1}$ have been set by USEPA. As listed in IRIS, this chemical has no adverse effect. The uncertainty factor was determined to be 100 and the modifying factor was 1. The IRIS RfD in drinking water is 0.005 mg/kg/day (Gradient, 1991).

Cadmium can upset the stomach, leading to vomiting and diarrhea in acute exposure; acute inhalation of cadmium-containing dust can irritate the lungs. Chronic exposure to cadmium, either via inhalation or ingestion, causes kidney damage (including kidney stones), emphysema, and high blood pressure. Other tissues reportedly injured by cadmium exposure in animals and humans include the lungs, testes, liver, immune system, blood, and nervous system. An RfD_o of 0.001 (mg/kg-day) has been determined by USEPA, based on human studies (food) involving chronic exposure in which significant increased protein was found in the urine. A separate RfD_o for water has been determined by USEPA to be 0.0005 mg/kg-day. For inhalation exposure, cadmium has been classified by USEPA as a group B1, or probable human carcinogen, based on limited evidence from epidemiological studies in which an excess risk of lung cancer was observed in cadmium smelter workers. As listed in IRIS (search date 6/28/95), the classification is based on limited evidence from occupational epidemiologic studies of cadmium consistent across investigations and study populations. There is sufficient evidence of carcinogenicity in rats and mice by inhalation and intramuscular and subcutaneous injection. Seven studies in rats and mice wherein cadmium salts (acetate, sulfate, chloride) were administered orally have shown no evidence of carcinogenic response. There is sufficient evidence of increased risk of lung cancer in rats and mice exposed to cadmium via inhalation. As listed in IRIS, the critical effect of this chemical in water is significant proteinuria. The uncertainty factor was 10 and the modifying

factor was 1. The critical effect of this chemical in food is human studies involving chronic exposures. The uncertainty factor was 10 and the modifying factor was 1 (Klaasen et al., 1986).

Chromium exists in two stable, natural forms: trivalent and hexavalent. Acute exposure to chromium can result in kidney damage following oral exposure, or damage to the nasal mucosa and septum following inhalation exposure. Chronic inhalation exposure to hexavalent chromium has resulted in kidney and respiratory tract damage, as well as excess lung cancer in both animals and humans following occupational exposure. Only hexavalent chromium is believed to be carcinogenic by inhalation. RfD_o values for both forms of chromium are 1.0 and 5E-3 (mg/kg-day), respectively. For trivalent chromium, the RfD is based on liver toxicity in the rat. For the hexavalent form, the RfD is based on unspecified pathological changes observed in rat studies. In addition, hexavalent chromium is considered a group A carcinogen for inhalation exposures, and an SF_o of 42 $(mg/kg\text{-}day)^{-1}$ has been established for the hexavalent form. Vitamin supplements contain approximately 0.025 mg of chromium. As listed in IRIS (search date 6/28/95), no critical effects were observed for trivalent chromium. The uncertainty factor was 100 and the modifying factor was 10. As listed in IRIS, no critical effects were observed for chromium VI. The uncertainty factor was determined to be 500 and the modifying factor was 1 (Gradient, 1991).

Manganese is an essential nutrient. Chronic exposure to manganese, 0.8 mg/kg-day, causes mental disturbances. Studies have shown that manganese uptake from water is greater than manganese uptake from food, and the elderly appear to be more sensitive than children. USEPA set an oral RfDs of 0.14 mg/kg-day, respectively. Using the prescribed modifying factor of 3, the RfD 0.047 mg/kg-day. FDEP recommends that the dietary intake of 5 mg/day manganese also be considered when evaluating the health effects resulting from environmental exposures. This yields an RfD of 0.023 mg/kg-day for manganese. In the formal risk assessment, the effect of using FDEP's recommended RfD appears as table footnotes. Inhalation of manganese dust causes

neurological effects and increased incidence of pneumonia, and an RfD_i was set to 0.0000143 mg/kg-day. According to USEPA, manganese cannot be classified as to its carcinogenicity. Therefore, the cancer class for manganese is group D. As listed in IRIS (search date 6/29/95), the classification is based on studies that are inadequate to assess its carcinogenicity. Manganese is an element considered essential to human health. The typical vitamin supplement dose of manganese is 2.5 mg/day. As listed in IRIS (search date 6/29/95, the critical effect of this chemical in water in the oral summary are CNS effects. The uncertainty factor was 1 and the modifying factor was 1. The critical effects of this chemical in food in the oral summary are CNS effects (Klaasen et al., 1986; Dreisbach et al., 1987). The uncertainty factor was 1 and the modifying factor was 1. As listed in IRIS (search date 6/29/95), the critical effect of this chemical in the inhalation summary is impairment of neuro-behavioral function. The uncertainty factor was 1,000 and the modifying factor was 1. The IRIS RfC is 0.00005 mg/m^3.

Nickel is also an essential nutrient; a 5 μg microgram dose is typical of supplemental vitamins. USEPA set the RfD_o to 0.02 mg/kg-day. Chronic exposure of rats to nickel caused decreased body and organ weights. For a chronically exposed individual, nickel salts would affect the gastrointestinal system, and would also target the liver and kidney. This element is a sensitizer, an element that can produce allergic reactions. Sensitization of skin to nickel dust has been shown to occur in industry. As listed in IRIS (search date 6/28/95), the critical effect of this chemical is decreased body and organ weights. The uncertainty factor was 300 and the modifying factor was 1.

PCBs are a group of chlorinated hydrocarbons (Aroclors-1248, -1254, and -1260) that accumulate in fat tissue. Occupational exposure (both inhalation and dermal) to PCBs causes eye and lung irritation, loss of appetite, liver enlargement, increased serum liver enzyme concentrations, rashes, chloracne, and decreased birth weight of infants in heavily exposed worker/mothers. Of the effects listed above, the liver is the primary target organ. USEPA classified PCB Aroclors as

group B2 carcinogens, primarily based on animal data. As listed in IRIS (search date 6/29/95), the classification is based on hepatocellular carcinomas in three strains of rats and two strains of mice and inadequate yet suggestive evidence of excess risk of liver cancer in humans by ingestion and inhalation or dermal contact. The cancer potency of PCB mixtures is determined using a tiered approach. The high risk and persistence tier uses an upper-bound slope factor of 2.0 $(mg/kg\text{-}day)^{-1}$ and is appropriate for food chain exposures, sediment and soil ingestion, dust or aerosol inhalation, and dermal exposure. The low risk and persistence tier uses an upper-bound slope factor of 0.4 $(mg/kg\text{-}day)^{-1}$ and is appropriate for ingestion of water soluble congeners and inhalation of evaporated congeners. The lowest risk and persistence tier uses an upper-bound slope factor of 0.07 $(mg/kf\text{-}day)^{-1}$ and is appropriate for PCB congener mixtures with congeners having more than four chlorines comprising less than 1/2% of the mixture. (Klaasen et al., 1986; Dreisbach et al., 1987).

Dieldrin is a polycyclic chlorinated pesticide. Short-term exposure to high doses of dieldrin causes tremors and convulsions. Chronic exposure can cause emotional and neuromuscular disturbances. Exposed individuals revert to normal approximately one week after the dieldrin source is removed. As listed in IRIS (search date 6/28/95), the B2 classification is based on that dieldrin being carcinogenic in seven strains of mice when administered orally. Dieldrin is structurally related to compounds (aldrin, chlordane, heptachlor, heptachlor epoxide, and chlorendic acid) which produce tumors in rodents. Dieldrin is classified as a B2 carcinogen by USEPA; the SF_o, SF_i, and RfD_o were set to 16 $(mg/kg\text{-}day)^{-1}$, 16.1 $(mg/kg\text{-}day)^{-1}$, and 0.00005 mg/kg-day, respectively. As listed in IRIS (search date 6/28/95), the critical effect of this chemical is liver lesions. The uncertainty factor was 100 and the modifying factor was 1 (Dreisbach et al., 1987).

PAHs include the following list of COPCs:

Benzo(a)anthracene	TEF	0.1
Benzo(b)fluoranthene	TEF	0.1
Dibenz(a,h)anthracene	TEF	1.0
Benzo(k)fluoranthene	TEF	0.01
Benzo(a)pyrene	TEF	1.0
Indeno(1,2,3-cd)pyrene	TEF	0.1
Chrysene	TEF	0.001

In accordance with Region IV supplemental guidance to *RAGS* (USEPA, 1993a), benzo(a)pyrene equivalents (BEQs) were computed, where appropriate, by multiplying the reported concentration of each the seven carcinogenic PAHs — benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) by its corresponding TEF. The BEQ values were then summed for each sample, and the total was compared to the benzo(a)pyrene RBC value during the screening process. Subsequent exposure quantification and risk/hazard projections for carcinogenic PAHs in soil and groundwater used total BEQ values for each sampling location rather than individual compound concentrations.

Some PAHs are toxic to the liver, kidney, and blood. However, the toxic effects of the PAHs above have not been well established. There are no RfDs for these PAHs due to a lack of data. All PAHs listed above are classified by USEPA as B2 carcinogens, and their carcinogenicity is addressed relative to that of benzo(a)pyrene, having an SF 7.3 $(mg/kg\text{-}day)^{-1}$. TEFs, also set by USEPA, are multipliers that are applied to the detected concentrations, which are subsequently used to calculate excess cancer risk. Most carcinogenic PAHs have been classified as such due to animal studies using large doses of purified PAHs. There is some doubt as to the validity of these listings, and the SFs listed in USEPA's RBC table are provisional. However, these PAHs are carcinogens when the exposure involves a mixture of other carcinogenic substances (i.e., coal tar, soot, cigarette smoke, etc.) As listed in IRIS (search date 6/28/95), the benzo(a)pyrene

B2 classification is based on a lack of human data specifically linking benzo(a)pyrene to a carcinogenic effect. There are, however, multiple animal studies in many species demonstrating benzo(a)pyrene to be carcinogenic following administration by numerous routes. Benzo(a)pyrene has produced positive results in numerous genotoxicity assays. At the June 1992 CRAVE Work Group meeting, a revised risk estimate for benzo(a)pyrene was verified (see Additional Comments for Oral Exposure). This section provides information on three aspects of the carcinogenic risk assessment for the agent in question; the USEPA classification, and quantitative estimates of exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in application of a low-dose extrapolation procedure and are presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per μg/L drinking water or risk per $\mu g/m^3$ air breathed. The third form in which risk is presented is drinking water or air concentration providing cancer risks of 1 in 10,000 or 1 in 1 million. The carcinogenicity background document provides details on the carcinogenicity values found in IRIS. Users are referred to the RfD_o and reference concentration sections for information on long-term toxic effects other than carcinogenicity. As listed in IRIS (search date 6/28/95), the dibenz(a,h)anthracene and benzo(b)fluoranthene B2 classification is based on no human data but sufficient data from animal bioassays. Benzo(b)fluoranthene produced tumors in mice after lung implantation, intraperitoneal (i.p.) or subcutaneous (s.c.) injection, and skin painting. As listed in IRIS (search date 6/28/95), the benzo(a)anthracene B2 classification is based on no human data but sufficient data from animal bioassays. Benzo(a)anthracene produced tumors in mice exposed by gavage; intraperitoneal, subcutaneous, or intramuscular injection; and topical application. Benzo(a)anthracene produced mutations in bacteria and in mammalian cells, and transformed mammalian cells in culture. As listed in IRIS (search date 6/28/95) the benzo(k)fluoranthene B2 classification is based on no human data but sufficient data from animal bioassays. Benzo(k)fluoranthene produced tumors after lung implantation in mice and when administered with

a promoting agent in skin-painting studies. Equivocal results have been found in a lung adenoma assay in mice. Benzo(k)fluoranthene is mutagenic in bacteria (Klaasen, et al., 1986).

Other PAHs — those not classified by USEPA as carcinogens — are toxic to the liver, kidney and blood. This group of PAHs includes compounds such as pyrene, acenaphthene, acenaphthylene, benzo(g,h,i)perylene, and phenanthrene. USEPA determined RfDs for only two of these compounds: pyrene's RfD_o is 0.03 mg/kg-day, and this RfD is also used as a surrogate RfD_o for phenanthrene. The RfD_o for acenaphthene was determined to be 0.06 mg/kg-day.

Bis(2-ethylhexyl)phthalate is a plasticizer used in virtually every major product category. Phthalate esters are ubiquitously distributed in the environment. Although its toxicity is relatively low, it is a carcinogen. Reproductive effects are also possible (indicated in animal studies) due to chronic exposure to bis (2-ethylhexyl) phthalate. As listed in IRIS (search date 10/17/95), the classification is based on orally administered bis (2-ethylhexyl) phthalate producing significant dose-related increase in liver tumor responses in rats and mice of both sexes. This compound is classified as a B2 carcinogen, and USEPA set the RfD_o and SF_o to 0.02 mg/kg-day and 0.014 $(mg/kg\text{-}day)^{-1}$, respectively. As listed in IRIS, the critical effect of this chemical is increased relative liver weight. The uncertainty factor was 1,000 and the modifying factor was 1.

Benzene is a VOC associated with leukemia. This chemical has been used as a solvent in coal tar naphtha, rubber, and plastic cement. USEPA lists benzene as a group A carcinogen. As listed in IRIS (search date 6/29/95), the classification is based on several studies of increased incidence of nonlymphocytic leukemia from occupational exposure, increased incidence of neoplasia in rats and mice exposed by inhalation and gavage, and some supporting data. In large doses, benzene depresses the CNS, and chronic exposure depresses bone marrow. The SF_o for benzene was set by USEPA as 2.9E-2 $(mg/kg\text{-}day)^{-1}$, and an oral RfD has not been set. Occupational inhalation exposure to benzene is acceptable at 3.25 mg/m^3 or 1 ppm in air.

Magnesium, potassium, iron, calcium, and **sodium** are all essential nutrients and thus were eliminated from formal assessment. These nutrients would be expected to be indigenous to the soil. In vitamin supplements, 100, 40, 18, and 162 mg are the daily dose for magnesium, potassium, iron, and calcium, and approximately 70 mg of sodium is found in the typical soda.

Copper is a nutritionally essential element, necessary for many of the body's enzymes. In the past, lead pipes and solder were used for residential water pipes, and resulting lead concentrations in drinking water exceeded the guidelines set by the USEPA. Copper has been used to replace water pipes in residences due to its lower toxicity to man. Short-term exposure to copper can result in anemia (the lack of iron), the breakdown of red blood cells, and liver and kidney lesions. The target organs for copper are the liver, kidney, and red blood cell. Vitamin C reduces copper uptake from the gut, and other substances can also influence copper uptake. Copper fumes can cause metal fume fever. As listed in IRIS (search date 6/28/95), the D classification is based on no human data, inadequate animal data from assays of copper compounds, and equivocal mutagenicity data. The RfD set by USEPA is 0.0371 mg/kg-day, which is 2.6 mg/day for the average adult (70 kg). In typical vitamin supplements, 2 mg/day is the approximate dose (NRC, 1989).

Lead has been classified as a group B2 carcinogen by USEPA based on animal data. No RfD or SF has been set by USEPA. However, an action level for soil has been proposed by USEPA Region IV, 400 mg/kg. As listed in IRIS (search date 10/17/95), the classification is based on sufficient animal evidence. Ten rat bioassays and one mouse assay have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. Animal assays provide reproducible results in several laboratories, in multiple rat strains with some evidence of multiple tumor sites. Short-term studies show that lead affects gene expression. Human evidence is inadequate. An RfD and SF have not been set because of the confounding nature of lead toxicity. Lead accumulates in fat tissue, and affects the brain,

blood, and mental development of children. RfDs are based on the assumption that a threshold must be exceeded to result in toxic effects (other than carcinogenicity). Once lead accumulates in the body, other influences cause the actual concentrations in the blood to fluctuate — sometimes the lead is attached to binding sites, and sometimes lead is free flowing. If an exposed individual has previously been exposed to lead, this individual could lose weight, and setting fat-bound lead free. This fluctuation and lack of previous lead exposure data are two of the reasons lead effects are difficult to predict (Klaasen et al., 1986).

Mercury occurs in three forms: elemental, organic, and inorganic. The major source of this element is the degassing of the earth's crust. Target organs of inorganic mercury include the kidney, nervous system, fetus, and neonate. This inorganic can be toxic to a fetus if the mother is exposed during pregnancy. Mercury is toxic to all cells in the body — it binds to enzymes in the cells and disrupts their function, usually causing the cell to be useless or die. Because this inorganic is concentrated in the kidney prior to excretion, the kidney is a major target organ for mercury ingestion. The primary target of mercury vapor is the brain. Some forms of mercury are drawn toward fats in the body (such as the nervous system), where it changes into its toxic form. This causes the nervous disorder known as Minimata disease, overexposure to mercury through ingestion of contaminated fish. The fish ingest inorganic mercury from an industrial discharge, and the inorganic form was metabolized to organic mercury. As listed in IRIS (search date 6/29/95), the D classification is based on inadequate human and animal data. Epidemiologic studies failed to show a correlation between exposure to elemental mercury vapor and carcinogenicity; the findings in these studies were confounded by possible or known concurrent exposures to other chemicals, including human carcinogens, as well as lifestyle factors (e.g., smoking). Findings from genotoxicity tests are severely limited and provide equivocal evidence that mercury adversely affects the number or structure of chromosomes in human somatic cells. USEPA set mercury's RfD to 0.0003 mg/kg-day (inorganic form). Mercury is liquid at room temperature, and is poorly absorbed in this form, if ingested. Typical daily exposure is less

than 1 μg/l-day. As listed in IRIS (search date 6/28/95), the critical effects of this chemical are hand tremor; increased in memory disturbances; and slight subjective and objective evidence of autonomic dysfunction. The uncertainty factor was 30 and the modifying factor was 1. The HEAST RfC is 0.0003 mg/m^3 (Klaasen et al., 1986; Dreisbach, et al., 1987).

Vanadium is not readily absorbed through the skin or oral ingestion and is a ubiquitous element. It is also a by-product of petroleum refining. Vanadium is soluble in fats and oils. Municipal water supplies contain 0.001 to 0.006 mg/l. The target organ is unclear, and the primary focus of toxicological information is inhalation of vanadium dust. Typical vitamin supplements contain approximately 0.010 mg in a daily dose. The RfD_o set by USEPA is 0.007 mg/kg-day.

Zinc is an essential, ubiquitous element present in food, water, and soil. The average American daily intake is approximately 12 to 15 mg, and the recommended daily allowance (RDA) is 15 mg. Excessive exposure to zinc is relatively uncommon and requires exposure to high concentrations. This element does not accumulate under chronic exposure conditions, and body content is self-regulated by zinc liver concentrations and absorption mechanisms. Inhalation of zinc dust can cause metal fume fever, and the primary effects of zinc ingestion (at toxic concentrations) are gastrointestinal disturbance and irritation. Other effects on the blood, liver, and kidney are possible at higher concentrations. Twelve grams of elemental zinc per day were not shown to elicit effects other than gastrointestinal disturbances over a two-day period. Experimental animals have been given 100 times the dietary requirements without discernible effects (Klaasen et al., 1986). As listed in IRIS (search date 6/28/95), the D classification is based on inadequate evidence in humans and animals. USEPA determined that the RfD_o is 0.3 mg/kg-day. As listed in IRIS (search date 6/28/95), the critical effect of this chemical is a 47% decrease in erythrocyte superoxide dismutase concentration in adult females after 10 weeks of zinc exposure.

Vinyl chloride is a volatile organic that can cause Raynaud's Phenomenon or white finger disease. It has been shown to cause angiosarcoma, a cancer. It has been also been associated with reproductive dysfunction in men and women. The primary target organs for noncarcinogenic effects are the liver, kidney, and nervous system. This compound inhibits one of the main metabolic pathways of the body (a group of enzymes), and can influence the toxicity of other compounds because of this effect. Due to the carcinogenicity of this compound, USEPA classified vinyl chloride as a class A carcinogen and set the SF_i and SF_o to 0.3 and 1.9 $(mg/kg\text{-}day)^{-1}$, respectively (Klaasen et al., 1986; Dreisbach, et al., 1987).

1,2-Dichlorobenzene is a CLP SVOC; however, it was evaluated for the inhalation pathway as a volatile due to its Henry's law constant (a measure of its likelihood to volatilize at a given temperature). This compound affects the CNS, causes liver and kidney damage, and irritates of the mucous membranes, skin, and eyes. USEPA set the RfD_o and RfD_i to 0.09 and 0.0571 mg/kg-day, respectively (Dreisbach et al., 1987).

1,3-Dichlorobenzene is a CLP SVOC, however, it was evaluated for the inhalation pathway as a volatile due to its Henry's law constant. This compound likely affects the CNS based on structural similarities to the other analogues addressed in this risk assessment. 1,3-Dichlorobenzene could cause liver and kidney damage, and irritates of the mucous membranes, skin, and eyes. USEPA set the RfD_o to 0.089 mg/kg-day (Dreisbach et al., 1987).

1,4-Dichlorobenzene is a CLP SVOC, however, it was evaluated for the inhalation pathway as a volatile due to its Henry's law constant. This compound affects the central nervous system, causes liver and kidney damage, and irritation of the mucous membranes, skin and eyes. This compound is classified by USEPA as a B2 carcinogen, with an SF_o of 0.024 $(mg/kg\text{-}day)^{-1}$. The RfD_i was set to 0.229 mg/kg-day. As listed in IRIS (search date 6/29/95), the critical effect of

this chemical is increased liver weights in P1 males. The uncertainty factor was 100 and the modifying factor was 1. The IRIS RfC is 0.8 mg/m^3 (Dreisbach et al., 1987).

Ethyl benzene is used as a solvent. Chronic exposure to ethylbenzene can cause dizziness, weight loss, weakness and/or numbness in the limbs, anemia, and nervousness. The target organ is the CNS. As listed in IRIS (search date 6/29/95), the D classification is based on a lack of animal bioassays and human studies. This compound is a volatile organic, and USEPA determined the RfD_o to be 0.1 mg/kg-day; the RfD_i was set to 0.286 mg/kg-day. As listed in IRIS, the critical effect of this chemical is liver and kidney toxicity. The uncertainty factor was 1,000 and the modifying factor was 1 (Dreisbach, et al., 1987).

4,4'-DDD, a by-product of the pesticide DDT, is a compound typical of halobenzene derivatives. It is soluble in fat, but not in water, and its target organ is the brain. This analog of DDT is the least toxic of the three primary DDT analogues (i.e., the least likely to cause cancer). Other DDD effects could include cell death in the liver, fatty change of heart muscles, and kidney damage. In a study mentioned in Dreisbach et al., no adverse health effects were observed in workers historically exposed to DDT who had up to 648 ppm DDT in their body fat. If an individual loses body fat, DDD concentrations are not stored at sufficient concentrations to induce toxic effects. This compound is listed as a B2 carcinogen, and USEPA set the SF_o for DDD to 0.24 (mg/kg-day)$^{-1}$ (Dreisbach et al., 1987).

Chlorobenzene, is a volatile organic that affects the CNS, causes liver and kidney damage and irritates the mucous membranes, skin, and eyes. As listed in IRIS (search date 6/28/95), the D classification is based on no human data, inadequate animal data, and predominantly negative genetic toxicity data in bacterial, yeast, and mouse lymphoma cells. USEPA set the RfD_o and RfD_i to 0.02 and 0.00571 mg/kg-day, respectively. As listed in IRIS, the critical effect of this

chemical is histopathologic changes in liver. The uncertainty factor was 1,000 and the modifying factor was 1 (Dreisbach et al., 1987).

Toluene is a gasoline additive, and is used as a solvent in glues, inks, adhesives; and is used as a detergent in the manufacture of dyes, lacquers, perfumes, pharmaceuticals, and saccharin. In humans, toluene is a known respiratory irritant with CNS, effects which can be enhanced by the ingestion of ethyl alcohol. Toluene has not been determined to be a carcinogen by USEPA, having a USEPA Classification of D. As listed in IRIS (search date 11/1/95), the classification is based on no human data and inadequate animal data. Toluene did not produce positive results in most genotoxic assays. The critical effect of this VOC is changes in liver and kidney weights in study organisms. USEPA determined the RfD_i and RfD_o to be 0.4 mg/m^3 and 0.01 mg/kg-day, respectively. As listed in IRIS, the RFD_o critical effect of this chemical is change in liver and kidney weights. The uncertainty factor was determined to be 1000 and the modifying factor was determined to be 1. The RFD_i critical effect of this chemical is neurological effects. The uncertainty factor was 300 and the modifying factor was 1 (Harte et al., 1991).

Xylene is widely used in industry and consumer products. This VOC is a building block for other solvents, plastics, and pharmaceuticals. Xylene is also used as a base for various pesticides, and is commonly found in paint, paint remover, nail polish, air fresheners, degreasing cleaners, lacquers, glues, and pens. Xylene targets the respiratory tract and the CNS, and the effects can be enhanced by the ingestion of ethyl alcohol. Xylene has not been determined to be a carcinogen by USEPA, having a classification of D. The critical effects of xylene in study organisms are hyperactivity, decreased body weight, and increased mortality. USEPA determined the oral RfD to be 2 mg/kg-day. As listed in IRIS (search date 11/1/95), the uncertainty factor was 100 and the modifying factor was 1 (Harte et al., 1991).

1,2-DCE, or 1,2-dichloroethene, is a halogenated hydrocarbon associated with toxicity to the mucous membrane, skin, lung, cornea (irritation), and liver. This compound is less toxic than its alkane counterparts, and is neither mutagenic nor carcinogenic. USEPA has no carcinogenicity listing for this compound. However, the RfD_o has been set to 0.009 mg/kg-day by USEPA (HEAST RfD_o for total 1,2-DCE). As listed in IRIS (search date 6/29/95), the critical effect of this chemical is increased serum alkaline phosphatase in male mice. The uncertainty factor was 1,000 and the modifying factor was 1. The IRIS RfD for trans-1,2-DCE is 0.02 mg/kg/day.

Aldrin, Isodrin are structurally similar pesticides. Risk estimates for isodrin were based on aldrin's toxicology. Although **endrin** has not been classified as a carcinogen by USEPA, aldrin is a B2 carcinogen. Therefore, using aldrin as a surrogate compound is more conservative than using endrin as a surrogate. Aldrin, a chlorinated pesticide, is metabolized into its epoxide form — dieldrin. Short-term exposure to high doses of aldrin and dieldrin causes tremors and convulsions. Chronic exposure can cause emotional and neuromuscular disturbances, and reproductive effects have also developed from overexposure to these pesticides. Aldrin accumulates in adipose tissue as an epoxide (i.e., in the form of dieldrin). Exposed individuals revert to normal approximately one week after the dieldrin source is removed (Dreisbach et al., 1987).

Dieldrin, discussed earlier, is structurally related to compounds (aldrin, chlordane, heptachlor, heptachlor epoxide, and chlorendic acid) which produce tumors in rodents. Aldrin's SF_o and RfD_o were set to 17 $(mg/kg\text{-}day)^{-1}$ and 0.00003 mg/kg-day, respectively. Aldrin is classified as a probable human carcinogen. When orally administered, aldrin produced significant increases in tumor responses in three different strains of male and female mice. Tumor induction has been observed for structurally related chemicals, including dieldrin (a metabolite). As listed in IRIS, the critical noncarcinogenic effect of this chemical is liver toxicity. For aldrin, the uncertainty factor and modifying factor were 100 and 1, respectively (IRIS search date 1/8/96).

Ta 4.1-1
Toxicological Database Information
for Chemicals of Potential Concern
Naval Air Station Pensacola
Pensacola, Florida

Non-Carcinogenic Toxicity Data

Chemical	Oral Reference Dose (mg/kg/day)		Conf. Level	Critical Effect	Uncertainty Factor Oral	Inhalation Reference Dose (mg/kg/day)		Conf. Level	Critical Effect	Uncertainty Factor Inhalation
Chemical	Oral Reference Dose (mg/kg/day)		Conf. Level	Critical Effect	Uncertainty Factor Oral	Inhalation Reference Dose (mg/kg/day)		Conf. Level	Critical Effect	Uncertainty Factor Inhalation
Aluminum	1	d				ND				
Aldrin	3E-05	a	M	liver toxicity	1000	ND				
Antimony	0.0004	a	L	increased mortality	1000	ND				
Arsenic	0.0003	a	M	hyperpigmentation	3	ND				
alpha-BHC	ND					ND				
Barium	0.07	a	M	increased blood pressure		0.000143	b			
Benzene	ND					0.00171	d			
Benzo(a)pyrene Equivalents	ND					ND				
Beryllium	0.005	a	L	microscopic organ changes	100	ND				
bis(2-Ethylhexyl)phthalate	0.02	a	M	increased liver weight	1000	ND				
Bromodichloromethane	0.02	a	M	renal cytomegaly	1000	ND				
2-Butanone	0.6	a				0.286	a			
Cadmium (food)	0.001	a	H	proteinuria	10	ND				
Cadmium (water)	0.0005	a	H	proteinuria	10	ND				
Carbazole	ND					ND				
Carbon tetrachloride	0.0007	a	M	liver lesions	1000	0.000571	d			
Chlorobenzene	0.02	a	M	liver changes	1000	0.00571	c			10000
Chloroethane	0.4	d				2.86	a	M	delayed fetal ossificatio	300
Chloroform	0.01	a	M/L	fatty cysts in liver	1000	ND				
Chloromethane	0.257	a	H	hepatotoxicity	300	0.257	a	H	hepatotoxicity	
Chromium (trivalent)	1	a	L		100/10	ND				
Chromium (hexavalent)	0.005	a	L		500	ND				
Copper	0.0371	b				ND				
Dibromochloromethane	0.02	a	M	renal cytomegaly	1000	ND				
1,1-Dichloroethane	0.1	b				0.143	c			
1,1-Dichloroethene	0.009	a	M	liver lesions	1000	ND				
1,2-Dichlorobenzene	0.09	a	M	liver necrosis	1000	0.09	b	M	whole body weight gain	1000
1,2-Dichloroethane	ND					0.00286	d			
1,2-Dichloroethene (cis)	0.01	b				ND				
1,2-Dichloroethene (total)	0.009	b	L	increased serum phosphatase	1000	ND				
1,3-Dichlorobenzene	0.089	d				ND				
1,4-Dichlorobenzene	ND					0.229	a	M	increased liver weight	100
4,4'-DDD	ND					ND				
Dieldrin	5E-05	a	M	liver lesions	100	ND				
Ethylbenzene	0.1	a	L	liver and kidney toxicity	1000	0.286	a		liver and kidney toxicity	1000
Heptachlor	0.0005	a	L	liver weight increase	300	ND				
Heptachlor epoxide	0.000013	a	L	liver weight increase	1000	ND				
Iron	0.3	d				ND				
Lead	ND					ND				
4-Methylphenol	0.005	b		CNS/respiratory distress	1000	ND				
Manganese (food)	0.047	a		neurological effects	1	ND				
Manganese (dietary exposure	0.023	a		neurological effects	1	1.43E-05	a	M	neurological effects	1000
Mercury	0.0003	a	M	CNS/memory disturbances	30	ND				
Methylene chloride	0.06	a	M	liver toxicity	100	0.857	a		liver toxicity	
Naphthalene	0.04	b				ND				
Nickel	0.02	a	M	decreased body weight	300	ND				
PCB Aroclor-1242	ND					ND				
PCB Aroclor-1254	2E-05	a				ND				
PCB Aroclor-1260	ND					ND				

Table 10.4.1-1
Toxicological Database Information
for Chemicals of Potential Concern
Naval Air Station Pensacola
Pensacola, Florida

Non-Carcinogenic Toxicity Data

Chemical	Oral Reference Dose (mg/kg/day)		Conf. Level	Critical Effect	Uncertainty Factor Oral	Inhalation Reference Dose (mg/kg/day)		Conf. Level	Critical Effect	Uncertainty Factor Inhalation
Pentachlorophenol	0.03	a	M	fetotoxicity	100	ND				
Silver	0.005	a	L	argyria	3	ND				
1,1,2,2-Tetrachloroethane	ND					ND				
Tetrachloroethene	0.01	a	M	hepatotoxicity	1000	ND				
Toluene	0.2	a	M	increased liver weight	1000	0.114	a		neurological effects	300
Toxaphene	ND					ND				
1,1,1-Trichloroethane	0.035	d				0.286	d			
Trichloroethene	0.006	d				0.006	d			
Vanadium	0.007	a		unclear	100	ND				
Vinyl chloride	ND					ND				
Xylene	2	a	M	hyperactivity, mortality	100	ND				
Zinc	0.3	a	M	decreased enzyme levels	3	ND				

NOTES:
a Integrated Risk Information System (IRIS)
b Health Effects Assessment Summary Tables (HEAST)
c HEAST alternative method
d EPA Environmental Criteria and Assessment Office - Cincinnati (provisional)
ND Not determined due to lack of information

10.5 Ecological Risk Assessment

10.5.1 Introduction

Ecological risk is assessed to determine the actual or potential effects to ecological receptors due to contamination. At OU 2, the specific focus is on the terrestrial ecosystem. This assessment considers surface soil contaminant concentrations and distributions, media-specific physicochemical conditions, and exposure pathways which could result in unacceptable concentrations of exposure to ecological receptors now or in the future. Lacking aquatic habitat, only surface soil was assessed at OU 2. The approach to this assessment is based on USEPA's *Risk Assessment Guidance for Superfund Volume II — Environmental Evaluation Manual* (1989d) and USEPA's *Framework for Ecological Risk Assessment* (USEPA/630/R-92/001)(USEPA, 1992e).

10.5.2 Problem Formulation

Site Description

OU 2 is an industrial area consisting of 11, 12, 25, 26, 27, and 30, described in Section 2. Figure 2-1 offers the location of each site.

Ecosystem at Risk

At most of OU 2, no quality habitat is available. The grass between roads and buildings could be used by terrestrial receptors such as passerine birds and/or small mammals as foraging areas, but their occurrence would be transient or opportunistic. Overall, no viable terrestrial community exists at OU 2 except for Site 11. Since Site 11 was filled with dredge spoil, opportunistic grasses and small shrubs have acquired the area and offer foraging and possible nesting habitat for passerine birds and small mammals. Adjacent to OU 2 are wetland complexes and estuary embayments.

Ecological Chemicals of Potential Concern

For ecological risk, only the results from surficial soil (0 to 1 foot bls) are addressed. It is presumed, even considering root development in the lower strata, that most biological effects will be limited to surficial soil.

Inorganic parameters detected in site surface soil exceeding twice the maximum concentration detected in reference sample concentrations, or not detected in reference samples, are identified as ecological chemicals of potential concern (ECPCs). Any organic constituent detected in greater than 5% of the samples was considered an ECPC.

Calcium, magnesium, potassium, and sodium were not assessed as they are naturally occurring nutrients. Soil contaminants were identified from the soil sampling data generated during the RI. Each analyte group is summarized below.

VOCs

Only subsurface soil VOC exceedances occurred at OU 2.

SVOCs

Seven SVOCs were identified in the surface soil at OU 2 with a concentration above established PRGs. The SVOCs detected were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Surface soil SVOC exceedances are summarized in Appendix E, Figure 6.

Pesticides and PCBs

One pesticide and three PCBs were identified in the surface soil at OU 2 with concentrations exceeding established PRGs. The PCBs detected were Aroclor-1242, Aroclor-1254, and

Aroclor-1260. The only pesticide detected with a concentration above established PRGs was dieldrin. Surface soil pesticide and PCB exceedances are detailed in Appendix E, Figure 8.

Metals

To be consistent with the USEPA's drinking water standards for inorganics, the soil inorganics (metals) have been subdivided into two similar categories identified as primary metals and secondary metals. Primary metals in soil include antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, sodium, thallium, vanadium. Secondary metals in soil include aluminum, copper, iron, manganese, silver, zinc.

Primary Metals: Eight primary metals were identified in the surface soil at OU 2 with concentrations above established PRGs. The primary metals detected were antimony, arsenic, barium, cadmium, total chromium, hexavalent chromium, lead, and mercury. Exceedances are summarized in Appendix E, Figure 10.

Secondary Metals: Six secondary metals were identified in the surface soil at OU 2 with concentrations above established PRGs. The secondary metals detected were aluminum, copper, iron, manganese, silver, and zinc. Exceedances are summarized in Appendix E, Figure 12.

Radiation

A preliminary radiological screening was completed across OU 2. The measuring surface gamma radiation anomalies at the six sites. During the field investigation, numerous soil samples were collected from surface soil for both standard laboratory analysis and for radiological analysis. Radiological sampling was focused in areas that had gamma anomalies detected in the preliminary sampling. Based on the results of the preliminary radiological screening and results of the laboratory analysis, Site 12 had the most extensive radiological impact to surface soil. Laboratory analysis revealed the presence of Ra-226 in five surface (0 to 1 foot) soil samples collected in

Site 12. Various pieces of contaminated metal debris were recovered during Site 12 soil sampling. Sections 4 and 5 and Appendix D discuss procedures, results, and analysis of the preliminary radiological screening and subsequent analytical results from OU 2.

Stressor Characteristics

Metals

In general, heavy metals adversely affect survival, growth, reproduction, development, and metabolism of both terrestrial and aquatic invertebrate species, but effects are substantially modified by physical, chemical, and biological variables. Most heavy metals do not biomagnify. In contact tests with terrestrial earthworms, the order of toxicity for heavy metals from most toxic to least toxic was copper > zinc > nickel = cadmium > lead (Neuhauser, 1986).

Arsenic occurs naturally and, with respect to cycling in the environment, is constantly changing its chemical form. Many inorganic arsenicals are known teratogens and are more toxic than organic arsenicals (Eisler, 1988). Soil biota appear to be capable of tolerating and metabolizing relatively high concentrations (microbiota to 1,600 ppm) of arsenic (Wang et al., 1984).

Cadmium is a relatively rare heavy metal. It is a known teratogen, carcinogen, and possible mutagen, and has been implicated as the cause of severe deleterious effects on fish and wildlife (Eisler, 1985). Birds and mammals are comparatively resistant to the biocidal properties of cadmium.

Hexavalent chromium produces more adverse effects to biota than does the trivalent phase. In clayey sediments, trivalent chromium dominates and benthic invertebrate bioaccumulation is limited (Neff et al., 1978). The solubility and potential bioavailability of waste chromium added to soil through sewage sludge are modified by soil pH and organic complexing substances

(James and Bartlett, 1983). As stated in Section 7, no hexavalent chromium was found in surface soil.

Copper is an essential micronutrient, and therefore, it is readily accumulated by aquatic organisms. It is a broad spectrum biocide, which may be associated with both acute and chronic toxicity. Little information exists on copper chemistry in soil.

In soil, lead concentrates in organic-rich surface horizons (NRCC, 1973). Estimated residence time of lead in soil is about 20 years (Nriagu, 1978).

No information was available on the toxicological effects associated with antimony, barium, beryllium, cobalt, nickel, selenium, silver, vanadium, or zinc contamination in soil.

Organics

PAH vary by molecular weight. With increasing molecular weight, aqueous solubility decreases and the partition coefficient (log K_{ow}) increases, suggesting increased solubility in fats, a decrease in resistance to oxidation and reduction, and a decrease in vapor pressure (Eisler, 1987). Accordingly, PAHs of different molecular weight vary substantially in their behavior and distribution in the environment and in their biological effects. In water, PAHs either evaporate, disperse into the water column, become incorporated into sediments or undergo degradative processes such a photo-oxidation, chemical oxidation, and biological transformation by bacteria and animals (Neff, 1979).

Most environmental concern has focused on PAHs that range in molecular weight from 128.16 (naphthalene) to 300.36 (coronene). Generally, lower molecular weight (LMW) PAH compounds, containing two or three aromatic rings, exhibit significant acute toxicity but are not carcinogenic. High molecular weight PAH compounds, four to seven are significantly

less toxic, but are demonstrably carcinogenic, mutagenic, or teratogenic to aquatic species. PAHs show little tendency to biomagnify in food chains because most are rapidly metabolized (Eisler, 1987). Very little information is available on food chain adverse effects as a result of soil PAH contamination.

Organochlorine pesticides have been used extensively in the U.S. since the 1940s. They appear to be ubiquitous in the environment being found in soil, surface water, sediment, and biological tissue. They are readily absorbed by warm-blooded species and degradatory products are frequently more toxic than the parent form. Food chain biomagnification is usually low, except in some marine mammals. In soil invertebrates, organochlorine pesticides can accumulate to concentrations higher than those in the surrounding soil, and residues may in turn be ingested by birds and other animals feeding on earthworms (Beyer and Gish, 1980). Most environmental effects studies have been directed at mammals and birds.

PCBs are distributed worldwide with measurable concentrations recorded in fishery and wildlife resources from numerous locations (Eisler, 1986). They are known to bioaccumulate and to biomagnify within the food chain and to elicit biological effects such as death, birth defects, tumors, and a wasting syndrome. In terrestrial environments, PCBs are rapidly metabolized from the soil into the terrestrial food chain (McKee, 1992). Subsoil-dwelling organisms may directly absorb PCBs and food chain transfer to lower-level vertebrate species can potentially occur.

10.5.3 Conceptual Model

Pathways and Exposure Scenarios

Due to the physical nature of soil found across NAS Pensacola, contaminants in surface soil will not remain adsorbed to soil particles to undergo degradation, but migrate downward. In addition, contaminants sorbed to surface soil conceivably could be transported via air or surface water runoff. However, both pathways are unlikely as major routes. Migration via air pathways could

be significant as it relates to dispersal of upper soil layer particles during windy conditions. Contaminants are not expected to spread far via surface runoff based on the low-relief topography at the site and permeable nature of the substrate. The low cation exchange capacity of contaminants to soil particles and limited organic material limits soil adsorption.

The primary soil exposure pathway for terrestrial receptors at OU 2 will be through direct contact with surface soil. To faunal organisms, this would be via direct dermal contact and, to a lesser extent, through ingestion of soil particles. Small mammals could contact contaminated soil if the area is used as a migratory corridor or if animals burrow into the soil. The contact time, and thus exposure, will be limited when animals are crossing the area but could be lengthy if burrows are established. Dermal contact by small reptiles and amphibians would be similar to that for mammals. Although insect populations within the area appear to be limited, direct exposure to ground-dwelling species could provide a link for contaminant transfer to higher-level predators. Soil infaunal invertebrates may absorb or ingest particle-bound contaminants during normal feeding and life-cycle activities.

Understory plants could likely incorporate certain detected parameters (metals) through processes such as uptake/accumulation, translocation, adhesion, or biotransformation. Herbivores could ingest plant-borne constituents.

10.5.4 Ecological Effects Assessment

Risks to terrestrial receptors has been based on the potential for adverse ecological effects to soil infaunal invertebrates from identified ECPCs. Because soil MCLs are unavailable for effects levels, predictions are based on available literature. Effects studies are used for comparative qualitative assessments only. This assessment assumes that if effects to lower-level invertebrates are not potentially occurring, then upper-level vertebrate species will be affected.

10.5.5 Risk Characterization

Exposure Analyses

Studies of metal toxicity to terrestrial receptors have been directed at infaunal ecosystems. Information on relative metal toxicities to earthworms was provided by Roberts and Dorough (1984) where, along with 90 other chemicals, three metal salts (cadmium chloride, copper sulfate and lead nitrate) were tested. The results showed that these heavy metal salts fell into the "very toxic" category, with LC_{50} values in the 10 to 100 $\mu g/cm^2$ range (Table 10-5.5-1). Although these concentrations (more specifically, application doses) may be relative to earthworms, it is improper to apply them to upper-level trophic species. Studies indicate that some degradation products become increasingly more toxic to earthworms and less toxic to upper-level vertebrates such as birds.

Other studies on toxicities of metal salts to earthworms have been conducted by Neuhauser et al., (1985) and Malecki et al. (1982). In the former study, metal nitrate compounds were relatively toxic to earthworms in the order: copper > zinc > nickel > cadmium > lead. Mean LC_{50} values were 643, 662, 757, 1,843 and 6,000 ppm, respectively. In the latter study, six chemical forms of each metal were chosen to cover a broad range of solubility and to represent the forms likely to be found in the soil. Overall, cadmium was most toxic followed by nickel, copper, zinc, and lead. It appears obvious from the results of these two studies that the form of the metal in soil in a major consideration in judging effects of metal concentrations on soil biota.

Parmelee et al. (1993) found that total nematode/microarthropod (mostly mites) numbers declined in soil having copper concentrations exceeded 200 ppm; omnivore-predator nematodes and specific microarthropod groups were significantly reduced at 100 ppm copper. Strait (1984) found that populations of the mite *Platynothrus peltifer* decreased in soil containing 200 ppm copper, but six other species did not.

Table 10.5.5-1
Summary of Chemical Effects Studies on Terrestrial Infaunal Invertebrates

Study	Organisms	Measured Parameter	Effects Level	Measured Response
Parmelee et al. (1993)	Nematode/microarthropods	Copper	200 ppm	Significant decline in numbers
Neuhauser et al. (1985)	Earthworm *Eisenia foetida*	Copper salts	643 ppm	LC_{50}
		Zinc salts	662 ppm	LC_{50}
		Nickel salts	757 ppm	LC_{50}
		Cadmium salts	1843 ppm	LC_{50}
		Lead salts	5000 ppm	LC_{50}
Roberts & Dorough (1984)	*Eisenia foetida*	Cadmium chloride	10-100 $\mu g/cm^2$	LC_{50}
		Copper sulfate	10-100 $\mu g/cm^2$	LC_{50}
		Lead nitrate	10-100 $\mu g/cm^2$	LC_{50}
Malecki et al. (1982)[4]	*Eisenia foetida*	Cadmium	250 ppm	Growth difference to control
		Nickel	440 ppm	Growth difference to control
		Copper	1320 ppm	Growth difference to control
		Zinc	2800 ppm	Growth difference to control
		Lead	21,600 ppm	Growth difference to control
Strait (1984)	Mite *Platynothrus peltifer*	Copper	200 ppm	Population decrease
van Straalen et al. (1989)	Mites	Cadmium	> 128 ppm	Mortality

Table 10.5.5-1
Summary of Chemical Effects Studies on Terrestrial Infaunal Invertebrates

Study	Organisms	Measured Parameter	Effects Level	Measured Response
McKee (1992)	Terrestrial epigeic[b] invertebrates	PCBs	120,000 ppm	No community structure effects
Callahan et al. (1991)	Earthworms *L. terrestris*	DDT	400 ppb	No detectable concentration in
		DDD	700 ppb	tissue from soil concentrations
		DDE	200 ppb	
Menzie et al. (1992)	*E. foetida*	DDT	1,000 [4,000][c] ppb	Survival; no effect for LC_{50} test
		DDD	1,000 [12,000][c] ppb	
		DDE	1,000 [2,000][c] ppb	
Miller et al. (1985)	Earthworm	Copper	544 ppm	EC_{50}
		Zinc	528 ppm	EC_{50}
	Radish (seed germination)	Copper	47 ppm	EC_{50}
		Zinc	53 ppm	EC_{50}
	Cucumber (seed germination)	Copper	55 ppm	EC_{50}
		Zinc	61 ppm	EC_{50}
	Microtox (15 min.)	Copper	0.28-0.42 ppm	Photo reduction
		Zinc	1.6 ppm	Photo reduction
Paine et al. (1993)	Crickets *Acheta domesticus*	PCB	1200 ppm	LC_{50}
Rhett et al. (1988)	*Eisenia foetida*	PCB	240 ppm	LC_{50}

Notes:
a = Growth effects levels are average of at least five of six compounds: metal acetate, metal carbonate, metal chloride, metal nitrate, metal oxide, and metal sulfate
b = Carabidae, entobeyidae, formicidae, gryllidae, and staphylinidae
c = Average soil concentrations maximum values.

Van Straalen et al., (1989) found that soil-borne cadmium caused significant mortality to mites only in the highest exposure groups (512 ppm). At the next highest concentration, 128 ppm, very little mortality effects were observed.

Metal concentrations observed in surface soil at OU 2 are well below concentrations cited in the literature as producing negative effects to infaunal invertebrates. Even considering metal forms that could be available, it does not appear that metal concentrations onsite present a risk to lower-level terrestrial receptors.

Little information exists on the toxic effects to terrestrial organisms from VOCs. Primarily, the only information available are effects studies related to human health from inhalation of specific compounds by laboratory animals. Impact from the limited occurrence and low concentrations of volatile compounds observed across the site is difficult to assess, but it is predicted that no effects to terrestrial species will occur.

Although some of the semivolatiles found in soil are considered carcinogenic to mammals, very few field studies focus on their toxicity to terrestrial fauna. Generally, PAHs breakdown in natural systems via photodegradation and microbial transformation. Neuhauser et al., (1986) found that specific phenol compounds (4-nitrophenol, 2,4,6-trichlorophenol, phenol) were somewhat toxic to earthworms, with PAHs being relatively less toxic than other semivolatile compounds studied. Their study found that artificial soil tests produced LC_{50} values for fluorene and phenol near 200 ppm and 50 to 100 ppm, respectively. Callahan et al., (1994) found similar results in their study on toxicity of 62 chemicals to several earthworm species. Fluorene is considered to be acutely toxic at certain concentrations but it is not considered a carcinogen. It is important to note that measured field sampling variability and soil chemical matrices can greatly influence toxicological effects of PAH compounds.

A low risk to infaunal communities from PAH concentrations in OU 2 surface soil is predicted based on the spatial infrequency of detection and relatively low concentrations observed. The highest accumulative concentration of 1,194 ppb at location 05S0007 is below concentrations of significant effect found by Neuhauser et al., (1986) (i.e., >200 ppm) or Callahan et al., (1994) (i.e., 200-300 ppm). Most compounds observed at this location were high molecular weight PAHs and would not be prone to accumulation by lower-level invertebrate species.

Most toxicological studies on terrestrial infaunal organisms have been directed at measuring pesticide effects. Earthworm toxicology and response information is the most prevalent. In a study by Beyer and Gish (1980), persistence of DDT, dieldrin, and heptachlor were observed in earthworms from field study plots. Investigators agree that earthworms can accumulate pesticides to concentrations found in residence soil. Callahan, et al., (1991) showed very good soil-to-tissue correlation ® = 0.725) with accumulation of DDT in single earthworms up to 22 ppm. Beyer and Gish (1980) found that earthworms accumulated DDT(R) to 32 ppm. Barker (1958) associated poisoning (lethality) of robins with 60 ppm DDT(R) in earthworms, and Collett and Harrison (1968) found that blackbirds and thrushes were impacted at residues near 20 ppm. At concentrations observed in their study, Callahan et al., (1991) suggested that a feeding rate by robins of 10 to 12 earthworms in as many minutes (as observed by McDonald, 1983) could provide a sufficient concentration of contamination for impacts to robins. Callahan et al., (1991), also found that chlordane, as other pesticides, was taken up rapidly by earthworms. In Callahan et al., (1991), total DDT concentrations greater than 1,000 ppm in soil, along with documented long half-life information (5.7 years DDT), indicated a long-term significant risk to receptors.

Total pesticide concentrations at OU 2 never exceeded 304 ppb. When compared to Callahan et al. (1991) results (i.e., DDT concentrations > 1,000 ppm), it appears that pesticide

concentrations in surface soil presents no risk to infaunal species. Information on risks to reptile and amphibians is limited and, therefore, risk to these receptors has not been determined.

Risk factors associated with PCBs in soil are similar to those for pesticides. After acute mortality, food chain biomagnification and transfer are the most important issues to be considered when assessing long-term risk. Concentrations at OU 2 (maximum concentration = 57 ppb) are well below the 100 to 300 ppm range indicated by Paine et al., (1993) as a benchmark value for mortality in terrestrial insects. Also, Rhett et al., (1988) observed LC_{50} values for earthworms treated with PCBs at 240 ppm. McKee (1992) reported that community structure was not reduced by exposure to PCB-contaminated soil (maximum concentrations to 120,000 ppm wet weight) based on family level classification of invertebrates.

Except for Site 12, radiation concentrations in surface and subsurface soil at OU 2 did not exceed background and are not expected to pose significant risk to resident biota. The elevated gamma anomalies at Site 12, however, will likely require removal of contaminated media, rendering the assessment of ecological risk from such contamination irrelevant.

Most toxicological information reviewed for this risk assessment dealt with earthworms and other infaunal species. Although the presence of these species was not specifically verified for OU 2, it is assumed that alternate infaunal species which occupy this ecological niche should be similar and therefore comparison to toxicological concentrations presented is relative and applicable.

Typically, adverse effects to upper-level invertebrate and vertebrate species will occur at concentrations exceeding those indicated by the previously discussed soil infaunal studies. Metals appear to be the most significant contamination across the site. In general, metal biotransfer to upper-level species does not occur and, considering the low risk predicted with respect to invertebrate communities, direct soil contact risks to vertebrate species will be negligible.

Characterization of Ecological Effects

Exposure risk to terrestrial species near OU 2 is relatively very low considering the potential for effects to lower-level infaunal species. Biotransfer of contaminants up the food chain will not be a concern as contaminants are not at concentrations indicative of accumulation. Low soil concentrations and limited distribution of contaminants will limit the incidental ingestion risk to acceptable concentrations for locally foraging bird species.

10.5.6 Uncertainty

- Field sampling design (sample locations selected) may lend itself to uncertainties based on the subjective decisions that are necessary and unavoidable.

- Analytical uncertainties exist based on field and laboratory methods employed, but quantification of these is impossible.

- Synergistic or antagonistic relations between contaminants cannot be accounted for, especially when methods employing contaminant-specific benchmark comparisons are used.

- A lack of criteria or screening values for many chemicals compounds the uncertainty for screening level assessments.

- Toxicological effects studies may be different at individual versus community levels.

- Extrapolation of literature generated effects levels to onsite species and communities may not be appropriate.

11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

OU 2 has been an industrial area supporting supply, maintenance, and disposal activities for more than 40 years. The contaminants within OU 2 appear to be limited to the surface and subsurface soils, the surficial aquifer, groundwater to surface water discharge, and areas where point source or non-point source storm water discharges occur (e.g. wetlands). Current and potential receptors include:

- The surficial zone of the Sand-and-Gravel Aquifer, which is currently not in use due to taste and odor characteristics.

- The main producing zone of the Sand-and-Gravel Aquifer, which is used as a potable water source in Escambia County and underlies the surficial zone but is separated from it by a confining clay unit.

- NAS Pensacola Wetland 5A, which receives runoff from the southwestern portion of the OU 2 area (Site 30).

- NAS Pensacola Wetland 5B, which drains Wetland 5A to Wetland 6 (Sites 36, 25, and 27).

- The concrete-lined drainage ditch, also known as NAS Pensacola Wetland 6.

- The Yacht Basin, an arm of Bayou Grande, which receives runoff and groundwater flow from the areas of Sites 11, 12, 25, and 26.

The low permeability clay layer between the surficial and main producing zones may inhibit any downward contaminant migration into the deeper groundwater below the clay. The coastal waters

of surrounding NAS Pensacola have been classified by the Florida Department of Environmental Protection as Class III water, indicating their use for recreation and maintenance of a well-balanced fish and wildlife population. Potential ecological impacts on wetland areas adjacent OU 2 and Bayou Grande, will be addressed in separate upcoming RI/FSs for Bayou Grande (Site 40), and the NAS Pensacola Wetlands (Site 41).

This remedial investigation revealed the following results.

Site 11

The source of contamination was identified to be a former landfill, where trenching revealed evidence of a "seam" of blackened debris right at the water table. This oily material contained finely corroded bits of metal and other debris.

The BRA identified soil inorganic COPCs at Site 11 to include arsenic, beryllium, cadmium, chromium, and iron. Soil organic COPCs include Aroclor-1260 and BEQs. Groundwater inorganic COPCs include arsenic and beryllium. Groundwater organic COPCs include 1,2-DCE, aldrin, chloroform, 1,2-DCA, dieldrin, 1,1,2,2-tetrachloroethane, PCE, TCE, and vinyl chloride.

Site 12

The source of contamination at Site 12 is a storage yard for scrap materials include scrap metal of all types, aircraft, tires, used furniture, and a large amount of electronics. This material is resold as used equipment or for its scrap value. Site 12 soil exceedances mainly included primary/secondary metals, PCBs, and SVOCs. Though none were noted during the field investigation, past storage of old transformer pending their disposal are a possible contributor to the PCB contamination found at Site 12. Residual fuels and oils from aircraft and vehicles stored at the site are possible sources of SVOCs at Site 12.

The BRA identified soil inorganic COPCs at Site 12 to include arsenic, cadmium, and iron. Soil organic COPCs include Aroclor-1260 and BEQs. In addition, soil samples contained radium in amounts equal to four orders of magnitude greater than the standard in 40 CFR 192.12. These numbers are so high that a risk assessment is inappropriate. Immediate action should be taken to remove radium from the site. COPCs identified in groundwater included Aroclor-1260, chloroform, 1,1-DCE, dieldrin, heptachlor epoxide, and PCE.

Site 25

Site 25, was officially investigated as a radium spill area, based on former activities associated with Building 780. No radium was found at Site 25. However, Building 780, which currently houses the Joint Oil Analysis Laboratory, is the source of contamination found at Site 25. This activity analyzes oil samples from vehicles and aircraft from military activities nationwide. Soil samples collected behind this building revealed a wide range of primary/secondary metals and SVOC contamination. Shallow wells next to the building contained primary and secondary metals, and an adjacent intermediate depth well contained metals, as well as chlorinated solvents, benzene and xylene. Improper storage and disposal of materials at Building 780 are likely the sources of soil and groundwater contamination at this location. Another location of concern at Site 25 is the storage yard behind Building 225, used as a metal prefabricating shop by the NAS Pensacola PWC. This yard contains racks of metal sheeting, piping, etc. Shallow and intermediate wells located here contained numerous primary and secondary metals exceedances, as well as PCE and TCE. Activities in and around this building are a likely source for contamination in these wells.

The BRA identified soil inorganic COPCs at Site 25 to include arsenic, beryllium, cadmium, chromium, and iron. Soil organic COPCs include Aroclor-1254, Aroclor-1260, BEQs, and dieldrin. All inorganic COPCs associated with elevated HIs in Site 25 groundwater were eliminated from the risk assessment based on comparison of Phase I and Phase II groundwater

data. Groundwater organic COPCs include reported groundwater concentrations of chlorinated VOCs (1,1-DCE, chloroform, PCE, TCE, and vinyl chloride).

Site 26

No significant contamination was detected at Site 26. No inorganics contributed to risk in Site 26 soil. BEQs in Site 26 soil samples generally equate with a risk of close to 1E-06. Groundwater inorganic COPCs include arsenic, beryllium, and cadmium. Groundwater organic COPCs include dieldrin, and PCE.

Site 27

At Site 27, the focus of the investigation was located on the slab of the former building 709. SVOC exceedances were noted from wells previously installed by ABB, Inc., in support of UST removals at this location. The former USTs are likely contributors of contamination in these wells.

The BRA identified soil inorganic COPCs at Site 27 to include aluminum, arsenic, cadmium, chromium, iron, and mercury. Soil organic COPCs included dieldrin and BEQs. In groundwater, chromium, iron and manganese contributed to a cumulative HI. Groundwater organic COPCs reported concentrations of chlorinated VOCs, including 1,4-dichlorobenzene, 1,1-DCE, 1,2-DCA, dieldrin, chloroform, PCE, and TCE, are associated with risk projections ranging from 1E-06 to 6E-04.

Site 30

At Site 30, numerous former ABB, Inc. wells associated with previous UST removals revealed chlorinated solvents and benzene exceeding PRGs. E/A&H wells installed on the western side of this complex revealed SVOC and VOC exceedances. Above ground storage tanks at this complex, the former USTs, and associate buried piping are considered sources for this contamination.

Several former ABB, Inc. wells in and around Building 3220 exhibited benzene, chlorinated VOC, and phenol exceeding PRGs. Also, former ABB, Inc. wells south of Building 3450 exhibited phenol above PRGs. An E/A&H shallow well (30GS154) located on the north side of Building 3450 exhibited vinyl chloride and xylene above PRGs.

The BRA identified soil inorganic COPCs at Site 30 to include arsenic, and beryllium. Soil organic COPCs include BEQs, and PCBs. Groundwater inorganic COPCs include arsenic, cadmium and chromium. Groundwater organic COPCs include benzene, chloroform, 1,1-DCE, 1,4-dichlorobenzene, PCE, and 1,1,1-TCA. In addition to noting the risk associated in and around previous UST removals in the Site 30 area of investigation, the BRA noted that groundwater concentrations of vinyl chloride contributed significantly to elevated risk at locations represented by monitoring well 30GS154, just north of Building 3450.

Along the IWTP sewer line (Site 36) contamination was found adjacent the former hazardous materials accumulation area located at the former Building 3189. The intermediate well (30GI111) adjacent the southwest corner of this building exhibited chlorinated VOCs, benzene, iron, manganese, and sodium above PRGs. Samples from well 30GS103 installed in a fenced storage yard directly north Building 3644 (a former NADEP building), contained primary/secondary metals contamination, as well as chlorobenzene. Nearby well 30GS101 contained xylene and benzene. The contamination in 30GS103 is likely attributable to NADEP activities at Building 3644. Well 30GS101 is adjacent the IWTP, and may be impacted from IWTP activities. Chlorobenzene and toxaphene were detected at well 30GS123, near a lift station for the IWTP sewer line. Past spills from this lift station are the likely sources of this contamination. Also, the BRA found that groundwater concentrations of arsenic, benzene, 1,4-dichlorobenzene, and vinyl chloride contribute significantly to elevated risk while chlorobenzene and iron contributed significantly to elevated HIs at the location represented by monitoring well pair 30GS111 and 30GI111, near the former Building 3189 (activities surrounding this building are described in

Section 7.5). Other than 30GI111, for Site 36, the BRA only addressed soil boring 30S102, north of the Building 3644 complex, reporting elevated risk concentrations for BEQs.

11.2 Recommendations

No data gaps are noted that require additional fieldwork or analysis to complete this investigation and provide the basis for the feasibility study. The soil data offer sufficient analytical quantitation and distribution to assess the nature and extent. Soil exceedances due to metals, pesticides, PCBs, and SVOCs represent a risk that will need to be addressed by the feasibility study. Metals represent the largest proportion of the risk from soil. No VOCs detected pose any risk due to a soil exceedance. SVOCs and pesticide/PCB compounds represent a minor part of the cumulative soil risk.

Phase I groundwater sampling data are inappropriate to evaluate nature and extent due to turbidity. However, Phase I data were used to focus Phase II sampling on the locations with the highest concentrations to verify their presence. Phase II sampling confirmed the presence of inorganics, SVOCs, and VOCs to be addressed by the FS. These COCs exhibit a risk greater than 1E-6 and should be considered in the feasibility study. Three volatiles and two metals represent 90% of the risk to groundwater. Since no trend analysis is available, groundwater should be monitored quarterly before remedial design. The specific capacity used to calculate hydraulic conductivity is a rough order of magnitude estimate and should be amended with pumping tests to provide information during remedial design. The current pairing and distribution of monitoring wells appear to offer sufficient coverage to monitor trends effectively.

The low-level radiological waste encountered at Sites 12 and 27 will be remediated by the Naval Sea Systems Command RASO. RASO will be responsible for assessing, containing, packing, transporting, and disposal of any low-level radiological wastes. As a result, the FS will not be concerned with alternatives for low-level radiological wastes at these sites.

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13.0 FLORIDA PROFESSIONAL GEOLOGIST SEAL

I have read and approve of this Final Remedial Investigation Report, NAS Pensacola OU 2 and seal it in accordance with Chapter 492 of the Florida Statutes. In sealing this document, I certify the geological information contained in it is true to the best of my knowledge and the geological methods and procedures included herein are consistent with currently accepted geological practices.

Name:	Henry H. Beiro
License Number:	#1847
State:	Florida
Expiration Date:	July 31, 1998

Henry H. Beiro

Henry H. Beiro

10-10-97

Date

Appendix A

IRA TCLP Analyses

Navy Public Works Center
Environmental Laboratory

Bldg.3297, Code 920
NAS Pensacola, Fl. 32508-6500
Phone 904-452-3642/4758
Autovon 922-3642

Laboratory Report
TCLP Metals

Requester:	NPWC Environmental	Lab ID Number:	9408273 B
Address:	Bldg. 3691	Sample Date:	16 Aug 94
	NAS Pensacola, FL 32508	Received Date:	16 Aug 94
Phone #:	452-3043	Sample Site:	NAS Pensacola
Contact:	Chad Berthelson	Job Order #:	160 6001

Sample ID#	Lab	1- 5628	2-	3-	4-	Analyst(s):
Sample Name	Requester	IR Site 30				Jim Taylor
Collector Name		C. Berthelson				Brian Nelson
Date/Time	Comp start					ATI - Hg
Collected	Comp stop					Date(s) of analysis:
(Military)	Grab	16 Aug 94 @ 1300				Various
Sample Type	Comp/Grab	Grab				
Sample Matrix		TCLP Extract				

PARAMETER	SW-846	ID#		Det.	ID#		Det.	ID#		Det.	ID#		Det.	
TCLP Metals:	METHOD #	1- 5628	units	Limit	2-	units	Limit	3-	units	Limit	4-	units	Limit	Preservative(s)
Arsenic(As)	EPA 6010A	X	<0.5 mg/l	0.5		mg/l	0.5		mg/l	0.5		mg/l	0.5	None
Barium(Ba)	EPA 6010A	X	<1.0 mg/l	1.0		mg/l	1.0		mg/l	1.0		mg/l	1.0	None
Cadmium(Cd)	EPA 6010A	X	0.7 mg/l	0.1		mg/l	0.1		mg/l	0.1		mg/l	0.1	None
Chromium(Cr)	EPA 6010A	X	<0.5 mg/l	0.5		mg/l	0.5		mg/l	0.5		mg/l	0.5	None
Lead(Pb)	EPA 6010A	X	2.5 mg/l	0.5		mg/l	0.5		mg/l	0.5		mg/l	0.5	None
Mercury(Hg)*	EPA 7470	X	<0.0002 mg/l	0.02		mg/l	0.02		mg/l	0.02		mg/l	0.02	None
Selenium(Se)	EPA 6010A	X	<1.0 mg/l	0.1		mg/l	0.1		mg/l	0.1		mg/l	0.1	None
Silver(Ag)	EPA 7761	X	<0.0005 mg/l	0.5		mg/l	0.5		mg/l	0.5		mg/l	0.5	None

Comments: **mg/l=milligrams per liter. * - Analysis performed by ATI.**

TCLP limits are: Arsenic<5, Barium<100, Cadmium<1, Chromium<5, Lead<5, Mercury<0.2, Selenium<1, Silver<5.

Approved by: Jerry Dees, Laboratory Director

Date/Time: 07-Sep-94 08:58

End of Report

PWC 5090/14

Navy Public Works Center
Environmental Laboratory

Bldg.3297, Code 920
NAS Pensacola, Fl. 32508-6500
Phone 904-452-3642/4758
Autovon 922-3642

Laboratory Report
F001-F005 Solvents

Requester: NPWC Environmental
Address: Bldg. 3691
NAS Pensacola, FL 32508
Phone #: 452-3043
Contact: Chad Bertheison

Lab ID Number: 9408273 A
Received Date: 16 Aug 94
Sample Site: NAS Pensacola
Job Order #: 160 6001

Sample ID#	Lab	1- 5628	2-	3-	4-
Sample Name	Requester	IR Site 30			
Collector Name		C. Bertheison			
Date/Time	Comp start				
Collected	Comp stop				
(Military)	Grab	16 Aug 94 @ 1300			
Sample Type	Comp/Grab	Grab			
Analyst		J. W. Moore			
Date of Analysis/Batch No.		19 Aug 94			
Sample Matrix		Sludge			
Dilution		Dilution X 50	Dilution X 1	Dilution X 1	Dilution X 1

PARAMETER: F001-F005 Vol. by GCMS (Capillary)	METHOD #	Sample ID# 1- 5628	units	Det. Limit	Sample ID# 2-	units	Det. Limit	Sample ID# 3-	units	Det. Limit	Sample ID# 4-	units	Det. Limit
Acetone	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
Benzene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Carbon disulfide	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Carbon Tetrachloride	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Chlorobenzene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Cyclohexanone	EPA 8260	BDL	ug/kg	250		ug/l	5		ug/l	5		ug/l	5
1,2-Dichlorobenzene	EPA 8260	480	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Dichlorodifluoromethane	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
Ethyl acetate	EPA 8260	BDL	ug/kg	150		ug/l	3		ug/l	3		ug/l	3
Ethylbenzene	EPA 8260	55	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Ethyl ether	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Methyl ethyl ketone (MEK)	EPA 8260	BDL	ug/kg	250		ug/l	5		ug/l	5		ug/l	5
Methylene chloride	EPA 8260	820	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
Methyl isobutyl ketone (MIBK)	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
2-Nitropropane	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
Tetrachloroethylene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Toluene	EPA 8260	55	ug/kg	1		ug/l	1		ug/l	1		ug/l	1
1,1,1-Trichloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,1,2-Trichloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Trichloroethylene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Trichlorofluoromethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
o-Xylene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
m,p-Xylene	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2

Surrogate Recoveries Volatile Compounds	Acceptance Limits				
1,2-Dichloroethane-d4	76-114	89			
Toluene-d8	88-110	99			
Bromofluorobenzene	86-115	96			

Alcohols by Direct Injection:		Dilution x 1			Dilution x 1			Dilution x 1			Dilution x 1		
n-Butyl alcohol	EPA 8260	BDL	mg/kg	40		mg/l	40		mg/l	40		mg/l	40
Isobutanol	EPA 8260	BDL	mg/kg	50		mg/l	50		mg/l	50		mg/l	50
Methanol	EPA 8260	BDL	mg/kg	170		mg/l	170		mg/l	170		mg/l	170

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Requester: NPWC Environmental
Address: Bldg. 3691
NAS Pensacola, FL 32508
Phone #: 452-3043
Contact: Chad Berthelson

Laboratory Report
F001-F005 Solvents

Lab ID Number: 16 Aug 94
Received Date: NAS Pensacola
Sample Site: 160 6001
Job Order #:

Analyst		M. Chambers											
Date of Analysis/Batch No.		18 Aug 94											
Dilution		Dilution	X	333	Dilution	X	1	Dilution	X	1	Dilution	X	1
PARAMETER: F001-F005		Sample ID#		Det.	Sample ID#		Det.	Sample ID#		Det.	Sample ID#		Det.
Extr. by GCMS (Capillary)	METHOD #	1- 5628	units	Limit	2-	units	Limit	3-	units	Limit	4-	units	Limit
p-Chloro-m-cresol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
2-Chlorophenol	EPA 8270	BDL	ug/kg	3330		ug/l	10		ug/l	10		ug/l	10
o-Cresol (2-Methylphenol)	EPA 8270	BDL	ug/kg	3330		ug/l	10		ug/l	10		ug/l	10
m,p-Cresol (3&4-Methylphe	EPA 8270	BDL	ug/kg	3330		ug/l	10		ug/l	10		ug/l	10
Cresylic Acid (Total cresols)	EPA 8270	BDL	ug/kg	3330		ug/l	10		ug/l	10		ug/l	10
2,4-Dichlorophenol	EPA 8270	BDL	ug/kg	3330		ug/l	10		ug/l	10		ug/l	10
2,4-Dimethylphenol	EPA 8270	BDL	ug/kg	3330		ug/l	10		ug/l	10		ug/l	10
4,6-Dinitrocresol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
2,4-Dinitrophenol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
2-Ethoxyethanol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
Nitrobenzene	EPA 8270	BDL	ug/kg	3330		ug/l	10		ug/l	10		ug/l	10
2-Nitrophenol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
4-Nitrophenol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
Pentachlorophenol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
Pyridine	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20
2,4,6-Trichlorophenol	EPA 8270	BDL	ug/kg	6660		ug/l	20		ug/l	20		ug/l	20

Surrogate Recoveries Extractable Compounds	Acceptance Limits				
2-Fluorophenol	21-110	104			
Phenol-d5	10-110	117*			
Nitrobenzene-d5	35-114	61			
2-Fluorobiphenyl	43-116	104			
2,4,6-tribromophenol	10-123	115			
Terphenyl-d14	33-141	143*			

Comments: ug/l=micrograms per liter. ug/kg=micrograms per kilogram. BDL=Below Detection Limit.
* - Surrogates outside acceptance limits.

Approved by: Jerry Dees, Laboratory Director Date: 7 Sep 94

PWC 5090/14

End of Report

Navy Public Works Center
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Requester: NPWC Environmental
Address: Bldg. 3691
NAS Pensacola, FL 32508
Phone #: 452-3043
Contact: Chad Berthelson

Laboratory Report
Extractables by Method 8270A

Lab ID Number: 9408273 D
Sample Date: 16 Aug 94
Received Date: 16 Aug 94
Sample Site: NAS Pensacola
Job Order #: 160 6001

Sample ID#	Lab	1- 5628	2-	3-	4-
Sample Name	Requester	IR Site 30			
Collector Name		C. Berthelson			
Date/Time Collected (Military)	Comp start				
	Comp stop				
	Grab	16 Aug 94 @ 1300			
Sample Type	Comp/Grab	Grab			
Analyst		Joe Moore			
Date of Analysis		18 Aug 94			
Sample Matrix		Water			
Dilution		Dilution X 333	Dilution X 1	Dilution X 1	Dilution X 1

PARAMETER BNA Extr.:	METHOD #	ID# 1- 5628	units	Det. Limit	ID# 2-	units	Det. Limit	ID# 3-	units	Det. Limit	ID# 4-	units	Det. Limit
Acenaphthene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Acenaphthylene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Acetophenone	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2-Acetylaminofluorene	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Aldrin	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4-Aminobiphenyl	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Aniline	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Anthracene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Aramite	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
Benzidine	EPA 8270A	BDL	ug/kg	16650		ug/kg	50		ug/kg	50		ug/kg	50
Benzoic Acid	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Benz(a)anthracene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Benzo(b)fluoranthene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Benzo(k)fluoranthene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Benzo(g,h,i)perylene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Benzo(a)pyrene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
p-Benzoquinone	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Benzyl alcohol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
alpha-BHC	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
beta-BHC	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
delta-BHC	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
gamma-BHC (Lindane)	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Bis(2-chloroethoxy)methane	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Bis(2-chloroethyl)ether	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Bis(2-chloroisopropyl)ether	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Bis(2-ethylhexyl)phthalate	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
4-Bromophenyl phenyl ether	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Butyl benzyl phthalate	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4-Chloroaniline	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Chlorobenzilate	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4-Chloro-3-methylphenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2-Chloronaphthalene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2-Chlorophenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4-Chlorophenyl phenyl ether	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Chrysene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4,4'-DDD	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4,4'-DDE	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4,4'-DDT	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Dibenzo(a,h)anthracene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Dibenzofuran	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Di-n-butyl phthalate	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
1,2-Dichlorobenzene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
1,3-Dichlorobenzene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5

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Laboratory Report
Extractables by Method 8270A

Requester: NPWC Environmental
Address: Bldg. 3691
NAS Pensacola, FL 32508
Phone #: 452-3043
Contact: Chad Berthelson

Lab ID Number: 9408273 D
Sample Date: 16 Aug 94
Received Date: 16 Aug 94
Sample Site: NAS Pensacola
Job Order #: 160 6001

PARAMETER		ID#		Det.	ID#		Det.	ID#		Det.	ID#		Det.
BNA Extr.:	METHOD #	1- 5628	units	Limit	2-	units	Limit	3-	units	Limit	4-	units	Limit
1,4-Dichlorobenzene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
3,3-Dichlorobenzidine	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2,4-Dichlorophenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2,6-Dichlorophenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Dieldrin	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Diethyl phthalate	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Dimethoate	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
Dimethylaminazobenzene	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
7,12-Dimethylbenz(a)anthracene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
3,3'-Dimethylbenzidine	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
a,a,-Dimethylphenethylamine	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2,4-Dimethylphenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Dimethyl phthalate	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
4,6-Dinitro-o-cresol	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
2,4-Dinitrophenol	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
2,4-Dinitrotoluene	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
2,6-Dinitrotoluene	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
1,2-Diphenylhydrazine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Di-n-octyl phthalate	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Endosulfan-I	EPA 8270A	BDL	ug/kg	6660		ug/kg	20		ug/kg	20		ug/kg	20
Endosulfan-II	EPA 8270A	BDL	ug/kg	6660		ug/kg	20		ug/kg	20		ug/kg	20
Endosulfan Sulfate	EPA 8270A	BDL	ug/kg	6660		ug/kg	20		ug/kg	20		ug/kg	20
Endrin	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Endrin aldehyde	EPA 8270A	BDL	ug/kg	6660		ug/kg	20		ug/kg	20		ug/kg	20
Endrin ketone	EPA 8270A	BDL	ug/kg	6660		ug/kg	20		ug/kg	20		ug/kg	20
Ethyl methanesulfonate	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Fluoranthene	EPA 8270A	4700	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Fluorene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Heptachlor	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Heptachlor epoxide	EPA 8270A	BDL	ug/kg	6660		ug/kg	20		ug/kg	20		ug/kg	20
Hexachlorobenzene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Hexachlorobutadiene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Hexachlorocyclopentadiene	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
Hexachloroethane	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Indeno(1,2,3-cd)pyrene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Isodrin	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
Isophorone	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
3-Methylcholanthrene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Methyl methanesulfonate	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2-Methylnaphthalene	EPA 8270A	11000	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
o-Cresol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
m,p-Cresols	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Naphthalene	EPA 8270A	2400	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
1,4-Naphthoquinone	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
1-Naphthylamine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
2-Naphthylamine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
2-Nitroaniline	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
3-Nitroaniline	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
4-Nitroaniline	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Nitrobenzene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2-Nitrophenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
4-Nitrophenol	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25

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Laboratory Report
Extractables by Method 8270A

Requester: NPWC Environmental
Address: Bldg. 3691
NAS Pensacola, FL 32508
Phone #: 452-3043
Contact: Chad Berthelson

Lab ID Number: 9408273 D
Sample Date: 16 Aug 94
Received Date: 16 Aug 94
Sample Site: NAS Pensacola
Job Order #: 160 6001

PARAMETER BNA Extr.:	METHOD #	ID# 1- 5628	units	Det. Limit	ID# 2-	units	Det. Limit	ID# 3-	units	Det. Limit	ID# 4-	units	Det. Limit
5-Nitro-o-toluidine	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
N-nitrosodibutylamine	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
N-nitrosodiethylamine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
N-nitrosodimethylamine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
N-nitrosomethylethylamine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
N-nitrosodiphenylamine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
N-nitrosodi-n-propylamine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
N-nitrosomorpholine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
N-nitrosopiperidine	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
N-nitrosopyrrolidine	EPA 8270A	BDL	ug/kg	6660		ug/kg	20		ug/kg	20		ug/kg	20
Pentachlorobenzene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Pentachloronitrobenzene	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Pentachlorophenol	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Phenacetin	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Phenanthrene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Phenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
1,4-Phenylenediamine	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Phorate	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2-Picoline	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Pronamide	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Pyrene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
Pyridine	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
Safrole	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
2,3,4,6-Tetrachlorophenol	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10
Thionazine	EPA 8270A	BDL	ug/kg	8325		ug/kg	25		ug/kg	25		ug/kg	25
o-Toluidine	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
1,2,4-Trichlorobenzene	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2,4,5-Trichlorophenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
2,4,6-Trichlorophenol	EPA 8270A	BDL	ug/kg	1665		ug/kg	5		ug/kg	5		ug/kg	5
1,3,5-Trinitrobenzene	EPA 8270A	BDL	ug/kg	3330		ug/kg	10		ug/kg	10		ug/kg	10

SURROGATE RECOVERIES Compound	Acceptance Limits				
2-Fluorophenol	21-110	104			
Phenol-d5	10-110	117*			
Nitrobenzene-d5	35-114	61			
2-Fluorobiphenyl	43-116	104			
2,4,6-Tribromophenol	10-123	115			
Terphenyl-d14	33-141	143*			

Comments: ug/l=micrograms per liter. ug/kg=micrograms per kilogram. BDL=Below Detection Limit. * – Outside acceptance limits.
Other compounds identified: 1-Methylnaphthalene @ 11000 ug/kg.

Approved by: Jerry Deck, Laboratory Director **Date/Time:** 07-Sep-94 @ 09:00

PWC 5090/14

Navy Public Works Center
Environmental Laboratory

Bldg.3297, Code 920
NAS Pensacola, Fl. 32508-6500
Phone 904-452-3642/4758
Autovon 922-3642

Requester: NPWC Environmental
Address: Bldg. 3691
NAS, Pensacola, FL
Phone #: 452-3043
Contact: Mr. Chad Berthelson

Laboratory Report
Volatiles by Method 8260

Lab ID Number: 9408273 C
Sample Date: 16 Aug 94
Received Date: 16 Aug 94
Sample Site: NAS Pensacola
Job Order #: 160 6001

Sample ID#	Lab	1- 5628	2-	3-	4-
Sample Name	Requester	IR Site 30			
Collector Name		C. Berthelson			
Date/Time Collected (Military)	Comp start				
	Comp stop				
	Grab	16 Aug 94 @ 1300			
Sample Type	Comp/Grab	Grab			
Analyst		Joe Moore			
Date of Analysis		19 Aug 94			
Sample Matrix		Sludge			
Dilution		Dilution X 50	Dilution X 1	Dilution X 1	Dilution X 1

PARAMETER Volatiles by GCMS (Capillary)	METHOD #	ID# 1- 5628	units	Det. Limit	ID# 2-	units	Det. Limit	ID# 3-	units	Det. Limit	ID# 4-	units	Det. Limit
Benzene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Bromobenzene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Bromochloromethane	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
Bromodichloromethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Bromoform	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Bromomethane	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
n-Butylbenzene	EPA 8260	550	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
sec-Butylbenzene	EPA 8260	250	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
tert-Butylbenzene	EPA 8260	250	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Carbon Tetrachloride	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Chlorobenzene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Chloroethane	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
Chloroform	EPA 8260	400	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Chloromethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
2-Chlorotoluene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
4-Chlorotoluene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Dibromochloromethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2-Dibromo-3-chloropropane	EPA 8260	BDL	ug/kg	250		ug/l	5		ug/l	5		ug/l	5
1,2-Dibromoethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Dibromomethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2-Dichlorobenzene	EPA 8260	480	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,3-Dichlorobenzene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,4-Dichlorobenzene	EPA 8260	60	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Dichlorodifluoromethane	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
1,1-Dichloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2-Dichloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,1-Dichloroethene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
cis-1,2-Dichloroethene	EPA 8260	18000	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
trans-1,2-Dichloroethene	EPA 8260	130	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2-Dichloropropane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,3-Dichloropropane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
2,2-Dichloropropane	EPA 8260	BDL	ug/kg	200		ug/l	4		ug/l	4		ug/l	4
1,1-Dichloropropene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Ethylbenzene	EPA 8260	55	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Hexachlorobutadiene	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
Isopropylbenzene	EPA 8260	60	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
p-Isopropyltoluene	EPA 8260	300	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Methylene chloride	EPA 8260	820	ug/kg	50		ug/l	1		ug/l	1		ug/l	1

Navy Public Works Center
Environmental Laboratory

Bldg.3297, Code 920
NAS Pensacola, Fl. 32508-6500
Phone 904-452-3642/4758
Autovon 922-3642

Laboratory Report
Volatiles by Method 8260

Requester: NPWC Environmental
Address: Bldg. 3691
NAS, Pensacola, FL
Phone #: 452-3043
Contact: Mr. Chad Berthelson

Lab ID Number: 9408273 C
Sample Date: 16 Aug 94
Received Date: 16 Aug 94
Sample Site: NAS Pensacola
Job Order #: 160 6001

PARAMETER		ID#		Det.	ID#		Det.	ID#		Det.	ID#		Det.
Volatiles by GCMS (Capillary)	METHOD #	1- 5628	units	Limit	2-	units	Limit	3-	units	Limit	4-	units	Limit
Naphthalene	EPA 8260	1000	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
n-Propylbenzene	EPA 8260	200	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Styrene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,1,1,2-Tetrachloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,1,2,2-Tetrachloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Tetrachloroethene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Toluene	EPA 8260	55	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2,3-Trichlorobenzene	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2,4-Trichlorobenzene	EPA 8260	BDL	ug/kg	100		ug/l	2		ug/l	2		ug/l	2
1,1,1-Trichloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,1,2-Trichloroethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Trichloroethene	EPA 8260	2800	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Trichlorofluoromethane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2,3-Trichloropropane	EPA 8260	BDL	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,2,4-Trimethylbenzene	EPA 8260	1700	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
1,3,5-Trimethylbenzene	EPA 8260	620	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
Vinyl Chloride	EPA 8260	7000	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
o-Xylene	EPA 8260	120	ug/kg	50		ug/l	1		ug/l	1		ug/l	1
m,p-Xylene	EPA 8260	220	ug/kg	100		ug/l	2		ug/l	2		ug/l	2

Surrogate Recoveries Compound	Acceptance Limits				
1,2-Dichloroethane-d4	76-114	89			
Toluene-d8	88-110	99			
Bromofluorobenzene	86-115	96			

Comments: ug/l=micrograms per liter. ug/kg=micrograms per kilogram. BDL=Below Detection Limit.

Approved by: Jerry Dees, Laboratory Director Date/Time: 07-Sep-94 @ 09:07

PWC 5090/14

 End of Report

HAZARDOUS WASTE CHAIN OF CUSTODY/REQUEST FOR ANALYSIS

NPWC Environmental Laboratory
Bldg.3287, Code 820
NAS Pensacola, FL 32508-6500

Ph#-(904)452-3842/4758
Autovon-922-3842

Requester: PWC ENVIRONMENTAL
Address: NASP FL
Phone #: 452-3043
Contact: Chad Berthelson
Job Order #: 11606001

5628

Report Required? Yes No DER? Yes No
Lab ID Number:
Sample Date: 8-16-94
Received Date: 8-16-94
Sample Site: NAS Pensacola
Lab Due Date:

Sample ID #	Lab	#1- 5628	#2-	#3-	#4-
Sample Name or Location	----------	IR Site 30			
Sampled by	----------	Chad Berthelson			
Composite Date/Time Collected	Begin				
	Frequency	8/16/94			
	End				
Grab Time	----------	1300			
Sample Matrix	----------	sludge			

Notes: wetland 5A IR Site 30 Pulled tank material

SINGLE PARAMETER by Method Name	METHOD #	X	Bottle ID #'s	X	Bottle ID #'s	X	Bottle ID #'s	X	Bottle ID #'s	Bottle Units	Containers Required (L/S)	Preservative(s) Used (Liquids)
Gas Chromatography	EPA 8000									4	40 ml x 2/4 oz.	HCl to pH<2/4° C
Halo. Vol. Org./GC	EPA 8010									4	40 ml x 2/4 oz.	HCl to pH<2/4° C
EDB & DBCP/GC	EPA 8011									3	40 ml x 2/4 oz.	HCl to pH<2/4° C
Non-Halo. Vol. Org./GC	EPA 8015(MOD)									4	1L (A) x 2/4 oz.	4° C
Arom. Vol. Org./GC	EPA 8020									3	40 ml x 2/4 oz.	HCl to pH<2/4° C
Halo./Arom. Vol. Org./GC	EPA 8021									8	40 ml x 2/4 oz.	HCl to pH<2/4° C
Halo./Arom. Vol. Org./GC	EPA 8010/8020									8	40 ml x 2/4 oz.	HCl to pH<2/4° C
Phenols/GC	EPA 8040									5	1Lx2/4 oz.	4° C
Phthalate Esters/GC	EPA 8060									6	1Lx2/4 oz.	4° C
Organochlor. Pest./PCB/GC	EPA 8080									5	1Lx2/4 oz.	4° C
Org. Pest/PCB/GC-Cap.	EPA 8081									8	1Lx2/4 oz.	4° C
Chlor. Herb./GC	EPA 8150									5	40 ml x 2/4 oz.	4° C
VOC/GCMS-Cap.	EPA 8260									8	40 ml x 2/4 oz.	HCl to pH<2/4° C
Semivol. Org./GCMS-Cap.	EPA 8270									18	1Lx3/4 oz.	4° C
Semivol. Org./GCMS-Cap.	EPA 8270A									18	1Lx3/4 oz.	4° C

GROUP PARAMETERS by Method Name	METHOD #	X	Bottle ID #'s	X	Bottle ID #'s	X	Bottle ID #'s	X	Bottle ID #'s	Bottle Units	Containers Required (L/S)	Preservative(s) Used (Liquids)
HW Characterization (complete)	EPA SW-846									50	See below	See below
Ignitability (Flashpoint)	EPA 1010									1	250ml/4 oz.	4° C
Reactivity (Cyanide & Sulfide)	SW 846									3	1L/4 oz.	4° C
Corrosivity (pH)	EPA 9040 or 9045									1	250ml/4 oz.	4° C
Toxicity (TCLP) complete	EPA SW-846									47	See below	See below
Non Volatile TCLP Extraction	EPA 1311	X	X							4	40 mlx3/4 oz.	4° C
ZHE TCLP Extraction	EPA 1311									5	1Lx4/32 oz.	HCl to pH<2/4° C
TCLP Acid Extractables	EPA 8270									8	1L/4 oz.	4° C
TCLP B/N Extractables	EPA 8270									8	1L/4 oz.	4° C
TCLP Pesticides	EPA 8080									8	1L/4 oz.	4° C
TCLP Herbicides	EPA 8150									5	1L/4 oz.	4° C
TCLP Volatiles	EPA 8260									8	40 mlx3/4 oz.	HCl to pH<2/4° C
TCLP Metals (8)	EPA SW-846	X	X							8	500 ml/4 oz.	HNO3 to pH<2
Priority Pollutants (complete)	EPA SW-846									39	See below	See below
PP Acid Extractables	EPA 8270									8	1L/4 oz.	4° C
PP B/N Extractables	EPA 8270									8	1L/4 oz.	4° C
PP Pesticides	EPA 8080									6	1L/4 oz.	4° C
PP Volatiles	EPA 8260									8	40 mlx3/4 oz.	HCl to pH<2/4° C
PP Metals (13)	EPA SW-846									8	500 ml/4 oz.	HNO3 to pH<2
F001 - F005 Solvents	EPA SW-846	X	X							24	1Lx2& 40mlx3/16 oz.	
RCRA Metals (8)	EPA SW-846									8	500 ml/4 oz.	HNO3 to pH<2
PCBs in Oil	EPA 8080									2	40 ml	4° C
Other:												
PCB wipe										3		
PCB wipe-foil										4		
F-0												

4
6
24
34

Comments:

Relinquished by: [signature]
Date/Time: Aug 16, 1994

Received by: J W Moore
Date/Time: 8-16-94 1350

PWC 8510/8

Appendix B

IRA Analytical Data

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

METAL															
	SAMPLE ID ------->	030-M-0001-00		030-W-0001-00		030-M-0002-00		030-M-0002-00		030-W-0002-00		030-M-0003-00	
	ORIGINAL ID ----->	030M000100		030W000100		30M02		030M000200		030W000200		30M03	
	LAB SAMPLE ID --->	635590		WATER63078		ZZ1207		635572		WATER63439		ZZ1208	
	ID FROM REPORT -->	30M0001		030W000		30M02		30M0002		030W000		30M03	
	SAMPLE DATE ----->	08/23/94				08/04/93		08/23/94				08/04/93	
	MATRIX ---------->	Sediment		Water		Sediment		Sediment		Water		Sediment	
	UNITS ---------->	MG/KG		UG/L		MG/KG		MG/KG		UG/L		MG/KG	
CAS #	Parameter	079253	NV	079153	NV	PN004	VAL	079253	NV	079233	NV	PN004	VAL
7429-90-5	Aluminum (Al)	4960.		167.	B	4210.		12700.		335.		8760.	
7440-36-0	Antimony (Sb)	19.4	B	1.2	B	5.2	U	15.5	B	1.6	B	14.6	U
7440-38-2	Arsenic (As)	2.6	B	2.	U	2.		2.8	B	2.	U	5.6	
7440-39-3	Barium (Ba)	62.7	B	22.1	B	37.3		75.8	B	19.1	B	41.9	J
7440-41-7	Beryllium (Be)	0.35	U	1.	U	0.17	UJ	0.95	U	1.	U	0.83	J
7440-43-9	Cadmium (Cd)	101.	N	1.	U	132.		131.	N	1.	U	157.	
7440-70-2	Calcium (Ca)	6480.		7370.		1260.		5220.		7990.		5060.	
7440-47-3	Chromium (Cr)	2690.		1.	U	2160.		2380.		1.1	B	507.	
7440-48-4	Cobalt (Co)	14.8	B	4.2	B	27.8		28.5	B	1.6	B	24.3	
7440-50-8	Copper (Cu)	144.	*	2.3	B	606.		232.	*	6.7	B	144.	
7439-89-6	Iron (Fe)	6960.		765.	E	4530.		11700.		616.	N*	14400.	
7439-92-1	Lead (Pb)	2650.	*	5.3		4720.		3400.	*	4.4	*	1190.	
7439-95-4	Magnesium (Mg)	892.	B	1800.	B	259.	J	855.	B	1770.	B	844.	J
7439-96-5	Manganese (Mn)	63.		233.		53.4		82.5		40.5	*	76.8	
7439-97-6	Mercury (Hg)	1.5		0.2	U	2.1		1.6		0.2	U	1.2	
7440-02-0	Nickel (Ni)	213.	*	1.	U	304.	J	135.	*	2.6	B	83.5	J
7440-09-7	Potassium (K)	302.	B	1070.	B	174.	U	493.	B	1210.	B	485.	U
7782-49-2	Selenium (Se)	1.7	B	3.	U	0.35	J	5.5		3.	U	6.1	J
7440-22-4	Silver (Ag)	85.4	N*	1.	U	5.7		54.6	N*	1.	U	43.8	
7440-23-5	Sodium (Na)	238.	B	8630.	E	40.6	J	1060.	B	9950.	E	108.	J
7440-28-0	Thallium (Tl)	1.1	U	3.	U	0.35	U	2.9	U	3.	U	0.97	U
7440-62-2	Vanadium (V)	8.3	B	1.	U	6.4	J	19.5	B	1.1	B	13.9	J
7440-66-6	Zinc (Zn)	252.	N	77.6		367.		605.	N	39.9		363.	
57-12-5	Cyanide (CN)	2.		20.	U	1.7	UR	2.4	U	20.	U	4.9	UR
7439-98-7	Molybdenum (Mo)	NR		NR		NR		NR		NR		NR	

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

METAL															
	SAMPLE ID ------->	030-W-0003-00		030-M-0004-00		030-M-0100-00		030-W-S200-01		030-W-S300-01		030-W-S400-01	
	ORIGINAL ID ----->	030W000300		30M04		30M01		30WS200		30WS300		30WS400	
	LAB SAMPLE ID --->	WATER63813		ZZ1209		ZZ1206		90750S		90751S		90755S	
	ID FROM REPORT -->	30W0003		30M04		30M01		30WS200		30WS300		30WS400	
	SAMPLE DATE ----->			08/04/93		08/04/93		11/10/93		11/10/93		11/10/93	
	MATRIX ---------->	Water		Sediment		Sediment		Water		Water		Water	
	UNITS ---------->	UG/L		MG/KG		MG/KG		UG/L		UG/L		UG/L	
CAS #	Parameter	92712I	NV	PN004	VAL	PN004	VAL	FD1034	VAL	FD1034	VAL	FD1034	VAL
7429-90-5	Aluminum (Al)	154.	B	8790.		15300.		1960.		35.6	U	89900.	
7440-36-0	Antimony (Sb)	2.2	B	8.9	U	19.7	U	114.		35.	U	35.	U
7440-38-2	Arsenic (As)	1.9	U	1.8	U	3.9	U	27.8		2.	U	6.6	J
7440-39-3	Barium (Ba)	23.5	B	53.	J	75.2	J	479.		5.3	U	5.6	U
7440-41-7	Beryllium (Be)	0.1	U	0.3	UJ	0.66	UJ	9.9		1.	U	1.	U
7440-43-9	Cadmium (Cd)	0.3	U	132.		189.		50.1		3.	U	3.	U
7440-70-2	Calcium (Ca)	11000.		2550.		2950.	J	152.	U	96.	U	2240.	J
7440-47-3	Chromium (Cr)	1.9	B	952.		1610.		49.8		4.	U	4.	U
7440-48-4	Cobalt (Co)	1.4	B	22.7		65.8		105.		3.	U	3.	U
7440-50-8	Copper (Cu)	4.1	B	510.		230.		58.3		7.5	U	11.3	U
7439-89-6	Iron (Fe)	650.	E	6850.		45500.		1160.		44.6	U	91500.	
7439-92-1	Lead (Pb)	4.3		1930.		2760.		23.	J	2.	U	2.	U
7439-95-4	Magnesium (Mg)	3030.	B	715.	J	693.	J	2030.	J	60.4	U	222.	U
7439-96-5	Manganese (Mn)	36.8		52.3		261.		52.5		2.	U	2.9	U
7439-97-6	Mercury (Hg)	0.2	U	1.5		0.73		0.2	U	0.2	U	0.2	U
7440-02-0	Nickel (Ni)	1.4	B	111.	J	356.	J	108.		15.	U	15.	U
7440-09-7	Potassium (K)	3010.	BE	354.	J	658.	U	400.	U	400.	U	400.	U
7782-49-2	Selenium (Se)	2.8	U	1.1	J	1.3	UJ	20.2		2.5	U	2.2	U
7440-22-4	Silver (Ag)	0.4	U	87.8		97.3		4.	U	4.	U	4.	U
7440-23-5	Sodium (Na)	10800.	E	79.7	J	133.	J	387.		200.	U	233.	
7440-28-0	Thallium (Tl)	3.	U	0.6	U	1.3	U	21.		2.	U	2.	U
7440-62-2	Vanadium (V)	1.1	B	14.7	J	23.8	J	99.7		3.	U	3.	U
7440-66-6	Zinc (Zn)	21.6	E	880.		1860.		27.6	U	5.	U	5.	U
57-12-5	Cyanide (CN)	10.	U	3.	UR	6.4	UR	19.3	J	10.	UJ	NR	
7439-98-7	Molybdenum (Mo)	NR		NR		NR		NR		NR		NR	

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

PEST															
	SAMPLE ID ------->	030-M-0001-00		030-W-0001-00		030-M-0002-00		030-M-0002-00		030-W-0002-00		030-M-0003-00	
	ORIGINAL ID ----->	030M000100		030W000100		30M02		030M000200		030W000200		30M03	
	LAB SAMPLE ID --->	635589		630782		ZZ1211		635561		634388		ZZ1212	
	ID FROM REPORT -->	30M000100		030W00010		30M02		30M000200		030W00020		30M03	
	SAMPLE DATE ----->	08/23/94		08/02/94		08/04/93		08/23/94		08/15/94		08/04/93	
	DATE EXTRACTED -->	08/27/94		08/08/94		08/06/93		08/27/94		08/21/94		08/06/93	
	DATE ANALYZED --->	09/08/94		08/16/94		08/24/93		09/08/94		08/23/94		08/24/93	
	MATRIX ---------->	Sediment		Water		Sediment		Sediment		Water		Sediment	
	UNITS ---------->	UG/KG		UG/L		UG/KG		UG/KG		UG/L		UG/KG	
CAS #	Parameter	00024	NV	00013	NV	PN004	VAL	00024	NV	00022	NV	PN004	VAL
319-84-6	alpha-BHC	3.	U	0.05	U	2.9	U	0.52	JP	0.05	U	8.1	U
319-85-7	beta-BHC	3.	U	0.05	U	2.9	UJ	8.1	U	0.05	U	8.1	UJ
319-86-8	delta-BHC	1.5	JP	0.05	U	2.9	U	0.92	JP	0.05	U	8.1	U
58-89-9	gamma-BHC (Lindane)	3.	U	0.05	U	2.9	U	0.44	JP	0.05	U	8.1	U
76-44-8	Heptachlor	2.	JP	0.05	U	20.	U	1.3	JP	0.05	U	8.1	U
309-00-2	Aldrin	3.	U	0.05	U	2.9	U	8.1	U	0.05	U	8.1	U
1024-57-3	Heptachlor epoxide	3.6	P	0.05	U	2.9	U	1.2	JP	0.05	U	8.1	U
959-98-8	Endosulfan I	3.	U	0.05	U	2.9	U	8.1	U	0.05	U	8.1	U
60-57-1	Dieldrin	3.3	JP	0.1	U	5.7	U	4.4	JP	0.1	U	16.	U
72-55-9	4,4'-DDE	25.	P	0.1	U	21.		51.		0.1	U	30.	
72-20-8	Endrin	5.8	U	0.1	U	5.7	U	16.	U	0.1	U	16.	U
33213-65-9	Endosulfan II	5.8	U	0.1	U	5.7	U	16.	U	0.1	U	16.	U
72-54-8	4,4'-DDD	27.	P	0.1	U	70.	U	22.	P	0.1	U	69.	J
1031-07-8	Endosulfan sulfate	5.8	U	0.1	U	5.7	U	16.	U	0.1	U	16.	U
50-29-3	4,4'-DDT	9.4		0.1	U	5.7	U	2.4	JP	0.1	U	16.	U
72-43-5	Methoxychlor	10.	JP	0.5	U	29.	U	81.	U	0.5	U	81.	U
53494-70-5	Endrin ketone	5.8	U	0.1	U	5.7	U	16.	U	0.1	U	16.	U
7421-93-4	Endrin aldehyde	20.	P	0.1	U	5.7	U	14.	JP	0.1	U	16.	U
5103-71-9	alpha-Chlordane	3.	JP	0.05	U	2.9	U	2.4	JP	0.05	U	8.1	U
5103-74-2	gamma-Chlordane	1.1	JP	0.05	U	5.	U	1.6	JP	0.05	U	8.1	U
8001-35-2	Toxaphene	300.	U	5.	U	290.	U	810.	U	5.	U	810.	U
12674-11-2	Aroclor-1016	58.	U	1.	U	57.	U	160.	U	1.	U	160.	U
11104-28-2	Aroclor-1221	120.	U	2.	U	120.	U	320.	U	2.	U	320.	U
11141-16-5	Aroclor-1232	58.	U	1.	U	57.	U	160.	U	1.	U	160.	U
53469-21-9	Aroclor-1242	58.	U	1.	U	57.	U	160.	U	1.	U	160.	U
12672-29-6	Aroclor-1248	58.	U	1.	U	57.	U	160.	U	1.	U	160.	U
11097-69-1	Aroclor-1254	58.	U	1.	U	57.	U	160.	U	1.	U	160.	U
11096-82-5	Aroclor-1260	460.	YP	1.	U	450.		410.	Y	1.	U	160.	U

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

PEST															
	SAMPLE ID ------->	030-W-0003-00		030-M-0004-00		030-M-0100-00		030-W-S200-01		030-W-S200-01		030-W-S300-01	
	ORIGINAL ID ----->	030W000300		30M04		30M01		30WS200		30WS200		30WS300	
	LAB SAMPLE ID --->	638117		ZZ1213		ZZ1210		90750		4009-90750		90751	
	ID FROM REPORT -->	30W000300		30M04		30M01		30WS200		30WS200		30WS300	
	SAMPLE DATE ----->	09/12/94		08/04/93		08/04/93		11/10/93		11/10/93		11/10/93	
	DATE EXTRACTED -->	09/15/94		08/06/93		08/06/93		11/16/93		11/16/93		11/16/93	
	DATE ANALYZED --->	09/22/94		08/25/93		08/24/93		12/09/93		12/09/93		12/09/93	
	MATRIX ---------->	Water		Sediment		Sediment		Water		Water		Water	
	UNITS ---------->	UG/L		UG/KG		UG/KG		UG/L		UG/L		UG/L	
CAS #	Parameter	00001	VAL	PN004	VAL	PN004	VAL	FD1034	VAL	FD1035	VAL	FD1034	VAL
319-84-6	alpha-BHC	0.05	U	5.	U	11.	U	0.81	J	0.81		0.05	U
319-85-7	beta-BHC	0.05	U	5.	UJ	11.	U	0.05	U	0.05	U	0.05	U
319-86-8	delta-BHC	0.05	U	5.	U	11.	U	0.05	U	0.05	U	0.05	U
58-89-9	gamma-BHC (Lindane)	0.05	U	5.	U	11.	U	0.71	J	0.71		0.05	U
76-44-8	Heptachlor	0.05	U	5.	U	20.	J	0.5	J	0.5		0.05	U
309-00-2	Aldrin	0.05	U	5.	U	11.	U	0.05	U	0.05	U	0.05	U
1024-57-3	Heptachlor epoxide	0.05	U	5.	U	11.	U	0.05	U	0.05	U	0.05	U
959-98-8	Endosulfan I	0.05	U	5.	U	11.	U	0.05	U	0.05	U	0.05	U
60-57-1	Dieldrin	0.1	U	25.	J	22.	U	0.77	J	0.77		0.1	U
72-55-9	4,4'-DDE	0.1	U	92.	J	35.		0.57	J	0.57		0.1	U
72-20-8	Endrin	0.1	U	9.7	U	22.	U	0.85	J	0.85		0.1	U
33213-65-9	Endosulfan II	0.1	U	9.7	U	22.	U	0.1	U	0.1	U	0.1	U
72-54-8	4,4'-DDD	0.1	U	200.	U	110.	U	0.74	J	0.74		0.1	U
1031-07-8	Endosulfan sulfate	0.1	U	9.7	U	22.	U	0.1	U	0.1	U	0.1	U
50-29-3	4,4'-DDT	0.1	U	9.7	U	22.	U	0.1	U	0.1	U	0.1	U
72-43-5	Methoxychlor	0.5	U	50.	U	110.	U	0.5	U	0.5	U	0.5	U
53494-70-5	Endrin ketone	0.1	U	9.7	U	22.	U	0.1	U	0.046	JP	0.1	U
7421-93-4	Endrin aldehyde	0.1	U	9.7	U	22.	U	0.1	U	0.036	J	0.1	U
5103-71-9	alpha-Chlordane	0.05	U	10.	J	11.	U	0.05	U	0.05	U	0.05	U
5103-74-2	gamma-Chlordane	0.05	U	9.	J	11.	U	0.05	U	0.05	U	0.05	U
8001-35-2	Toxaphene	5.	U	500.	U	1100.	U	5.	U	5.	U	5.	U
12674-11-2	Aroclor-1016	1.	U	97.	U	220.	U	1.	U	1.	U	1.	U
11104-28-2	Aroclor-1221	2.	U	200.	U	440.	U	2.	U	2.	U	2.	U
11141-16-5	Aroclor-1232	1.	U	97.	U	220.	U	1.	U	1.	U	1.	U
53469-21-9	Aroclor-1242	1.	U	97.	U	220.	U	1.	U	1.	U	1.	U
12672-29-6	Aroclor-1248	1.	U	97.	U	220.	U	1.	U	1.	U	1.	U
11097-69-1	Aroclor-1254	1.	U	97.	U	220.	U	1.	U	1.	U	1.	U
11096-82-5	Aroclor-1260	1.	U	220.	J	840.		1.	U	1.	U	1.	U

*** Validation Complete ***

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

PEST

SAMPLE ID ------->	030-W-S300-01
ORIGINAL ID ----->	30WS300
LAB SAMPLE ID --->	4009-90751
ID FROM REPORT -->	30WS300
SAMPLE DATE ----->	11/10/93
DATE EXTRACTED -->	11/16/93
DATE ANALYZED --->	12/09/93
MATRIX ---------->	Water
UNITS ----------->	UG/L

CAS #	Parameter	FD1035	VAL
319-84-6	alpha-BHC	0.05	U
319-85-7	beta-BHC	0.05	U
319-86-8	delta-BHC	0.05	U
58-89-9	gamma-BHC (Lindane)	0.05	U
76-44-8	Heptachlor	0.05	U
309-00-2	Aldrin	0.05	U
1024-57-3	Heptachlor epoxide	0.05	U
959-98-8	Endosulfan I	0.05	U
60-57-1	Dieldrin	0.1	U
72-55-9	4,4'-DDE	0.1	U
72-20-8	Endrin	0.1	U
33213-65-9	Endosulfan II	0.1	U
72-54-8	4,4'-DDD	0.1	U
1031-07-8	Endosulfan sulfate	0.1	U
50-29-3	4,4'-DDT	0.1	U
72-43-5	Methoxychlor	0.5	U
53494-70-5	Endrin ketone	0.1	U
7421-93-4	Endrin aldehyde	0.1	U
5103-71-9	alpha-Chlordane	0.05	U
5103-74-2	gamma-Chlordane	0.05	U
8001-35-2	Toxaphene	5.	U
12674-11-2	Aroclor-1016	1.	U
11104-28-2	Aroclor-1221	2.	U
11141-16-5	Aroclor-1232	1.	U
53469-21-9	Aroclor-1242	1.	U
12672-29-6	Aroclor-1248	1.	U
11097-69-1	Aroclor-1254	1.	U
11096-82-5	Aroclor-1260	1.	U

*** Validation Complete ***

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

SVOA													
	SAMPLE ID ------->	030-M-0001-00		030-W-0001-00		030-M-0002-00		030-M-0002-00		030-W-0002-00		030-M-0003-00	
	ORIGINAL ID ----->	030M000100		030W000100		30M02		030M000200		030W000200		30M03	
	LAB SAMPLE ID --->	635589		630782		ZZ1211		635561		634388		ZZ1212	
	ID FROM REPORT -->	M000100		030W00010		30M02		M000200		030W00020		30M03	
	SAMPLE DATE ----->	08/23/94		08/02/94		08/04/93		08/23/94		08/15/94		08/04/93	
	DATE EXTRACTED -->	08/25/94		08/08/94		08/10/93		08/25/94		08/20/94		08/06/93	
	DATE ANALYZED --->	08/30/94		08/11/94		08/19/93		08/30/94		08/23/94		08/19/93	
	MATRIX ---------->	Sediment		Water		Sediment		Sediment		Water		Sediment	
	UNITS ---------->	UG/KG		UG/L		UG/KG		UG/KG		UG/L		UG/KG	
CAS #	Parameter	00024	NV	00013	NV	PN004	VAL	00024	NV	00022	NV	PN004	VAL
108-95-2	Phenol	390.	J	10.	U	29000.	U	480.	J	10.	U	7800.	U
111-44-4	bis(2-Chloroethyl)ether	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
95-57-8	2-Chlorophenol	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
541-73-1	1,3-Dichlorobenzene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
106-46-7	1,4-Dichlorobenzene	920.	J	10.	U	29000.	U	1600.	U	10.	U	7800.	U
95-50-1	1,2-Dichlorobenzene	16000.		10.	U	29000.	U	1600.	U	10.	U	7800.	U
95-48-7	2-Methylphenol (o-Cresol)	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
39638-32-9	Bis(2-Chloroisopropyl)Ether	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
106-44-5	4-Methylphenol (p-Cresol)	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
621-64-7	N-Nitroso-di-n-propylamine	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
67-72-1	Hexachloroethane	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
98-95-3	Nitrobenzene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
78-59-1	Isophorone	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
88-75-5	2-Nitrophenol	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
105-67-9	2,4-Dimethylphenol	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
111-91-1	bis(2-Chloroethoxy)methane	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
120-83-2	2,4-Dichlorophenol	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
120-82-1	1,2,4-Trichlorobenzene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
91-20-3	Naphthalene	3200.		10.	U	29000.	U	1600.	U	10.	U	7800.	U
106-47-8	4-Chloroaniline	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
87-68-3	Hexachlorobutadiene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
59-50-7	4-Chloro-3-methylphenol	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
91-57-6	2-Methylnaphthalene	16000.		10.	U	9000.	J	6800.		10.	U	1200.	J
77-47-4	Hexachlorocyclopentadiene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
88-06-2	2,4,6-Trichlorophenol	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
95-95-4	2,4,5-Trichlorophenol	7000.	U	25.	U	72000.	U	3800.	U	25.	U	19000.	U
91-58-7	2-Chloronaphthalene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
88-74-4	2-Nitroaniline	7000.	U	25.	U	72000.	U	3800.	U	25.	U	19000.	U
131-11-3	Dimethyl phthalate	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
208-96-8	Acenaphthylene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
606-20-2	2,6-Dinitrotoluene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
99-09-2	3-Nitroaniline	7000.	U	25.	U	72000.	UJ	3800.	U	25.	U	19000.	UJ
83-32-9	Acenaphthene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
51-28-5	2,4-Dinitrophenol	7000.	U	25.	U	72000.	U	3800.	U	25.	U	19000.	U
100-02-7	4-Nitrophenol	7000.	U	25.	U	72000.	U	3800.	U	25.	U	19000.	U
132-64-9	Dibenzofuran	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

SVOA													
	SAMPLE ID ------->	030-M-0001-00		030-W-0001-00		030-M-0002-00		030-M-0002-00		030-W-0002-00		030-M-0003-00	
	ORIGINAL ID ----->	030M000100		030W000100		30M02		030M000200		030W000200		30M03	
	LAB SAMPLE ID --->	635589		630782		ZZ1211		635561		634388		ZZ1212	
	ID FROM REPORT -->	M000100		030W00010		30M02		M000200		030W00020		30M03	
	SAMPLE DATE ----->	08/23/94		08/02/94		08/04/93		08/23/94		08/15/94		08/04/93	
	DATE EXTRACTED -->	08/25/94		08/08/94		08/10/93		08/25/94		08/20/94		08/06/93	
	DATE ANALYZED --->	08/30/94		08/11/94		08/19/93		08/30/94		08/23/94		08/19/93	
	MATRIX ---------->	Sediment		Water		Sediment		Sediment		Water		Sediment	
	UNITS ---------->	UG/KG		UG/L		UG/KG		UG/KG		UG/L		UG/KG	
CAS #	Parameter	00024	NV	00013	NV	PN004	VAL	00024	NV	00022	NV	PN004	VAL
121-14-2	2,4-Dinitrotoluene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
84-66-2	Diethylphthalate	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
7005-72-3	4-Chlorophenylphenylether	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
86-73-7	Fluorene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
100-01-6	4-Nitroaniline	7000.	U	25.	U	72000.	U	3800.	U	25.	U	19000.	U
534-52-1	2-Methyl-4,6-Dinitrophenol	7000.	U	25.	U	72000.	U	3800.	U	25.	U	19000.	U
86-30-6	N-Nitrosodiphenylamine	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
101-55-3	4-Bromophenyl-phenylether	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
118-74-1	Hexachlorobenzene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
87-86-5	Pentachlorophenol	7000.	U	25.	U	72000.	U	3800.	U	25.	U	19000.	U
85-01-8	Phenanthrene	730.	J	10.	U	29000.	U	350.	J	10.	U	7800.	U
120-12-7	Anthracene	2900.	U	10.	U	29000.	U	310.	J	10.	U	7800.	U
86-74-8	Carbazole	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
84-74-2	Di-n-butylphthalate	310.	J	10.	U	29000.	U	1600.	U	10.	U	7800.	U
206-44-0	Fluoranthene	6900.		10.	U	16000.	J	8700.		10.	U	1800.	J
129-00-0	Pyrene	790.	J	10.	U	4000.	J	640.	J	10.	U	7800.	U
85-68-7	Butylbenzylphthalate	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
91-94-1	3,3'-Dichlorobenzidine	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
56-55-3	Benzo(a)anthracene	780.	J	10.	U	3800.	J	680.	J	10.	U	7800.	U
218-01-9	Chrysene	970.	J	10.	U	3500.	J	630.	J	10.	U	7800.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	10000.		10.	U	440000.	D	6900.		10.	U	1300.	J
117-84-0	Di-n-octyl phthalate	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
205-99-2	Benzo(b)fluoranthene	1000.	XJ	10.	U	2900.	J	1300.	JX	10.	U	7800.	U
207-08-9	Benzo(k)fluoranthene	840.	XJ	10.	U	3300.	J	1500.	JX	10.	U	7800.	U
50-32-8	Benzo(a)pyrene	480.	J	10.	U	3200.	J	470.	J	10.	U	7800.	U
193-39-5	Indeno(1,2,3-cd)pyrene	2900.	U	10.	U	29000.	U	370.	J	10.	U	7800.	U
53-70-3	Dibenz(a,h)anthracene	2900.	U	10.	U	29000.	U	1600.	U	10.	U	7800.	U
191-24-2	Benzo(g,h,i)perylene	2900.	U	10.	U	29000.	U	370.	J	10.	U	7800.	U

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

SVOA											
	SAMPLE ID ------->	030-W-0003-00		030-M-0004-00		030-M-0100-00		030-W-S200-01		030-W-S300-01	
	ORIGINAL ID ----->	030W000300		30M04		30M01		30WS200		30WS300	
	LAB SAMPLE ID --->	638117		ZZ1213		ZZ1210		90750		90751	
	ID FROM REPORT -->	30W000300		30M04		30M01		30WS200		30WS300	
	SAMPLE DATE ----->	09/12/94		08/04/93		08/04/93		11/09/93		11/09/93	
	DATE EXTRACTED -->	09/13/94		08/06/93		08/10/93		11/16/93		11/16/93	
	DATE ANALYZED --->	09/15/94		08/19/93		08/19/93		12/13/93		12/13/93	
	MATRIX ---------->	Water		Sediment		Sediment		Water		Water	
	UNITS ---------->	UG/L		UG/KG		UG/KG		UG/L		UG/L	
CAS #	Parameter	00001	VAL	PN004	VAL	PN004	VAL	FD1034	VAL	FD1034	VAL
108-95-2	Phenol	10.	U	4800.	U	110000.	U	56.		10.	U
111-44-4	bis(2-Chloroethyl)ether	10.	U	4800.	U	110000.	U	10.	U	10.	U
95-57-8	2-Chlorophenol	10.	U	4800.	U	110000.	U	10.	U	10.	U
541-73-1	1,3-Dichlorobenzene	10.	U	4800.	U	110000.	U	10.	U	10.	U
106-46-7	1,4-Dichlorobenzene	10.	U	4800.	U	110000.	U	10.	U	10.	U
95-50-1	1,2-Dichlorobenzene	10.	U	4800.	U	110000.	U	10.	U	10.	U
95-48-7	2-Methylphenol (o-Cresol)	10.	U	4800.	U	110000.	U	10.	U	10.	U
39638-32-9	Bis(2-Chloroisopropyl)Ether	10.	U	4800.	U	110000.	U	10.	U	10.	U
106-44-5	4-Methylphenol (p-Cresol)	10.	U	4800.	U	110000.	U	10.	U	10.	U
621-64-7	N-Nitroso-di-n-propylamine	10.	U	4800.	U	110000.	U	10.	U	10.	U
67-72-1	Hexachloroethane	10.	U	4800.	U	110000.	U	10.	U	10.	U
98-95-3	Nitrobenzene	10.	U	4800.	U	110000.	U	10.	U	10.	U
78-59-1	Isophorone	10.	U	4800.	U	110000.	U	34.		10.	U
88-75-5	2-Nitrophenol	10.	U	4800.	U	110000.	U	10.	U	10.	U
105-67-9	2,4-Dimethylphenol	10.	U	4800.	U	110000.	U	64.		10.	U
111-91-1	bis(2-Chloroethoxy)methane	10.	U	4800.	U	110000.	U	10.	U	10.	U
120-83-2	2,4-Dichlorophenol	10.	U	4800.	U	110000.	U	10.	U	10.	U
120-82-1	1,2,4-Trichlorobenzene	10.	U	4800.	U	110000.	U	10.	U	10.	U
91-20-3	Naphthalene	10.	U	4800.	U	35000.	J	10.	U	10.	U
106-47-8	4-Chloroaniline	10.	U	4800.	U	110000.	U	10.	U	10.	U
87-68-3	Hexachlorobutadiene	10.	U	4800.	U	110000.	U	10.	U	10.	U
59-50-7	4-Chloro-3-methylphenol	10.	U	4800.	U	110000.	U	10.	U	10.	U
91-57-6	2-Methylnaphthalene	10.	U	2500.	J	220000.		10.	U	10.	U
77-47-4	Hexachlorocyclopentadiene	10.	U	4800.	U	110000.	U	10.	U	10.	UJ
88-06-2	2,4,6-Trichlorophenol	10.	U	4800.	U	110000.	U	57.		10.	U
95-95-4	2,4,5-Trichlorophenol	25.	U	12000.	U	280000.	U	25.	U	25.	U
91-58-7	2-Chloronaphthalene	10.	U	4800.	U	110000.	U	10.	U	10.	U
88-74-4	2-Nitroaniline	25.	U	12000.	U	280000.	U	25.	U	25.	U
131-11-3	Dimethyl phthalate	10.	U	4800.	U	110000.	U	10.	U	10.	U
208-96-8	Acenaphthylene	10.	U	4800.	U	110000.	U	10.	U	10.	U
606-20-2	2,6-Dinitrotoluene	10.	U	4800.	U	110000.	U	34.		10.	U
99-09-2	3-Nitroaniline	25.	U	12000.	UJ	280000.	UJ	25.	UJ	25.	U
83-32-9	Acenaphthene	10.	U	4800.	U	110000.	U	33.		10.	U
51-28-5	2,4-Dinitrophenol	25.	U	12000.	U	280000.	U	25.	U	25.	UJ
100-02-7	4-Nitrophenol	25.	U	12000.	U	280000.	UR	25.	U	25.	U
132-64-9	Dibenzofuran	10.	U	4800.	U	110000.	U	10.	U	10.	U

*** Validation Complete ***

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

SVOA											
	SAMPLE ID ------->	030-W-0003-00		030-M-0004-00		030-M-0100-00		030-W-S200-01		030-W-S300-01	
	ORIGINAL ID ----->	030W000300		30M04		30M01		30WS200		30WS300	
	LAB SAMPLE ID --->	638117		ZZ1213		ZZ1210		90750		90751	
	ID FROM REPORT -->	30W000300		30M04		30M01		30WS200		30WS300	
	SAMPLE DATE ----->	09/12/94		08/04/93		08/04/93		11/09/93		11/09/93	
	DATE EXTRACTED -->	09/13/94		08/06/93		08/10/93		11/16/93		11/16/93	
	DATE ANALYZED --->	09/15/94		08/19/93		08/19/93		12/13/93		12/13/93	
	MATRIX ---------->	Water		Sediment		Sediment		Water		Water	
	UNITS ---------->	UG/L		UG/KG		UG/KG		UG/L		UG/L	
CAS #	Parameter	00001	VAL	PN004	VAL	PN004	VAL	FD1034	VAL	FD1034	VAL
121-14-2	2,4-Dinitrotoluene	10.	U	4800.	U	110000.	UR	10.	U	10.	U
84-66-2	Diethylphthalate	10.	U	4800.	U	110000.	U	10.	U	10.	U
7005-72-3	4-Chlorophenylphenylether	10.	U	4800.	U	110000.	U	10.	U	10.	U
86-73-7	Fluorene	10.	U	4800.	U	110000.	U	34.		10.	U
100-01-6	4-Nitroaniline	25.	U	12000.	U	280000.	U	25.	UJ	25.	UJ
534-52-1	2-Methyl-4,6-Dinitrophenol	25.	U	12000.	U	280000.	U	25.	U	25.	U
86-30-6	N-Nitrosodiphenylamine	10.	U	4800.	U	110000.	U	10.	U	10.	U
101-55-3	4-Bromophenyl-phenylether	10.	U	4800.	U	110000.	U	10.	U	10.	U
118-74-1	Hexachlorobenzene	10.	U	4800.	U	110000.	U	10.	U	10.	U
87-86-5	Pentachlorophenol	25.	U	12000.	U	280000.	U	70.		25.	U
85-01-8	Phenanthrene	10.	U	4800.	U	110000.	U	36.		10.	U
120-12-7	Anthracene	10.	U	4800.	U	110000.	U	10.	U	10.	U
86-74-8	Carbazole	10.	U	4800.	U	110000.	U	10.	UJ	10.	U
84-74-2	Di-n-butylphthalate	10.	U	4800.	U	110000.	U	37.		10.	U
206-44-0	Fluoranthene	10.	U	4000.	J	58000.	J	10.	U	10.	U
129-00-0	Pyrene	10.	U	600.	J	110000.	U	29.		10.	U
85-68-7	Butylbenzylphthalate	10.	U	4800.	U	110000.	U	10.	U	10.	U
91-94-1	3,3'-Dichlorobenzidine	10.	U	4800.	U	110000.	U	10.	U	10.	U
56-55-3	Benzo(a)anthracene	10.	U	4800.	U	110000.	U	10.	U	10.	U
218-01-9	Chrysene	10.	U	4800.	U	110000.	U	10.	U	10.	U
117-81-7	bis(2-Ethylhexyl)phthalate (BEHP)	10.	U	2600.	J	990000.	D	10.	U	10.	U
117-84-0	Di-n-octyl phthalate	10.	U	4800.	U	110000.	U	10.	U	10.	U
205-99-2	Benzo(b)fluoranthene	10.	U	4800.	U	110000.	U	10.		10.	U
207-08-9	Benzo(k)fluoranthene	10.	U	4800.	U	110000.	U	10.	U	10.	U
50-32-8	Benzo(a)pyrene	10.	U	4800.	U	110000.	U	10.	U	10.	U
193-39-5	Indeno(1,2,3-cd)pyrene	10.	U	4800.	U	110000.	U	10.	UJ	10.	U
53-70-3	Dibenz(a,h)anthracene	10.	U	4800.	U	110000.	U	10.	U	10.	U
191-24-2	Benzo(g,h,i)perylene	10.	U	4800.	U	110000.	U	10.	U	10.	U

*** Validation Complete ***

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

VOA													
	SAMPLE ID ------->	030-M-0001-00		030-W-0001-00		030-M-0002-00		030-M-0002-00		030-W-0002-00		030-M-0003-00	
	ORIGINAL ID ----->	030M000100		030W000100		30M02		030M000200		030W000200		30M03	
	LAB SAMPLE ID --->	635589		630782		ZZ1203		635561		634388		ZZ1204	
	ID FROM REPORT -->	M000100		030W00010		30N02		M000200		030W00020		30M03	
	SAMPLE DATE ----->	08/23/94		08/02/94		08/04/93		08/23/94		08/15/94		08/04/93	
	DATE ANALYZED --->	08/29/94		08/12/94		08/12/93		08/26/94		08/26/94		08/12/93	
	MATRIX ---------->	Sediment		Water		Sediment		Sediment		Water		Sediment	
	UNITS ---------->	UG/KG		UG/L		UG/KG		UG/KG		UG/L		UG/KG	
CAS #	Parameter	00024	NV	00013	NV	PN004	VAL	00024	NV	00022	NV	PN004	VAL
74-87-3	Chloromethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
74-83-9	Bromomethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
75-01-4	Vinyl chloride	18.	U	10.	U	86.	UJ	240.		10.	U	6500.	J
75-00-3	Chloroethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
75-09-2	Methylene chloride	11.	JB	10.	U	110.	UJ	26.	JB	2.	JB	240.	U
67-64-1	Acetone	33.	B	10.	U	180.	UJ	48.	U	10.	U	420.	U
75-15-0	Carbon disulfide	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
75-35-4	1,1-Dichloroethene	3.	J	10.	U	86.	UJ	5.	J	10.	U	240.	U
75-34-3	1,1-Dichloroethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
540-59-0	1,2-Dichloroethene (total)	2700.	E	14.		86.	UJ	7200.	E	10.	U	2100.	
67-66-3	Chloroform	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
107-06-2	1,2-Dichloroethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	28.	J
78-93-3	2-Butanone (MEK)	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
71-55-6	1,1,1-Trichloroethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
56-23-5	Carbon tetrachloride	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
75-27-4	Bromodichloromethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
78-87-5	1,2-Dichloropropane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
10061-01-5	cis-1,3-Dichloropropene	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
79-01-6	Trichloroethene	10000.	E	10.	U	86.	UJ	310.		10.	U	240.	U
124-48-1	Dibromochloromethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
79-00-5	1,1,2-Trichloroethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
71-43-2	Benzene	2.	J	10.	U	86.	UJ	48.	U	10.	U	36.	J
10061-02-6	trans-1,3-Dichloropropene	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
75-25-2	Bromoform	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
108-10-1	4-Methyl-2-Pentanone (MIBK)	18.	U	10.	U	70.	J	48.	U	10.	U	110.	J
591-78-6	2-Hexanone	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
127-18-4	Tetrachloroethene	1800.	E	10.	U	86.	UJ	22.	J	10.	U	240.	U
79-34-5	1,1,2,2-Tetrachloroethane	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
108-88-3	Toluene	11.	J	10.	U	86.	UJ	9.	J	10.	U	240.	U
108-90-7	Chlorobenzene	11.	J	10.	U	17.	J	12.	J	10.	U	82.	J
100-41-4	Ethylbenzene	8.	J	10.	U	86.	UJ	48.	U	10.	U	240.	U
100-42-5	Styrene	18.	U	10.	U	86.	UJ	48.	U	10.	U	240.	U
1330-20-7	Xylene (Total)	62.		10.	U	86.	UJ	48.	U	10.	U	120.	J

PENSACOLA, SITE 30
Immediate Removal Action Samples
Wetland 5A

VOA												
	SAMPLE ID ------->	030-W-0003-00		030-M-0004-00		030-M-0100-00		030-W-S200-01		030-W-S300-01		
	ORIGINAL ID ----->	030W000300		30M04		30M01		30WS200		30WS300		
	LAB SAMPLE ID --->	638117		ZZ1205		ZZ1202		90750		90751		
	ID FROM REPORT -->	30W000300		30M04		30M01		30WS200		30WS300		
	SAMPLE DATE ----->	09/12/94		08/04/93		08/04/93		11/10/93		11/10/93		
	DATE ANALYZED --->	09/16/94		08/12/93		08/12/93		11/15/93		11/15/93		
	MATRIX ---------->	Water		Sediment		Sediment		Water		Water		
	UNITS ---------->	UG/L		UG/KG		UG/KG		UG/L		UG/L		
CAS #	Parameter	00001	VAL	PN004	VAL	PN004	VAL	FD1034	VAL	FD1034	VAL	
74-87-3	Chloromethane	10.	U	150.	U	330.	U	10.	U	10.	U	
74-83-9	Bromomethane	10.	U	150.	U	330.	U	10.	U	10.	U	
75-01-4	Vinyl chloride	10.	U	150.	U	990.		24.		10.	U	
75-00-3	Chloroethane	10.	U	150.	U	330.	U	10.	U	10.	U	
75-09-2	Methylene chloride	1.	JB	240.	U	840.	U	21.		10.	U	
67-64-1	Acetone	10.	U	290.	U	1500.	U	10.	U	10.	U	
75-15-0	Carbon disulfide	10.	U	150.	U	330.	U	10.	U	10.	U	
75-35-4	1,1-Dichloroethene	10.	U	150.	U	330.	U	10.	U	10.	U	
75-34-3	1,1-Dichloroethane	10.	U	150.	U	330.	U	10.	U	10.	U	
540-59-0	1,2-Dichloroethene (total)	3.	J	150.	U	360.		18.		10.	U	
67-66-3	Chloroform	10.	U	150.	U	330.	U	10.	U	10.	U	
107-06-2	1,2-Dichloroethane	10.	U	150.	U	330.	U	20.		10.	U	
78-93-3	2-Butanone (MEK)	10.	U	150.	U	380.	U	10.	U	10.	U	
71-55-6	1,1,1-Trichloroethane	10.	U	150.	U	330.	U	17.		10.	U	
56-23-5	Carbon tetrachloride	10.	U	150.	U	330.	U	10.	U	10.	U	
75-27-4	Bromodichloromethane	10.	U	150.	U	330.	U	18.		10.	U	
78-87-5	1,2-Dichloropropane	10.	U	150.	U	330.	U	10.	U	10.	U	
10061-01-5	cis-1,3-Dichloropropene	10.	U	150.	U	330.	U	14.		10.	U	
79-01-6	Trichloroethene	10.	U	150.	U	330.	U	10.	U	10.	U	
124-48-1	Dibromochloromethane	10.	U	150.	U	330.	U	18.		10.	U	
79-00-5	1,1,2-Trichloroethane	10.	U	150.	U	330.	U	10.	U	10.	U	
71-43-2	Benzene	10.	U	150.	U	330.	U	10.	U	10.	U	
10061-02-6	trans-1,3-Dichloropropene	10.	U	150.	U	330.	U	14.		10.	U	
75-25-2	Bromoform	10.	U	150.	U	330.	U	10.	U	10.	U	
108-10-1	4-Methyl-2-Pentanone (MIBK)	10.	U	150.	J	56.	J	10.	U	10.	U	
591-78-6	2-Hexanone	10.	U	150.	U	330.	U	10.	U	10.	U	
127-18-4	Tetrachloroethene	10.	U	150.	U	330.	U	17.		10.	U	
79-34-5	1,1,2,2-Tetrachloroethane	10.	U	150.	U	330.	U	10.	U	10.	U	
108-88-3	Toluene	10.	U	150.	U	330.	U	10.	U	10.	U	
108-90-7	Chlorobenzene	10.	U	150.	U	170.	J	10.	U	10.	U	
100-41-4	Ethylbenzene	10.	U	22.	J	140.	J	10.	U	10.	U	
100-42-5	Styrene	10.	U	150.	U	330.	U	10.	U	10.	U	
1330-20-7	Xylene (Total)	10.	U	150.	U	400.		10.	U	10.	U	

*** Validation Complete ***

Appendix C

Soil Gas Survey

(original Copy)

TARGET ENVIRONMENTAL SERVICES, INC.

SITE SCREENING DATA

PENSACOLA NAVAL AIR STATION
PENSACOLA, FLORIDA

PREPARED FOR

ENSAFE/ALLEN & HOSHALL
5720 SUMMER TREES DRIVE, #8
MEMPHIS, TENNESSEE

PREPARED BY

TARGET ENVIRONMENTAL SERVICES, INC.
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Sample Collection and Analysis

From May 27 to August 5, 1993, **TARGET Environmental Services, Inc. (TARGET)** conducted site screening services at **Pensacola Naval Air Station (NAS)**, located in Pensacola, Florida. Under the direction of **EnSafe/Allen & Hoshall (E/A&H)**, a total of 472 soil gas samples and 60 ground water samples were collected from Sites 11, 30, 38 and Building 45 at the NAS. The sampling depths varied from 2 to 24 feet due to subsurface conditions and lack of vehicular access. The sample breakdown for each site is as follows:

Site 11

A total of 44 soil gas samples were collected from Site 11. All of the samples were collected at a depth of 4 feet except for Sample SG34, which was collected at a depth of 3 feet due to probe refusal. The field control samples collected during soil gas sampling activities at this site were labelled as Samples B1 through B5, B49 and B50. The sampling locations for Site 11 were recorded by **E/A&H**'s on-site representative.

Site 30

A total of 347 soil gas samples and 44 ground water samples were collected at Site 30 The soil gas sampling depths ranged from 2 to 12 feet due to probe refusal or the presence of shallow ground water. As directed by **E/A&H**, the ground water samples were collected at the soil gas sample locations which revealed elevated levels of volatile hydrocarbons. The ground water sampling depths ranged from 5 to 24 feet. The sampling depths are provided in Table 1. The sampling locations for Site 30 are shown in Figure 1. The field control samples collected during soil gas sampling activities at this site were labelled as Samples B6 through B48 and B51 through B77. The equipment rinseate blanks collected during ground water sampling activities at this site were labelled as WB1 through WB20. In addition to the soil gas and ground water

samples collected by **TARGET**, 3 soil samples were collected from this site by **E/A&H** (Samples 27S27, 27S27A and 27GI05) and were relinquished to **TARGET**s mobile laboratory operator for in-field headspace analysis. The sampling locations and depths for these soil samples were recorded by **E/A&H**'s on-site representative.

Site 38

A total of 81 soil gas samples and 11 ground water samples were collected at Site 38. The soil gas sampling depths ranged from 2 to 4 feet due to the presence of shallow ground water. As directed by **E/A&H**, the ground water samples were collected at the soil gas sample locations which revealed elevated levels of volatile hydrocarbons. The ground water samples were collected at depths of 5 to 8 feet. The sampling depths are provided in Table 1. The sampling locations for Site 38 are shown in Figure 2. The field control samples collected during soil gas sampling activities at this site were labelled as Samples B600 through B609. The equipment rinseate blanks collected during ground water sampling activities at this site were labelled as WB600 and WB601.

Building 45 Site

Under the direction of **E/A&H**, a total of 5 ground water samples were collected from the Building 45 site. All of the samples were collected at a depth of 6 feet. The equipment rinseate blanks collected during ground water sampling activities at this site were labelled as WB45-B1 and WB45-B2. The sampling locations for the Building 45 site were recorded by **E/A&H**'s on-site representative. All of these ground water samples were sent to **TARGET**s "home" laboratory in Columbia, Maryland for GC/FID headspace analysis for vinyl chloride. A monitoring well sample, collected by **E/A&H** (Sample 38MW09), was sent to **Maryland Spectral Services, Inc.** in Columbia, Maryland for GC/MS analysis for vinyl chloride via EPA Method 8240.

Sampling and Analytical Procedures

To collect the **soil gas** samples, two sampling procedures were employed. For both methods, the entire sampling system was first purged with ambient air drawn through an organic vapor filter cartridge. In general, deep (>4 foot) samples were collected using a van-mounted hydraulic probe to advance connected 3-foot sections of 1-inch diameter threaded steel casing down to the sampling depth. A Teflon line was inserted into the casing to the bottom of the hole, and threaded through a plug which isolates the bottom-hole sampling chamber from the up-hole annulus. Shallow samples (4 feet or less) were collected manually using a drive rod to produce a 1/2 inch hole. A stainless steel probe was inserted to the full depth of the hole and sealed off from the atmosphere. Where pavement was present, a rotary hammer was employed for penetration prior to using the drive rod.

Following isolation of the sampling zone, a sample of in-situ soil gas was then withdrawn through the probe or line and used to purge atmospheric air from the sampling system. A second sample of soil gas was withdrawn through the probe and encapsulated in an EPA-clean, pre-evacuated glass vial at two atmospheres of pressure (15 psig). The self-sealing vial was detached from the sampling system, packaged, labeled, and stored for laboratory analysis.

Prior to the day's field activities all sampling equipment, slide hammer rods and probes were decontaminated by washing with a solution of Alconox/distilled water and rinsing thoroughly with distilled water. Internal surfaces were flushed dry using pre-purified nitrogen or filtered ambient air, and external surfaces were wiped clean using clean paper towels.

To collect the **ground water** samples the hydraulic probe was used to advance connected 3 foot sections of 1" diameter threaded steel casing to the sampling depth. Once the steel casing was in place, water was allowed to fill the pipe. A Teflon sampling tube was placed down the

pipe and ground water was collected from just below the water surface. Samples were placed in EPA-clean, amber glass bottles, sealed, labeled and stored on ice pending analysis.

Prior to the day's field activities and after collection of each ground water sample, the steel casing and Teflon sampling tube were decontaminated by washing with Alconox (a biodegradable, laboratory grade detergent), rinsing with distilled water and drying with nitrogen gas or filtered ambient air.

All of the soil gas samples and the headspaces of the ground water and soil samples collected from Sites 11, 30 and 38 were subjected to dual analyses using **TARGET**'s on-site laboratory gas chromatograph set-up. One analysis was conducted according to EPA Method 8010 (modified) on a gas chromatograph equipped with an electron capture detector (ECD), and using direct injection. Specific analytes standardized for this analysis were:

1,1-dichloroethene (11DCE)
methylene chloride (CH_2Cl_2)
trans-1,2-dichloroethene (t12DCE)
1,1-dichloroethane (11DCA)
cis-1,2-dichloroethene (c12DCE)
chloroform ($CHCl_3$)
1,1,1-trichloroethane (111TCA)
carbon tetrachloride (CCl_4)
trichloroethene (TCE)
1,1,2-trichloroethane (112TCA)
tetrachloroethene (PCE)

The chlorinated hydrocarbons in this suite were chosen because of their common usage in industrial solvents, and/or their degradational relationship to commonly used compounds.

The second analysis was conducted according to EPA Method 8020 (modified) on a gas chromatograph equipped with a flame ionization detector (FID), and using direct injection. The analytes selected for standardization in this analysis were:

benzene
toluene
ethylbenzene
meta- and para- xylene
ortho- xylene

These compounds were chosen because of their utility in evaluating the presence of fuel products, or petroleum based solvents.

The 5 ground water samples from the Building 45 site were analyzed in **TARGET**'s "home" laboratory according to EPA Method 8020 (modified) on a GC/FID using a modified headspace technique. The specific analyte standardized for this analysis was vinyl chloride.

The analytical equipment was calibrated using a 3-point instrument-response curve and injection of known concentrations of the target analytes. Retention times of the standards were used to identify the peaks in the chromatograms of the field samples, and their response factors were used to calculate the analyte concentrations. The ground water samples were prepared for analysis by pouring 15 ml of sample into a 30 ml EPA clean vial and sealing with a teflon-faced butyl rubber septum. The soil samples were prepared for analysis by placing a portion of each composite sample in an EPA-clean glass vial and sealing with a teflon-faced butyl rubber septum. Each vial was heated for 10 minutes in a 60°C heating block to volatilize hydrocarbons from the water or soil. The headspace of the sample was then directly injected into a gas chromatograph.

Total FID Volatiles values were generated by summing the areas of all integrated chromatogram peaks and calculated using the instrument response factor for toluene. Injection peaks, which also contain the light hydrocarbon methane, were excluded to avoid the skewing of Total FID Volatiles values due to injection disturbances and biogenic methane. For samples with low hydrocarbon concentrations, the calculated Total FID Volatiles concentration is occasionally lower than the sum of the individual analytes. This is because the response factor

used for the Total FID Volatiles calculation is a constant, whereas the individual analyte response factors are compound specific. It is important to understand that the Total FID Volatiles levels reported are relative, not absolute, values.

The tabulated results of the laboratory analyses of the soil gas samples and the headspaces of the ground water and soil samples are reported in micrograms per liter (µg/l) in Tables 1 and 2. Although "micrograms per liter" is equivalent to "parts per billion (v/v)" in water analyses, they are not equivalent in gas analyses, due to the difference in the mass of equal volumes of water and gas matrices. The xylenes concentrations reported in Table 1 are the sum of the m- and p-xylene and the o-xylene concentrations for each sample. 1,1-Dichloroethene (1,1-DCE) and 1,1,2-trichlorotrifluoroethane (TCTFA) co-elute using the electron capture detector (ECD) and **TARGET**s analytical conditions and are listed in Table 2 as a co-eluting pair. The concentrations for 1,1-DCE/TCTFA were calculated using the response factor for 1,1-DCE. Because the ECD response to TCTFA is much larger than its response to 11DCE, the same size peak represents only about 5% TCTFA. In other words, 100 µg/l of 1,1-DCE represents approximately 5 µg/l of TCTFA. The concentrations of 1,1-DCE/TCTFA that are shown in bold italics may be higher than reported due to saturation of the detector. The analytical results of the GC/FID vinyl chloride analysis for the 5 ground water samples collected at the Building 45 site are reported in Table 3.

Monitoring well Sample 38MW09 was analyzed for vinyl chloride on a gas chromatograph equipped with a mass spectrometer (GC/MS) according to EPA Method 8240 and using a purge and trap. The results of this analysis (including QA/QC) are included in Appendix A as received from **Maryland Spectral Services**.

Quality Assurance/Quality Control (QA/QC)

Field QA/QC Samples

Field control samples were collected at the beginning and end of each day's field activities and after every twentieth soil gas sample. These QA/QC samples were obtained by filtering ambient air through a dust and organic vapor filter cartridge or by inserting the probe tip into a tube flushed with a 20 psi flow of pre-purified nitrogen and encapsulating as described above. The laboratory results of the analyses of these samples are reported in Tables 1 and 2.

Equipment rinseate blanks were collected at the beginning and end of each day's ground water sampling activities. These QA/QC samples were obtained by pouring bottled distilled water through the Teflon sampling tube and into a glass vial as described above. The laboratory results of the analyses of these samples are reported in Tables 1 through 3.

Laboratory QA/QC Samples

To document analytical repeatability, a duplicate analysis was performed on every tenth field sample. Laboratory blanks of nitrogen gas were also analyzed after every tenth field sample. The results of these analyses are reported in Tables 1 through 3.

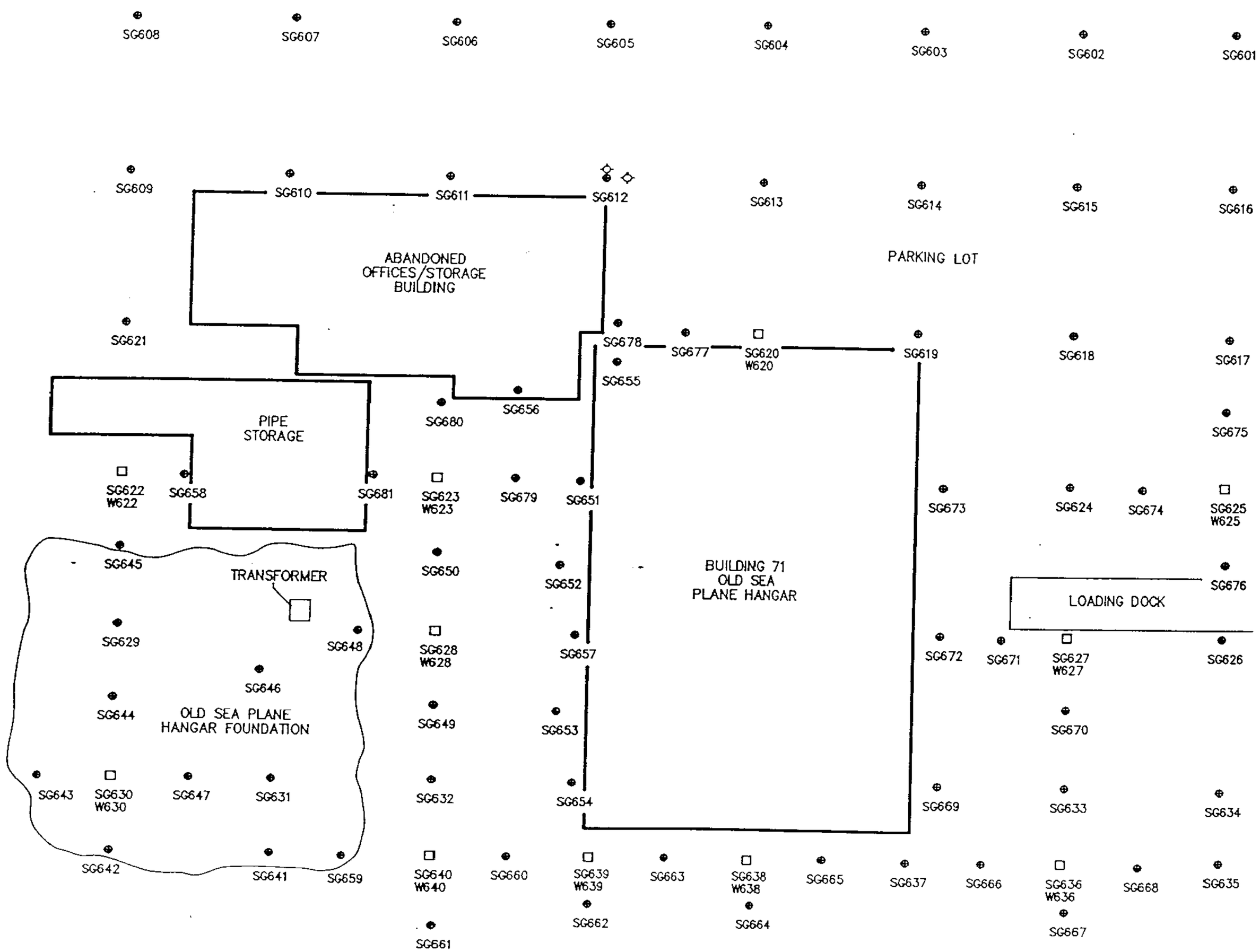

FIGURE 2. Sample Locations

TARGET ENVIRONMENTAL SERVICES, INC.

This map is integral to a written report and should be viewed in that context.

SITE #38
PENSACOLA NAVAL AIR STATION
PENSACOLA, FLORIDA

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 11 - SOIL GAS						
SG1	4	<1.0	<1.0	<1.0	<1.0	<10
SG2	4	<1.0	<1.0	<1.0	<1.0	<10
SG3	4	<1.0	<1.0	<1.0	<1.0	<10
SG4	4	<1.0	<1.0	<1.0	<1.0	<10
SG5	4	<1.0	<1.0	<1.0	<1.0	<10
SG6	4	<1.0	<1.0	<1.0	<1.0	<10
SG7	4	<1.0	<1.0	<1.0	<1.0	<10
SG8	4	<1.0	<1.0	<1.0	<1.0	<10
SG9	4	<1.0	<1.0	<1.0	<1.0	<10
SG10	4	<1.0	<1.0	<1.0	<1.0	<10
SG11	4	<1.0	<1.0	<1.0	<1.0	<10
SG12	4	<1.0	<1.0	<1.0	<1.0	<10
SG13	4	<1.0	<1.0	<1.0	<1.0	<10
SG14	4	<1.0	<1.0	<1.0	<1.0	<10
SG15	4	<1.0	<1.0	<1.0	<1.0	<10
SG16	4	<1.0	<1.0	<1.0	<1.0	<10
SG17	4	<1.0	<1.0	<1.0	<1.0	26
SG18	4	<1.0	<1.0	<1.0	<1.0	35
SG19	4	<1.0	<1.0	<1.0	<1.0	<10
SG20	4	<1.0	<1.0	<1.0	<1.0	<10
SG21	4	<1.0	<1.0	<1.0	<1.0	<10
SG22	4	<1.0	<1.0	<1.0	<1.0	<10
SG23	4	<1.0	<1.0	<1.0	<1.0	<10
SG24	4	<1.0	<1.0	<1.0	<1.0	<10
SG25	4	<1.0	<1.0	<1.0	<1.0	<10
SG26	4	<1.0	<1.0	<1.0	<1.0	<10
SG27	4	<1.0	<1.0	<1.0	<1.0	<10
SG28	4	<1.0	<1.0	<1.0	<1.0	<10
SG29	4	<1.0	<1.0	<1.0	<1.0	<10
SG30	4	<1.0	<1.0	<1.0	<1.0	18

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 11 - SOIL GAS (CONT.)						
SG31	4	<1.0	<1.0	<1.0	<1.0	<10
SG32	4	<1.0	<1.0	<1.0	<1.0	<10
SG33	4	<1.0	<1.0	<1.0	<1.0	<10
SG34	3	<1.0	<1.0	<1.0	<1.0	<10
SG35	4	<1.0	<1.0	<1.0	<1.0	<10
SG36	4	<1.0	<1.0	<1.0	<1.0	<10
SG37	4	<1.0	<1.0	<1.0	<1.0	<10
SG38	4	<1.0	<1.0	<1.0	<1.0	<10
SG39	4	<1.0	<1.0	<1.0	<1.0	<10
SG40	4	<1.0	<1.0	<1.0	<1.0	<10
SG41	4	<1.0	1.4	<1.0	2.5	34
SG42	4	<1.0	<1.0	<1.0	<1.0	<10
SG43	4	<1.0	<1.0	<1.0	<1.0	<10
SG44	4	<1.0	<1.0	<1.0	<1.0	<10
SITE 30 - SOIL GAS						
SG101	12	<1.0	<1.0	<1.0	<1.0	<10
SG102	12	<1.0	<1.0	<1.0	<1.0	<10
SG103	12	<1.0	<1.0	<1.0	<1.0	<10
SG104	12	<1.0	<1.0	<1.0	<1.0	<10
SG105	12	<1.0	<1.0	<1.0	<1.0	<10
SG106	12	<1.0	<1.0	<1.0	<1.0	<10
SG107	12	<1.0	<1.0	<1.0	<1.0	<10
SG108	12	<1.0	<1.0	<1.0	<1.0	<10
SG109	12	<1.0	<1.0	<1.0	<1.0	<10
SG110	12	<1.0	<1.0	<1.0	<1.0	<10
SG111	12	<1.0	<1.0	<1.0	<1.0	<10
SG112	12	1.8	1.1	1.3	5.5	4,674
SG113	12	<1.0	<1.0	<1.0	<1.0	<10
SG114	12	<1.0	<1.0	<1.0	<1.0	<10
SG115	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG116	12	<1.0	<1.0	<1.0	<1.0	<10
SG117	12	<1.0	<1.0	<1.0	<1.0	<10
SG118	12	<1.0	<1.0	<1.0	<1.0	<10
SG119	12	<1.0	<1.0	<1.0	<1.0	<10
SG120	12	<1.0	<1.0	<1.0	<1.0	<10
SG121	12	<1.0	<1.0	<1.0	<1.0	<10
SG122	12	<1.0	<1.0	<1.0	<1.0	<10
SG123	12	<1.0	<1.0	<1.0	<1.0	<10
SG124	12	<1.0	<1.0	<1.0	<1.0	<10
SG125	12	<1.0	<1.0	<1.0	<1.0	<10
SG126	12	<1.0	<1.0	<1.0	<1.0	<10
SG127	12	<1.0	<1.0	<1.0	<1.0	<10
SG128	12	<1.0	<1.0	<1.0	<1.0	<10
SG129	12	<1.0	<1.0	<1.0	<1.0	<10
SG130	12	<1.0	<1.0	<1.0	<1.0	<10
SG131	12	<1.0	<1.0	<1.0	<1.0	<10
SG132	12	<1.0	<1.0	<1.0	<1.0	<10
SG133	12	<1.0	<1.0	<1.0	<1.0	<10
SG134	12	<1.0	<1.0	<1.0	<1.0	<10
SG135	9	<1.0	<1.0	<1.0	<1.0	<10
SG136	12	<1.0	<1.0	<1.0	<1.0	<10
SG137	12	<1.0	<1.0	<1.0	<1.0	<10
SG138	12	<1.0	<1.0	<1.0	<1.0	<10
SG139	12	<1.0	<1.0	<1.0	<1.0	<10
SG140	12	<1.0	<1.0	<1.0	<1.0	<10
SG140A	12	<1.0	<1.0	<1.0	<1.0	<10
SG141	12	<1.0	<1.0	<1.0	<1.0	<10
SG142	12	<1.0	<1.0	<1.0	<1.0	<10
SG143	12	<1.0	<1.0	<1.0	<1.0	<10
SG144	12	<1.0	<1.0	<1.0	<1.0	<10
SG145	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG146	12	<1.0	<1.0	<1.0	<1.0	<10
SG147	12	<1.0	<1.0	<1.0	<1.0	<10
SG148	12	<1.0	<1.0	<1.0	<1.0	<10
SG149	12	<1.0	<1.0	<1.0	<1.0	<10
SG150	12	<1.0	<1.0	<1.0	<1.0	<10
SG151	9	<1.0	<1.0	<1.0	<1.0	<10
SG152	9	<1.0	<1.0	<1.0	<1.0	<10
SG153	12	<1.0	<1.0	<1.0	<1.0	<10
SG154	12	<1.0	<1.0	<1.0	<1.0	<10
SG155	12	<1.0	<1.0	<1.0	<1.0	<10
SG156	12	<1.0	<1.0	<1.0	<1.0	<10
SG157	12	<1.0	<1.0	<1.0	<1.0	<10
SG158	12	<1.0	<1.0	<1.0	<1.0	<10
SG159	12	<1.0	<1.0	<1.0	<1.0	<10
SG160	12	<1.0	<1.0	<1.0	<1.0	<10
SG161	12	<1.0	<1.0	<1.0	<1.0	<10
SG162	3.5	<1.0	<1.0	<1.0	<1.0	51
SG163	3	<1.0	<1.0	<1.0	<1.0	<10
SG164	2	<1.0	<1.0	<1.0	<1.0	<10
SG165	2.5	<1.0	<1.0	<1.0	<1.0	<10
SG166	2.5	<1.0	<1.0	<1.0	<1.0	<10
SG167	12	<1.0	<1.0	<1.0	<1.0	<10
SG168	12	<1.0	<1.0	<1.0	<1.0	<10
SG169	12	<1.0	<1.0	<1.0	<1.0	<10
SG170	12	<1.0	<1.0	<1.0	<1.0	<10
SG171	12	<1.0	<1.0	<1.0	<1.0	<10
SG172	12	<1.0	<1.0	<1.0	<1.0	<10
SG173	9	<1.0	<1.0	<1.0	<1.0	<10
SG174	12	<1.0	<1.0	<1.0	<1.0	<10
SG175	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG176	12	<1.0	<1.0	<1.0	<1.0	<10
SG177	12	<1.0	<1.0	<1.0	<1.0	<10
SG178	12	<1.0	<1.0	<1.0	<1.0	<10
SG179	12	<1.0	<1.0	<1.0	<1.0	<10
SG180	12	<1.0	<1.0	<1.0	<1.0	<10
SG181	12	<1.0	<1.0	<1.0	<1.0	<10
SG182	12	<1.0	<1.0	<1.0	<1.0	<10
SG183	12	<1.0	<1.0	<1.0	<1.0	<10
SG184	12	<1.0	<1.0	<1.0	<1.0	<10
SG185	12	<1.0	<1.0	<1.0	<1.0	<10
SG186	12	<1.0	<1.0	<1.0	<1.0	<10
SG187	12	<1.0	<1.0	<1.0	<1.0	<10
SG188	12	<1.0	<1.0	<1.0	<1.0	<10
SG189	12	<1.0	<1.0	<1.0	<1.0	<10
SG190	12	<1.0	<1.0	<1.0	<1.0	<10
SG191	12	<1.0	<1.0	<1.0	<1.0	<10
SG192	12	<1.0	<1.0	<1.0	<1.0	<10
SG193	12	<1.0	<1.0	<1.0	<1.0	<10
SG194	12	<1.0	<1.0	<1.0	<1.0	<10
SG195	4	<1.0	<1.0	<1.0	<1.0	<10
SG196	3	<1.0	<1.0	<1.0	<1.0	<10
SG197	2	<1.0	<1.0	<1.0	<1.0	<10
SG198	2	<1.0	<1.0	<1.0	<1.0	<10
SG199	12	<1.0	<1.0	<1.0	<1.0	<10
SG200	12	<1.0	<1.0	<1.0	<1.0	<10
SG201	12	<1.0	<1.0	<1.0	<1.0	<10
SG202	12	<1.0	<1.0	<1.0	<1.0	<10
SG203	12	<1.0	<1.0	<1.0	<1.0	<10
SG204	12	<1.0	<1.0	<1.0	<1.0	<10
SG205	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG206	12	<1.0	<1.0	<1.0	<1.0	<10
SG207	12	<1.0	<1.0	<1.0	<1.0	<10
SG208	12	<1.0	<1.0	<1.0	<1.0	<10
SG209	12	<1.0	<1.0	<1.0	<1.0	<10
SG210	12	<1.0	<1.0	<1.0	<1.0	<10
SG211	12	<1.0	<1.0	<1.0	<1.0	<10
SG212	12	<1.0	<1.0	<1.0	<1.0	<10
SG213	12	<1.0	<1.0	<1.0	<1.0	<10
SG214	12	<1.0	<1.0	<1.0	<1.0	<10
SG215	12	<1.0	<1.0	<1.0	<1.0	<10
SG216	12	<1.0	<1.0	<1.0	<1.0	<10
SG217	3	<1.0	<1.0	<1.0	<1.0	<10
SG218	3	<1.0	<1.0	<1.0	<1.0	<10
SG219	3	<1.0	<1.0	<1.0	<1.0	<10
SG220	3	<1.0	<1.0	<1.0	<1.0	<10
SG221	3	<1.0	<1.0	<1.0	<1.0	<10
SG222	3	<1.0	<1.0	<1.0	<1.0	<10
SG223	3	<1.0	<1.0	<1.0	<1.0	<10
SG224	3	<1.0	<1.0	<1.0	3.2	<10
SG225	2	<1.0	<1.0	<1.0	<1.0	<10
SG226	3	<1.0	<1.0	<1.0	<1.0	<10
SG227	2	<1.0	<1.0	<1.0	<1.0	17
SG228	2	<1.0	<1.0	<1.0	<1.0	<10
SG229	2	<1.0	<1.0	<1.0	<1.0	15
SG230	2	<1.0	<1.0	<1.0	<1.0	<10
SG231	2	<1.0	<1.0	<1.0	<1.0	<10
SG232	2	<1.0	<1.0	<1.0	<1.0	13
SG233	12	<1.0	<1.0	<1.0	<1.0	<10
SG234	12	<1.0	<1.0	<1.0	<1.0	20
SG235	12	<1.0	<1.0	<1.0	1.6	2,103

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG236	12	4.9	<1.0	1.8	2.0	6,179
SG237	12	<1.0	<1.0	<1.0	<1.0	<10
SG238	12	<1.0	<1.0	<1.0	<1.0	<10
SG239	12	<1.0	<1.0	<1.0	<1.0	<10
SG240	12	<1.0	<1.0	<1.0	<1.0	<10
SG241	12	<1.0	<1.0	<1.0	<1.0	<10
SG242	12	<1.0	<1.0	<1.0	<1.0	<10
SG243	12	<1.0	<1.0	<1.0	<1.0	<10
SG244	12	<1.0	<1.0	<1.0	<1.0	<10
SG245	12	<1.0	<1.0	<1.0	<1.0	10
SG246	12	<1.0	<1.0	<1.0	<1.0	<10
SG247	12	<1.0	<1.0	<1.0	<1.0	<10
SG248	12	<1.0	<1.0	<1.0	<1.0	<10
SG249	12	<1.0	<1.0	<1.0	<1.0	<10
SG250	12	<1.0	<1.0	<1.0	<1.0	<10
SG251	9	<1.0	<1.0	<1.0	<1.0	<10
SG252	12	<1.0	<1.0	<1.0	2.5	<10
SG253	12	<1.0	<1.0	<1.0	<1.0	<10
SG254	12	<1.0	<1.0	<1.0	<1.0	19
SG255	12	<1.0	<1.0	<1.0	<1.0	<10
SG256	12	<1.0	<1.0	<1.0	<1.0	<10
SG257	12	<1.0	<1.0	<1.0	<1.0	20
SG258	12	<1.0	<1.0	<1.0	<1.0	<10
SG259	12	<1.0	<1.0	<1.0	<1.0	21
SG260	12	<1.0	<1.0	<1.0	<1.0	79
SG261	12	<1.0	<1.0	<1.0	<1.0	26
SG262	12	<1.0	<1.0	<1.0	<1.0	15
SG263	12	<1.0	<1.0	<1.0	<1.0	<10
SG264	12	<1.0	<1.0	<1.0	1.3	<10
SG265	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG266	12	<1.0	<1.0	<1.0	<1.0	<10
SG267	12	<1.0	<1.0	<1.0	<1.0	<10
SG268	9	<1.0	<1.0	<1.0	<1.0	<10
SG269	6	<1.0	<1.0	<1.0	<1.0	<10
SG270	6	<1.0	<1.0	<1.0	<1.0	<10
SG271	6	<1.0	<1.0	<1.0	<1.0	<10
SG272	6	<1.0	<1.0	<1.0	<1.0	<10
SG273	4	<1.0	<1.0	<1.0	<1.0	<10
SG274	5	<1.0	<1.0	<1.0	<1.0	17
SG275	5	<1.0	<1.0	<1.0	<1.0	<10
SG276	5	<1.0	<1.0	<1.0	<1.0	<10
SG277	5	<1.0	<1.0	<1.0	<1.0	<10
SG278	12	<1.0	<1.0	<1.0	<1.0	<10
SG279	12	<1.0	<1.0	<1.0	<1.0	<10
SG280	12	<1.0	<1.0	<1.0	<1.0	<10
SG281	12	<1.0	<1.0	<1.0	<1.0	<10
SG282	12	<1.0	<1.0	<1.0	<1.0	<10
SG283	4	<1.0	<1.0	<1.0	<1.0	<10
SG284	4	<1.0	<1.0	<1.0	<1.0	<10
SG285	12	<1.0	<1.0	<1.0	<1.0	<10
SG286	12	<1.0	<1.0	<1.0	<1.0	69
SG287	6	<1.0	<1.0	<1.0	<1.0	<10
SG288	12	<1.0	<1.0	<1.0	<1.0	<10
SG289	3	<1.0	<1.0	<1.0	<1.0	<10
SG290	3	<1.0	<1.0	<1.0	<1.0	<10
SG291	3	<1.0	<1.0	<1.0	<1.0	<10
SG292	4	<1.0	<1.0	<1.0	<1.0	<10
SG293	4	<1.0	<1.0	<1.0	<1.0	<10
SG294	6	<1.0	<1.0	<1.0	<1.0	<10
SG295	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG296	12	<1.0	<1.0	<1.0	<1.0	<10
SG297	12	<1.0	<1.0	<1.0	<1.0	<10
SG298	12	<1.0	<1.0	<1.0	<1.0	<10
SG299	12	<1.0	<1.0	<1.0	<1.0	<10
SG300	12	<1.0	<1.0	<1.0	<1.0	<10
SG301	6	<1.0	<1.0	<1.0	<1.0	<10
SG302	6	<1.0	<1.0	<1.0	<1.0	<10
SG303	6	<1.0	<1.0	<1.0	<1.0	<10
SG304	6	<1.0	<1.0	<1.0	<1.0	<10
SG305	9	<1.0	<1.0	<1.0	<1.0	<10
SG306	6	<1.0	<1.0	<1.0	<1.0	<10
SG307	3	<1.0	<1.0	<1.0	<1.0	<10
SG308	12	<1.0	<1.0	<1.0	<1.0	41
SG309	9	<1.0	<1.0	<1.0	<1.0	<10
SG310	6	<1.0	<1.0	<1.0	<1.0	<10
SG311	12	<1.0	<1.0	<1.0	<1.0	72
SG312	12	<1.0	<1.0	<1.0	<1.0	<10
SG313	12	<1.0	<1.0	<1.0	<1.0	<10
SG314	12	<1.0	<1.0	<1.0	<1.0	26
SG315	12	<1.0	<1.0	<1.0	<1.0	<10
SG316	9	<1.0	<1.0	<1.0	<1.0	<10
SG317	12	<1.0	<1.0	<1.0	<1.0	<10
SG318	12	<1.0	<1.0	<1.0	3.1	<10
SG319	6	<1.0	<1.0	<1.0	<1.0	57
SG320	12	<1.0	<1.0	<1.0	<1.0	17
SG401	12	<1.0	<1.0	<1.0	<1.0	<10
SG402	12	<1.0	<1.0	<1.0	<1.0	<10
SG403	12	<1.0	<1.0	<1.0	<1.0	11
SG404	12	<1.0	<1.0	<1.0	<1.0	<10
SG405	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG406	12	<1.0	<1.0	<1.0	<1.0	<10
SG407	12	<1.0	<1.0	<1.0	<1.0	<10
SG408	12	<1.0	<1.0	<1.0	<1.0	<10
SG409	12	<1.0	<1.0	<1.0	<1.0	<10
SG410	12	<1.0	<1.0	<1.0	<1.0	<10
SG411	12	<1.0	<1.0	<1.0	<1.0	<10
SG412	12	<1.0	<1.0	<1.0	<1.0	<10
SG413	12	<1.0	<1.0	<1.0	<1.0	<10
SG414	12	<1.0	<1.0	<1.0	<1.0	10
SG415	12	<1.0	<1.0	<1.0	<1.0	11
SG416	2	<1.0	<1.0	<1.0	<1.0	18
SG417	2	<1.0	<1.0	<1.0	<1.0	<10
SG418	2	<1.0	<1.0	<1.0	<1.0	<10
SG419	12	<1.0	<1.0	<1.0	<1.0	10
SG420	12	<1.0	<1.0	<1.0	<1.0	<10
SG421	12	<1.0	<1.0	<1.0	<1.0	<10
SG422	12	<1.0	<1.0	<1.0	<1.0	<10
SG423	12	<1.0	<1.0	<1.0	<1.0	<10
SG424	12	1.1	<1.0	<1.0	<1.0	12
SG425	12	<1.0	<1.0	<1.0	<1.0	<10
SG426	12	<1.0	<1.0	<1.0	<1.0	<10
SG427	12	<1.0	<1.0	<1.0	<1.0	<10
SG428	12	<1.0	<1.0	<1.0	<1.0	<10
SG429	12	<1.0	<1.0	<1.0	<1.0	<10
SG430	12	<1.0	<1.0	<1.0	<1.0	<10
SG431	12	<1.0	<1.0	<1.0	<1.0	<10
SG432	12	<1.0	<1.0	<1.0	<1.0	37
SG433	12	<1.0	<1.0	<1.0	<1.0	12
SG434	12	<1.0	<1.0	<1.0	<1.0	25
SG435	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG436	12	<1.0	<1.0	<1.0	<1.0	<10
SG437	12	<1.0	<1.0	<1.0	<1.0	27
SG438	12	<1.0	<1.0	<1.0	<1.0	<10
SG439	12	<1.0	<1.0	<1.0	<1.0	<10
SG440	12	<1.0	31	75	90	1,785
SG441	12	<1.0	<1.0	<1.0	<1.0	16
SG442	12	<1.0	<1.0	<1.0	<1.0	50
SG443	12	<1.0	<1.0	<1.0	<1.0	428
SG444	12	<1.0	<1.0	<1.0	<1.0	<10
SG445	12	<1.0	<1.0	<1.0	<1.0	<10
SG446	12	<1.0	<1.0	<1.0	<1.0	<10
SG447	9	<1.0	<1.0	<1.0	<1.0	<10
SG448	9	<1.0	<1.0	<1.0	<1.0	<10
SG449	10	<1.0	<1.0	2.6	13	74
SG450	9	<1.0	<1.0	<1.0	<1.0	<10
SG451	12	<1.0	<1.0	<1.0	<1.0	73
SG452	9	<1.0	<1.0	<1.0	<1.0	<10
SG453	12	<1.0	<1.0	<1.0	<1.0	<10
SG454	12	<1.0	<1.0	<1.0	<1.0	14
SG455	12	<1.0	<1.0	<1.0	<1.0	<10
SG456	12	<1.0	<1.0	<1.0	<1.0	<10
SG457	12	<1.0	<1.0	<1.0	<1.0	<10
SG458	12	<1.0	<1.0	<1.0	<1.0	109
SG459	12	<1.0	2.1	<1.0	<1.0	83
SG460	12	<1.0	<1.0	<1.0	<1.0	<10
SG461	12	<1.0	<1.0	<1.0	<1.0	<10
SG462	12	<1.0	<1.0	<1.0	<1.0	<10
SG463	12	<1.0	<1.0	<1.0	<1.0	<10
SG464	12	<1.0	<1.0	<1.0	<1.0	<10
SG465	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG466	12	<1.0	<1.0	<1.0	<1.0	<10
SG467	12	<1.0	<1.0	<1.0	<1.0	<10
SG468	12	<1.0	<1.0	<1.0	<1.0	<10
SG469	12	<1.0	<1.0	<1.0	<1.0	27
SG470	12	<1.0	<1.0	<1.0	<1.0	<10
SG471	12	<1.0	<1.0	<1.0	<1.0	<10
SG472	12	<1.0	<1.0	<1.0	<1.0	<10
SG473	12	<1.0	<1.0	<1.0	<1.0	<10
SG474	12	<1.0	<1.0	<1.0	<1.0	<10
SG475	12	19	1.6	11	5.2	40,190
SG476	12	<1.0	<1.0	<1.0	<1.0	17
SG477	12	<1.0	<1.0	<1.0	<1.0	<10
SG478	12	7.9	1.1	2.7	7.6	13,340
SG479	12	<1.0	<1.0	<1.0	<1.0	16
SG480	12	<1.0	<1.0	<1.0	<1.0	37
SG481	12	<1.0	<1.0	<1.0	<1.0	<10
SG482	12	<1.0	<1.0	<1.0	<1.0	<10
SG483	12	<1.0	<1.0	<1.0	<1.0	<10
SG484	6	<1.0	<1.0	<1.0	<1.0	<10
SG485	6	<1.0	<1.0	<1.0	<1.0	<10
SG486	2	<1.0	<1.0	<1.0	<1.0	<10
SG487	2	<1.0	<1.0	<1.0	<1.0	<10
SG488	2	<1.0	<1.0	<1.0	<1.0	<10
SG489	3	<1.0	<1.0	<1.0	<1.0	<10
SG490	2	<1.0	<1.0	<1.0	<1.0	<10
SG491	3	<1.0	<1.0	<1.0	<1.0	<10
SG492	3	<1.0	<1.0	<1.0	<1.0	<10
SG493	3	<1.0	<1.0	<1.0	<1.0	12
SG494	3	<1.0	<1.0	<1.0	<1.0	<10
SG495	3	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - SOIL GAS (CONT.)						
SG496	12	<1.0	<1.0	<1.0	<1.0	<10
SG497	12	<1.0	<1.0	<1.0	<1.0	<10
SG498	12	<1.0	<1.0	<1.0	<1.0	<10
SG499	12	<1.0	<1.0	<1.0	<1.0	<10
SG500	9	<1.0	<1.0	<1.0	<1.0	<10
SG501	9	<1.0	<1.0	<1.0	<1.0	<10
SG502	8	<1.0	<1.0	<1.0	<1.0	<10
SG503	9	<1.0	<1.0	<1.0	<1.0	<10
SG504	12	<1.0	<1.0	<1.0	<1.0	<10
SG505	9	<1.0	<1.0	<1.0	<1.0	<10
SG506	9	<1.0	<1.0	<1.0	<1.0	<10
SG507	9	<1.0	<1.0	<1.0	<1.0	<10
SG508	9	<1.0	<1.0	<1.0	<1.0	<10
SG509	9	<1.0	<1.0	<1.0	<1.0	<10
SG510	12	<1.0	<1.0	<1.0	<1.0	<10
SG511	12	<1.0	<1.0	<1.0	<1.0	<10
SG512	12	<1.0	<1.0	<1.0	<1.0	<10
SG513	12	<1.0	<1.0	<1.0	<1.0	<10
SG514	12	30	2.0	<1.0	18	28,880
SG515	12	<1.0	<1.0	<1.0	<1.0	40
SG516	12	<1.0	<1.0	<1.0	<1.0	20
SG517	12	<1.0	<1.0	<1.0	<1.0	14
SG518	12	<1.0	<1.0	<1.0	<1.0	<10
SG519	12	<1.0	<1.0	<1.0	<1.0	72
SG520	12	<1.0	<1.0	<1.0	<1.0	<10
SG521	12	<1.0	<1.0	<1.0	<1.0	11
SG522	12	<1.0	<1.0	<1.0	<1.0	14
SG523	12	<1.0	<1.0	<1.0	<1.0	<10
SG524	12	<1.0	<1.0	<1.0	<1.0	<10
SG525	12	<1.0	<1.0	<1.0	<1.0	<10
SG526	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - GROUND WATER						
W105	23	<1.0	<1.0	<1.0	<1.0	<10
W106	23	<1.0	<1.0	<1.0	<1.0	<10
W108	23	<1.0	<1.0	<1.0	<1.0	<10
W111	23	<1.0	<1.0	<1.0	<1.0	<10
W112	23	<1.0	<1.0	<1.0	<1.0	<10
W134	23	<1.0	<1.0	<1.0	<1.0	<10
W162	5.5	<1.0	<1.0	<1.0	<1.0	<10
W169	20	<1.0	<1.0	<1.0	<1.0	<10
W170	17	<1.0	<1.0	<1.0	<1.0	<10
W177	23	<1.0	<1.0	<1.0	<1.0	<10
W188	20	<1.0	<1.0	<1.0	<1.0	<10
W191	24	<1.0	<1.0	<1.0	<1.0	11
W193	23	<1.0	<1.0	<1.0	<1.0	<10
W204	23	<1.0	<1.0	1.8	2.8	18
W205	20	<1.0	<1.0	<1.0	<1.0	<10
W206	23	<1.0	<1.0	<1.0	<1.0	<10
W215	21	<1.0	6.3	10	117	1,873
W216	22	<1.0	1.0	<1.0	<1.0	44
W221	8	<1.0	<1.0	<1.0	<1.0	<10
W224	5	<1.0	<1.0	<1.0	<1.0	<10
W227	5	<1.0	<1.0	<1.0	<1.0	33
W229	5	<1.0	<1.0	<1.0	<1.0	<10
W232	5	<1.0	<1.0	<1.0	<1.0	<10
W234	20	<1.0	<1.0	<1.0	<1.0	<10
W235	20	<1.0	<1.0	<1.0	<1.0	13
W236	20	<1.0	<1.0	<1.0	<1.0	<10
W244	23	<7.5	<7.5	<7.5	<7.5	180
W245	20	<1.0	<1.0	<1.0	<1.0	<10
W249	23	<1.0	<1.0	<1.0	2.0	<10
W250	23	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 30 - GROUND WATER (CONT.)						
W253	23	<1.0	<1.0	<1.0	<1.0	<10
W254	23	<1.0	<1.0	<1.0	<1.0	<10
W255	23	<1.0	<1.0	<1.0	<1.0	<10
W256	23	<1.0	<1.0	<1.0	<1.0	<10
W257	23	<1.0	<1.0	<1.0	<1.0	<10
W259	23	<1.0	<1.0	<1.0	4.7	30
W260	23	1.4	5.2	9.6	41	70
W261	23	<1.0	<1.0	1.7	5.6	<10
W262	20	<1.0	<1.0	<1.0	<1.0	<10
W268	14	<1.0	<1.0	<1.0	<1.0	<10
W279	23	<1.0	<1.0	<1.0	<1.0	<10
W282	23	<1.0	<1.0	<1.0	<1.0	<10
W286	23	<1.0	<1.0	<1.0	<1.0	<10
W287	17	<1.0	<1.0	<1.0	<1.0	<10
SITE 30 - SOIL						
27S27	NR	<1.0	<1.0	<1.0	<1.0	<10
27S27A	NR	<1.0	<1.0	<1.0	<1.0	<10
27GI05	NR	<1.0	<1.0	<1.0	6.4	<10
SITE 38 - SOIL GAS						
SG601	4	<1.0	<1.0	<1.0	<1.0	<10
SG602	4	<1.0	<1.0	<1.0	<1.0	<10
SG603	4	<1.0	<1.0	<1.0	<1.0	<10
SG604	4	<1.0	<1.0	<1.0	<1.0	<10
SG605	4	<1.0	<1.0	<1.0	<1.0	<10
SG606	4	<1.0	<1.0	<1.0	<1.0	<10
SG607	4	<1.0	<1.0	<1.0	<1.0	<10
SG608	4	<1.0	<1.0	<1.0	<1.0	<10
SG609	4	<1.0	<1.0	<1.0	<1.0	<10
SG610	4	<1.0	<1.0	<1.0	<1.0	<10

NR = SAMPLE DEPTH NOT RECORDED BY TARGET PERSONNEL

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 38 - SOIL GAS (CONT.)						
SG611	4	<1.0	<1.0	<1.0	<1.0	<10
SG612	4	<1.0	1.2	<1.0	<1.0	<10
SG613	4	<1.0	<1.0	<1.0	<1.0	<10
SG614	4	<1.0	<1.0	<1.0	<1.0	<10
SG615	4	<1.0	<1.0	<1.0	<1.0	<10
SG616	4	<1.0	<1.0	<1.0	<1.0	<10
SG617	4	<1.0	<1.0	<1.0	<1.0	<10
SG618	4	<1.0	<1.0	<1.0	<1.0	<10
SG619	4	<1.0	<1.0	<1.0	<1.0	<10
SG620	4	<1.0	<1.0	<1.0	<1.0	<10
SG621	4	<1.0	<1.0	<1.0	<1.0	<10
SG622	3	<1.0	<1.0	<1.0	<1.0	<10
SG623	3	<1.0	<1.0	<1.0	<1.0	297
SG624	3	<1.0	<1.0	<1.0	<1.0	<10
SG625	3	<1.0	<1.0	<1.0	<1.0	<10
SG626	3	<1.0	<1.0	<1.0	<1.0	<10
SG627	3	<1.0	<1.0	<1.0	<1.0	<10
SG628	2	<1.0	<1.0	<1.0	<1.0	25
SG629	3	<1.0	1.1	<1.0	<1.0	<10
SG630	3	<1.0	2.2	<1.0	<1.0	17
SG631	3	<1.0	<1.0	<1.0	<1.0	20
SG632	3	<1.0	<1.0	<1.0	<1.0	206
SG633	3	<1.0	1.0	<1.0	<1.0	12
SG634	3	<1.0	<1.0	<1.0	1.1	<10
SG635	3	<1.0	<1.0	<1.0	<1.0	<10
SG636	3	<1.0	<1.0	<1.0	<1.0	<10
SG637	3	<1.0	<1.0	<1.0	<1.0	<10
SG638	2	<1.0	<1.0	<1.0	<1.0	58
SG639	2	<1.0	<1.0	<1.0	<1.0	23
SG640	2	<1.0	<1.0	<1.0	<1.0	44

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 38 - SOIL GAS (CONT.)						
SG641	2	<1.0	<1.0	<1.0	<1.0	<10
SG642	2	<1.0	<1.0	<1.0	<1.0	<10
SG643	3	<1.0	2.3	<1.0	<1.0	<10
SG644	3	<1.0	1.2	<1.0	<1.0	<10
SG645	3	<1.0	<1.0	<1.0	<1.0	<10
SG646	3	<1.0	<1.0	<1.0	<1.0	<10
SG647	3	<1.0	2.2	<1.0	<1.0	136
SG648	3	<1.0	1.2	<1.0	<1.0	23
SG649	3	<1.0	<1.0	<1.0	<1.0	112
SG650	3	<1.0	<1.0	<1.0	<1.0	318
SG651	3	<1.0	<1.0	<1.0	<1.0	1,553
SG652	3	<1.0	<1.0	<1.0	<1.0	137
SG653	3	<1.0	<1.0	<1.0	<1.0	79
SG654	3	<1.0	<1.0	<1.0	<1.0	23
SG655	3	<1.0	<1.0	<1.0	<1.0	37
SG656	3	<1.0	1.6	<1.0	<1.0	181
SG657	3	<1.0	<1.0	<1.0	<1.0	121
SG658	3	<1.0	2.2	<1.0	<1.0	29
SG659	3	<1.0	<1.0	<1.0	<1.0	34
SG660	3	<1.0	<1.0	<1.0	<1.0	30
SG661	3	<1.0	<1.0	<1.0	<1.0	29
SG662	3	<1.0	<1.0	<1.0	<1.0	<10
SG663	2	<1.0	<1.0	<1.0	<1.0	52
SG664	3	<1.0	<1.0	<1.0	<1.0	<10
SG665	3	<1.0	<1.0	<1.0	<1.0	13
SG666	3	<1.0	1.0	<1.0	<1.0	<10
SG667	3	<1.0	2.1	<1.0	2.9	39
SG668	3	<1.0	<1.0	<1.0	<1.0	<10
SG669	3	<1.0	<1.0	<1.0	<1.0	<10
SG670	3	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
SITE 38 - SOIL GAS (CONT.)						
SG671	3	<1.0	<1.0	<1.0	<1.0	<10
SG672	3	<1.0	1.8	<1.0	3.0	21
SG673	3	<1.0	<1.0	<1.0	<1.0	49
SG674	3	<1.0	<1.0	<1.0	<1.0	<10
SG675	3	<1.0	<1.0	<1.0	<1.0	<10
SG676	3	<1.0	<1.0	<1.0	<1.0	<10
SG677	3	<1.0	<1.0	<1.0	<1.0	<10
SG678	3	<1.0	<1.0	<1.0	<1.0	<10
SG679	3	<1.0	<1.0	<1.0	<1.0	991
SG680	3	<1.0	<1.0	<1.0	<1.0	110
SG681	3	<1.0	<1.0	<1.0	<1.0	31
SITE 38 - GROUND WATER						
W620	8	<15	128	9,525	13,800	158,900
W622	5	<1.0	<1.0	<1.0	<1.0	<10
W623	5	<1.0	<1.0	<1.0	<1.0	<10
W625	5	<1.0	<1.0	<1.0	<1.0	<10
W627	5	<1.0	<1.0	<1.0	<1.0	<10
W628	5	<1.0	<1.0	<1.0	<1.0	<10
W630	5	<7.5	<7.5	<7.5	<7.5	<75
W636	5	593	106,700	9,930	37,180	2,078,000
W638	5	<15	68	2,730	3,585	76,050
W639	5	<15	<15	<15	<15	<150
W640	5	<1.0	<1.0	<1.0	<1.0	<10
BUILDING 45 SITE - GROUND WATER						
W45-1	6	<1.0	<1.0	<1.0	<1.0	14
W45-2	6	<1.0	<1.0	5.8	2.5	82
W45-3	6	<1.0	<1.0	<1.0	<1.0	485
W45-4	6	<1.0	<1.0	<1.0	<1.0	<10
W45-5	6	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
FIELD CONTROL SAMPLES						
B1	N/A	<1.0	<1.0	<1.0	<1.0	<10
B2	N/A	<1.0	<1.0	<1.0	<1.0	<10
B3	N/A	<1.0	<1.0	<1.0	<1.0	<10
B4	N/A	<1.0	<1.0	<1.0	<1.0	<10
B5	N/A	<1.0	<1.0	<1.0	<1.0	<10
B6	N/A	<1.0	<1.0	<1.0	<1.0	<10
B7	N/A	<1.0	<1.0	<1.0	<1.0	<10
B8	N/A	<1.0	<1.0	<1.0	<1.0	<10
B9	N/A	<1.0	<1.0	<1.0	<1.0	<10
B10	N/A	<1.0	<1.0	<1.0	<1.0	<10
B11	N/A	<1.0	<1.0	<1.0	<1.0	<10
B12	N/A	<1.0	<1.0	<1.0	<1.0	<10
B13	N/A	<1.0	<1.0	<1.0	<1.0	<10
B14	N/A	<1.0	<1.0	<1.0	<1.0	<10
B15	N/A	<1.0	<1.0	<1.0	<1.0	<10
B16	N/A	<1.0	<1.0	<1.0	<1.0	<10
B17	N/A	<1.0	<1.0	<1.0	<1.0	<10
B18	N/A	<1.0	<1.0	<1.0	<1.0	<10
B19	N/A	<1.0	<1.0	<1.0	<1.0	<10
B20	N/A	<1.0	<1.0	<1.0	<1.0	<10
B21	N/A	<1.0	<1.0	<1.0	<1.0	<10
B22	N/A	<1.0	<1.0	<1.0	<1.0	<10
B23	N/A	<1.0	<1.0	<1.0	<1.0	<10
B24	N/A	<1.0	<1.0	<1.0	<1.0	<10
B25	N/A	<1.0	<1.0	<1.0	<1.0	<10
B26	N/A	<1.0	<1.0	<1.0	<1.0	<10
B27	N/A	<1.0	<1.0	<1.0	<1.0	<10
B28	N/A	<1.0	<1.0	<1.0	<1.0	<10
B29	N/A	<1.0	<1.0	<1.0	<1.0	<10
B30	N/A	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
FIELD CONTROL SAMPLES (CONT.)						
B31	N/A	<1.0	<1.0	<1.0	<1.0	<10
B32	N/A	<1.0	<1.0	<1.0	<1.0	<10
B33	N/A	<1.0	<1.0	<1.0	<1.0	<10
B34	N/A	<1.0	<1.0	<1.0	<1.0	<10
B35	N/A	<1.0	<1.0	<1.0	<1.0	<10
B37	N/A	<1.0	<1.0	<1.0	<1.0	<10
B38	N/A	<1.0	<1.0	<1.0	<1.0	<10
B39	N/A	<1.0	<1.0	<1.0	<1.0	<10
B40	N/A	<1.0	<1.0	<1.0	<1.0	<10
B41	N/A	<1.0	<1.0	<1.0	<1.0	<10
B42	N/A	<1.0	<1.0	<1.0	<1.0	<10
B43	N/A	<1.0	<1.0	<1.0	<1.0	<10
B44	N/A	<1.0	<1.0	<1.0	<1.0	<10
B45	N/A	<1.0	<1.0	<1.0	<1.0	<10
B46	N/A	<1.0	<1.0	<1.0	<1.0	<10
B47	N/A	<1.0	<1.0	<1.0	<1.0	<10
B48	N/A	<1.0	<1.0	<1.0	<1.0	<10
B49	N/A	<1.0	<1.0	<1.0	<1.0	<10
B50	N/A	<1.0	<1.0	<1.0	<1.0	<10
B51	N/A	<1.0	<1.0	<1.0	<1.0	<10
B52	N/A	<1.0	<1.0	<1.0	<1.0	<10
B53	N/A	<1.0	<1.0	<1.0	<1.0	<10
B54	N/A	<1.0	<1.0	<1.0	<1.0	<10
B55	N/A	<1.0	<1.0	<1.0	<1.0	<10
B56	N/A	<1.0	<1.0	<1.0	<1.0	<10
B57	N/A	<1.0	<1.0	<1.0	<1.0	<10
B58	N/A	<1.0	<1.0	<1.0	<1.0	<10
B59	N/A	<1.0	<1.0	<1.0	<1.0	<10
B60	N/A	<1.0	<1.0	<1.0	<1.0	<10
B61	N/A	<1.0	<1.0	<1.0	<1.0	<10
B62	N/A	<1.0	<1.0	<1.0	<1.0	<10
B63	N/A	<1.0	<1.0	<1.0	<1.0	<10
B64	N/A	1.1	<1.0	<1.0	<1.0	<10
B65	N/A	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
FIELD CONTROL SAMPLES (CONT.)						
B66	N/A	<1.0	<1.0	<1.0	<1.0	<10
B67	N/A	<1.0	<1.0	<1.0	<1.0	<10
B68	N/A	<1.0	<1.0	<1.0	<1.0	<10
B69	N/A	<1.0	<1.0	<1.0	<1.0	<10
B70	N/A	<1.0	<1.0	<1.0	<1.0	<10
B71	N/A	<1.0	<1.0	<1.0	<1.0	<10
B72	N/A	<1.0	<1.0	<1.0	<1.0	<10
B73	N/A	<1.0	<1.0	<1.0	<1.0	<10
B74	N/A	<1.0	<1.0	<1.0	<1.0	<10
B75	N/A	<1.0	<1.0	<1.0	<1.0	<10
B76	N/A	<1.0	<1.0	<1.0	<1.0	<10
B77	N/A	<1.0	<1.0	<1.0	<1.0	<10
B600	N/A	<1.0	<1.0	<1.0	<1.0	<10
B601	N/A	<1.0	<1.0	<1.0	<1.0	<10
B602	N/A	<1.0	<1.0	<1.0	<1.0	<10
B603	N/A	<1.0	<1.0	<1.0	<1.0	<10
B604	N/A	<1.0	<1.0	<1.0	<1.0	<10
B605	N/A	<1.0	<1.0	<1.0	<1.0	<10
B606	N/A	<1.0	<1.0	<1.0	<1.0	<10
B607	N/A	<1.0	<1.0	<1.0	<1.0	<10
B608	N/A	<1.0	<1.0	<1.0	<1.0	<10
B609	N/A	<1.0	<1.0	<1.0	<1.0	<10
EQUIPMENT RINSEATE SAMPLES						
WB1	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB2	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB3	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB4	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB5	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB6	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB7	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB8	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB9	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB10	N/A	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
EQUIPMENT RINSEATE SAMPLES (CONT.)						
WB11	N/A	<1.0	1.1	<1.0	<1.0	<10
WB12	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB13	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB14	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB15	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB16	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB17	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB18	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB19	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB20	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB600	N/A	<1.0	1.9	<1.0	<1.0	14
WB601	N/A	<1.0	<1.0	<1.0	<1.0	<10
W45-B1	N/A	<1.0	1.0	<1.0	<1.0	<10
W45-B2	N/A	<1.0	<1.0	<1.0	<1.0	<10
LABORATORY DUPLICATE ANALYSIS						
SG10	4	<1.0	<1.0	<1.0	<1.0	<10
SG10R	4	<1.0	<1.0	<1.0	<1.0	<10
SG25	4	<1.0	<1.0	<1.0	<1.0	<10
SG25R	4	<1.0	<1.0	<1.0	<1.0	<10
SG35	4	<1.0	<1.0	<1.0	<1.0	<10
SG35R	4	<1.0	<1.0	<1.0	<1.0	<10
SG110	12	<1.0	<1.0	<1.0	<1.0	<10
SG110R	12	<1.0	<1.0	<1.0	<1.0	<10
SG128	12	<1.0	<1.0	<1.0	<1.0	<10
SG128R	12	<1.0	<1.0	<1.0	<1.0	<10
SG149	12	<1.0	<1.0	<1.0	<1.0	<10
SG149R	12	<1.0	<1.0	<1.0	<1.0	<10
SG157	12	<1.0	<1.0	<1.0	<1.0	<10
SG157R	12	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
LABORATORY DUPLICATE ANALYSIS (CONT.)						
SG176	12	<1.0	<1.0	<1.0	<1.0	<10
SG176R	12	<1.0	<1.0	<1.0	<1.0	<10
SG194	12	<1.0	<1.0	<1.0	<1.0	<10
SG194R	12	<1.0	<1.0	<1.0	<1.0	<10
SG209	12	<1.0	<1.0	<1.0	<1.0	<10
SG209R	12	<1.0	<1.0	<1.0	<1.0	<10
SG217	3	<1.0	<1.0	<1.0	<1.0	<10
SG217R	3	<1.0	<1.0	<1.0	<1.0	<10
SG227	2	<1.0	<1.0	<1.0	<1.0	17
SG227R	2	<1.0	<1.0	<1.0	<1.0	17
SG235	12	<1.0	<1.0	<1.0	1.6	2,103
SG235R	12	<1.0	<1.0	<1.0	2.2	2,004
SG239	12	<1.0	<1.0	<1.0	<1.0	<10
SG239R	12	<1.0	<1.0	<1.0	<1.0	<10
SG249	12	<1.0	<1.0	<1.0	<1.0	<10
SG249R	12	<1.0	<1.0	<1.0	<1.0	<10
SG252	12	<1.0	<1.0	<1.0	2.5	<10
SG252R	12	<1.0	<1.0	<1.0	2.5	<10
SG262	12	<1.0	<1.0	<1.0	<1.0	15
SG262R	12	<1.0	<1.0	<1.0	<1.0	13
SG272	6	<1.0	<1.0	<1.0	<1.0	<10
SG272R	6	<1.0	<1.0	<1.0	<1.0	<10
SG282	12	<1.0	<1.0	<1.0	<1.0	<10
SG282R	12	<1.0	<1.0	<1.0	<1.0	<10
SG289	3	<1.0	<1.0	<1.0	<1.0	<10
SG289R	3	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
LABORATORY DUPLICATE ANALYSIS (CONT.)						
SG303	6	<1.0	<1.0	<1.0	<1.0	<10
SG303R	6	<1.0	<1.0	<1.0	<1.0	<10
SG410	12	<1.0	<1.0	<1.0	<1.0	<10
SG410R	12	<1.0	<1.0	<1.0	<1.0	<10
SG423	12	<1.0	<1.0	<1.0	<1.0	<10
SG423R	12	<1.0	<1.0	<1.0	<1.0	<10
SG431	12	<1.0	<1.0	<1.0	<1.0	<10
SG431R	12	<1.0	<1.0	<1.0	<1.0	<10
SG441	12	<1.0	<1.0	<1.0	<1.0	16
SG441R	12	<1.0	<1.0	<1.0	<1.0	15
SG456	12	<1.0	<1.0	<1.0	<1.0	<10
SG456R	12	<1.0	<1.0	<1.0	<1.0	<10
SG467	12	<1.0	<1.0	<1.0	<1.0	<10
SG467R	12	<1.0	<1.0	<1.0	<1.0	<10
SG477	12	<1.0	<1.0	<1.0	<1.0	<10
SG477R	12	<1.0	<1.0	<1.0	<1.0	<10
SG486	2	<1.0	<1.0	<1.0	<1.0	<10
SG486R	2	<1.0	<1.0	<1.0	<1.0	<10
SG496	12	<1.0	<1.0	<1.0	<1.0	<10
SG496R	12	<1.0	<1.0	<1.0	<1.0	<10
SG506	9	<1.0	<1.0	<1.0	<1.0	<10
SG506R	9	<1.0	<1.0	<1.0	<1.0	<10
SG519	12	<1.0	<1.0	<1.0	<1.0	72
SG519R	12	<1.0	<1.0	<1.0	<1.0	69
SG610	4	<1.0	<1.0	<1.0	<1.0	<10
SG610R	4	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
LABORATORY DUPLICATE ANALYSIS (CONT.)						
SG620	4	<1.0	<1.0	<1.0	<1.0	<10
SG620R	4	<1.0	<1.0	<1.0	<1.0	<10
SG630	3	<1.0	2.2	<1.0	<1.0	17
SG630R	3	<1.0	2.1	<1.0	<1.0	17
SG649	3	<1.0	<1.0	<1.0	<1.0	112
SG649R	3	<1.0	<1.0	<1.0	<1.0	109
SG659	3	<1.0	<1.0	<1.0	<1.0	34
SG659R	3	<1.0	<1.0	<1.0	<1.0	34
SG679	3	<1.0	<1.0	<1.0	<1.0	991
SG679R	3	<1.0	<1.0	<1.0	<1.0	981
W111	23	<1.0	<1.0	<1.0	<1.0	<10
W111R	23	<1.0	<1.0	<1.0	<1.0	<10
W232	5	<1.0	<1.0	<1.0	<1.0	<10
W232R	5	<1.0	<1.0	<1.0	<1.0	<10
B13	N/A	<1.0	<1.0	<1.0	<1.0	<10
B13R	N/A	<1.0	<1.0	<1.0	<1.0	<10
B15	N/A	<1.0	<1.0	<1.0	<1.0	<10
B15R	N/A	<1.0	<1.0	<1.0	<1.0	<10
B21	N/A	<1.0	<1.0	<1.0	<1.0	<10
B21R	N/A	<1.0	<1.0	<1.0	<1.0	<10
B48	N/A	<1.0	<1.0	<1.0	<1.0	<10
B48R	N/A	<1.0	<1.0	<1.0	<1.0	<10
B71	N/A	<1.0	<1.0	<1.0	<1.0	<10
B71R	N/A	<1.0	<1.0	<1.0	<1.0	<10
B77	N/A	<1.0	<1.0	<1.0	<1.0	<10
B77R	N/A	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
LABORATORY DUPLICATE ANALYSIS (CONT.)						
B603	N/A	<1.0	<1.0	<1.0	<1.0	<10
B603R	N/A	<1.0	<1.0	<1.0	<1.0	<10
B606	N/A	<1.0	<1.0	<1.0	<1.0	<10
B606R	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB601	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB601R	N/A	<1.0	<1.0	<1.0	<1.0	<10
LABORATORY BLANKS						
SG10B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG25B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG35B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG110B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG128B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG149B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG157B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG176B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG194B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG209B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG217B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG227B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG235B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG239B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG249B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG252B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG262B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG272B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG282B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG289B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG303B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG410B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG423B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG431B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG441B	N/A	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 1

ANALYTE CONCENTRATIONS VIA GC/FID (µg/l)

SAMPLE	DEPTH (FT)	BENZENE	TOLUENE	ETHYL-BENZENE	XYLENES	TOTAL FID VOLATILES*
REPORTING LIMIT		1.0	1.0	1.0	1.0	10
LABORATORY BLANKS (CONT.)						
SG456B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG467B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG477B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG486B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG496B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG506B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG519B	N/A	<1.0	<1.0	<1.0	<1.0	<10
W232B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG610B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG620B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG630B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG649B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG659B	N/A	<1.0	<1.0	<1.0	<1.0	<10
SG679B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B13B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B15B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B21B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B48B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B71B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B77B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B603B	N/A	<1.0	<1.0	<1.0	<1.0	<10
B606B	N/A	<1.0	<1.0	<1.0	<1.0	<10
WB601B	N/A	<1.0	<1.0	<1.0	<1.0	<10

** CALCULATED USING THE SUM OF THE AREAS OF ALL INTEGRATED CHROMATOGRAM PEAKS AND THE INSTRUMENT RESPONSE FACTOR FOR TOLUENE*

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 11 - SOIL GAS											
SG1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.3
SG5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG11	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG12	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG13	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG14	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG15	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG16	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG17	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG19	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG21	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG22	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG23	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG24	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG26	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG27	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG28	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.2

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 11 - SOIL GAS (CONT.)											
SG31	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG32	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG33	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG34	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG35	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG36	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG37	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG38	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG39	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG41	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG42	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG43	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<
SG44	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SITE 30 - SOIL GAS											
SG101	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG102	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG103	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG104	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG105	210	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG106	15	<1.0	<1.0	<1.0	<1.0	<1.0	5.9	<1.0	<1.0	<1.0	<1.0
SG107	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	9.5
SG108	3.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4
SG109	2.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG110	4.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG111	54	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.3
SG112	8.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG113	<1.0	<1.0	<1.0	<1.0	<1.0	3.1	<1.0	<1.0	<1.0	<1.0	<1.0
SG114	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG115	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.3	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG116	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG117	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG118	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG119	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG120	<1.0	<1.0	<1.0	<1.0	<1.0	3.9	<1.0	<1.0	<1.0	<1.0	<1.0
SG121	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG122	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG123	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG124	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG125	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG126	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG127	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG128	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG129	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG130	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG131	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG132	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG133	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG134	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG135	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG136	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG137	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG138	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG139	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG140	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG140A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG141	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG142	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG143	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG144	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG145	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG146	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG147	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG148	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0
SG149	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG150	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG151	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG152	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG153	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG154	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0
SG155	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG156	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG157	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG158	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<
SG159	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG160	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG161	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG162	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG163	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG164	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG165	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG166	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG167	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG168	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG169	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG170	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG171	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG172	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG173	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG174	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG175	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG176	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG177	<1.0	<1.0	<1.0	<1.0	<1.0	7.3	<1.0	<1.0	<1.0	<1.0	<1.0
SG178	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG179	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG180	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG181	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG182	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG183	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG184	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG185	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG186	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG187	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG188	3.2	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	4.6
SG189	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	<1.0
SG190	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG191	6.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG192	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG193	46	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG194	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG195	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG196	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG197	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG198	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG199	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG200	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG201	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG202	3.7	<1.0	<1.0	<1.0	<1.0	<1.0	2.2	<1.0	<1.0	<1.0	<1.0
SG203	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG204	20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.2
SG205	18	<1.0	<1.0	<1.0	<1.0	<1.0	2.4	<1.0	<1.0	<1.0	1.5

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG206	*83*	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG207	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG208	2.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG209	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG210	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG211	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG212	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG213	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG214	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG215	73	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	<1.0	10
SG216	34	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	7
SG217	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG218	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<
SG219	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG220	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG221	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	7.0	<1.0	<1.0	<1.0	<1.0
SG222	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG223	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG224	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG225	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG226	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG227	<1.0	<1.0	<1.0	20	<1.0	<1.0	38	<1.0	<1.0	<1.0	<1.0
SG228	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG229	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG230	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG231	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG232	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG233	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG234	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG235	7.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG236	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG237	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG238	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG239	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG240	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0
SG241	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG242	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG243	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG244	16	<1.0	<1.0	<1.0	<1.0	<1.0	7.8	<1.0	<1.0	<1.0	<1.0
SG245	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	12	<1.0	9.9
SG246	2.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG247	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0
SG248	5.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG249	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG250	57	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.4
SG251	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG252	3.8	<1.0	<1.0	<1.0	<1.0	4.7	<1.0	<1.0	<1.0	<1.0	<1.0
SG253	1.9	<1.0	<1.0	<1.0	<1.0	<1.0	8.9	<1.0	<1.0	<1.0	<1.0
SG254	***177***	<1.0	<1.0	<1.0	<1.0	<1.0	17	<1.0	<1.0	<1.0	4.1
SG255	49	<1.0	<1.0	<1.0	<1.0	<1.0	12	<1.0	<1.0	<1.0	<1.0
SG256	***90***	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	<1.0	<1.0	<1.0	<1.0
SG257	11	<1.0	<1.0	<1.0	<1.0	<1.0	59	<1.0	<1.0	<1.0	<1.0
SG258	2.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG259	***196***	<1.0	<1.0	2.5	<1.0	<1.0	36	<1.0	<1.0	<1.0	<1.0
SG260	44	<1.0	<1.0	10	3.1	<1.0	255	<1.0	4.6	<1.0	10
SG261	20	<1.0	<1.0	<1.0	<1.0	<1.0	82	<1.0	4.5	<1.0	4.0
SG262	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG263	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG264	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
SG265	<1.0	<1.0	<1.0	<1.0	<1.0	2.4	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG266	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG267	<1.0	<1.0	<1.0	<1.0	<1.0	2.7	<1.0	<1.0	<1.0	<1.0	<1.0
SG268	<1.0	<1.0	<1.0	<1.0	<1.0	4.3	<1.0	<1.0	<1.0	<1.0	<1.0
SG269	30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0
SG270	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG271	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG272	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG273	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG274	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG275	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG276	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG277	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG278	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<
SG279	6.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG280	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG281	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG282	2.3	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0
SG283	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG284	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG285	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG286	36	<1.0	<1.0	1.7	<1.0	<1.0	207	<1.0	2.4	<1.0	4.3
SG287	2.7	<1.0	<1.0	<1.0	<1.0	<1.0	7.4	<1.0	<1.0	<1.0	1.4
SG288	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG289	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG290	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG291	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG292	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG293	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG294	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0
SG295	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG296	<1.0	<1.0	<1.0	<1.0	<1.0	6.2	<1.0	<1.0	<1.0	<1.0	<1.0
SG297	17	<1.0	<1.0	<1.0	<1.0	<1.0	1.7	<1.0	<1.0	<1.0	<1.0
SG298	2.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.1	<1.0	<1.0	<1.0	<1.0
SG299	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0
SG300	23	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0
SG301	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	<1.0
SG302	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG303	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG304	12	<1.0	<1.0	<1.0	<1.0	<1.0	6.4	<1.0	<1.0	<1.0	<1.0
SG305	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG306	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG307	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0	<1.0
SG308	***156***	<1.0	<1.0	<1.0	<1.0	<1.0	34	<1.0	<1.0	<1.0	16
SG309	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG310	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG311	***162***	<1.0	<1.0	<1.0	<1.0	<1.0	101	<1.0	8.1	<1.0	35
SG312	***86***	<1.0	<1.0	4.8	<1.0	<1.0	4.8	<1.0	<1.0	<1.0	<1.0
SG313	4.6	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	1.4
SG314	***139***	<1.0	<1.0	1.6	<1.0	<1.0	24	<1.0	24	<1.0	14
SG315	49	<1.0	<1.0	<1.0	<1.0	<1.0	8.2	<1.0	<1.0	<1.0	<1.0
SG316	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG317	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG318	15	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0
SG319	21	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	16	<1.0	4.2
SG320	***189***	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.6	<1.0	43
SG401	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	3.2
SG402	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.5
SG403	13	<1.0	<1.0	<1.0	<1.0	<1.0	5.3	<1.0	5.8	<1.0	29
SG404	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	4.2
SG405	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.9

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
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c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG406	13	<1.0	<1.0	<1.0	<1.0	<1.0	1.7	<1.0	<1.0	<1.0	3.0
SG407	37	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0
SG408	4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.2
SG409	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG410	17	<1.0	<1.0	<1.0	<1.0	<1.0	2.7	<1.0	<1.0	<1.0	3.3
SG411	44	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.2
SG412	61	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	19
SG413	21	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.8
SG414	***127***	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	27
SG415	***142***	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.6	<1.0	29
SG416	2.7	<1.0	<1.0	12	<1.0	<1.0	53	<1.0	<1.0	<1.0	<1.0
SG417	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG418	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG419	44	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	22	<1.0	5.4
SG420	20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.1
SG421	37	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.7
SG422	10	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	2.1
SG423	5.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG424	12	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	1.5
SG425	8.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6
SG426	14	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	4.8
SG427	14	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG428	***136***	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0
SG429	18	<1.0	<1.0	<1.0	<1.0	<1.0	2.7	<1.0	<1.0	<1.0	<1.0
SG430	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG431	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.3	<1.0	<1.0	<1.0	<1.0
SG432	***222***	<1.0	<1.0	<1.0	<1.0	<1.0	20	<1.0	<1.0	<1.0	9.0
SG433	79	<1.0	<1.0	<1.0	<1.0	<1.0	34	<1.0	<1.0	<1.0	<1.0
SG434	31	<1.0	<1.0	<1.0	<1.0	<1.0	78	<1.0	<1.0	<1.0	<1.0
SG435	29	<1.0	<1.0	<1.0	<1.0	<1.0	15	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG436	***171***	<1.0	<1.0	<1.0	<1.0	<1.0	5.8	<1.0	<1.0	<1.0	<1.0
SG437	***186***	<1.0	<1.0	<1.0	<1.0	<1.0	45	<1.0	<1.0	<1.0	<1.0
SG438	67	<1.0	<1.0	<1.0	<1.0	<1.0	4.8	<1.0	2.6	<1.0	2.3
SG439	18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG440	9.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.6
SG441	5.9	<1.0	<1.0	<1.0	<1.0	<1.0	49	<1.0	<1.0	<1.0	<1.0
SG442	98	<1.0	<1.0	4.5	<1.0	<1.0	143	<1.0	2.7	<1.0	1.5
SG443	***299***	<1.0	<1.0	729	<1.0	<1.0	489	<1.0	<1.0	<1.0	2.2
SG444	14	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0	<1.0
SG445	5.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG446	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG447	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG448	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG449	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.5	<1.0	<1.0	<1.0	<1.0
SG450	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	<1.0	<1.0	<1.0	4.4
SG451	51	<1.0	<1.0	1.3	<1.0	<1.0	185	<1.0	18	<1.0	6.0
SG452	4.5	<1.0	<1.0	6.3	3.0	<1.0	6.0	<1.0	1.6	<1.0	4.2
SG453	19	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG454	50	<1.0	<1.0	<1.0	<1.0	<1.0	36	<1.0	<1.0	<1.0	5.7
SG455	2.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG456	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG457	7.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG458	40	<1.0	<1.0	<1.0	<1.0	<1.0	325	<1.0	7.7	<1.0	5.2
SG459	***125***	<1.0	<1.0	26	<1.0	<1.0	221	<1.0	3.1	<1.0	10
SG460	39	<1.0	<1.0	<1.0	<1.0	<1.0	3.0	<1.0	<1.0	<1.0	<1.0
SG461	***166***	<1.0	<1.0	<1.0	<1.0	<1.0	8.7	<1.0	<1.0	<1.0	<1.0
SG462	45	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG463	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	<1.0	<1.0
SG464	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG465	4.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG466	2.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG467	66	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG468	***193***	<1.0	<1.0	<1.0	<1.0	<1.0	6.4	<1.0	<1.0	<1.0	<1.0
SG469	***291***	<1.0	<1.0	<1.0	<1.0	<1.0	4.4	<1.0	<1.0	<1.0	<1.0
SG470	7.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG471	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG472	4.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG473	***129***	<1.0	<1.0	<1.0	<1.0	<1.0	3.9	<1.0	<1.0	<1.0	<1.0
SG474	80	<1.0	<1.0	<1.0	<1.0	<1.0	1.7	<1.0	<1.0	<1.0	<1.0
SG475	5.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG476	4.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG477	30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1[illegible]
SG478	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<[illegible]
SG479	<1.0	<1.0	<1.0	<1.0	<1.0	15	<1.0	<1.0	16	<1.0	11
SG480	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	80	<1.0	16
SG481	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG482	<1.0	<1.0	<1.0	<1.0	<1.0	3.6	<1.0	<1.0	<1.0	<1.0	<1.0
SG483	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.7	<1.0	7.9
SG484	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG485	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG486	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG487	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG488	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG489	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG490	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG491	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG492	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG493	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	37	<1.0	<1.0	<1.0	<1.0
SG494	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG495	12	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - SOIL GAS (CONT.)											
SG496	58	<1.0	<1.0	<1.0	<1.0	<1.0	16	<1.0	<1.0	<1.0	2.3
SG497	9.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.5	<1.0	<1.0	<1.0	<1.0
SG498	44	<1.0	<1.0	<1.0	<1.0	<1.0	13	<1.0	<1.0	<1.0	2.5
SG499	44	<1.0	<1.0	<1.0	<1.0	<1.0	11	<1.0	<1.0	<1.0	4.0
SG500	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0
SG501	<1.0	<1.0	<1.0	<1.0	<1.0	2.6	<1.0	<1.0	<1.0	<1.0	<1.0
SG502	<1.0	<1.0	<1.0	<1.0	<1.0	8.8	<1.0	<1.0	<1.0	<1.0	<1.0
SG503	5.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG504	2.3	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG505	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG506	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG507	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG508	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG509	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG510	***142***	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG511	91	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.7	<1.0	12
SG512	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG513	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG514	21	6.8	<1.0	12	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0
SG515	3.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG516	14	<1.0	<1.0	<1.0	<1.0	<1.0	58	<1.0	<1.0	<1.0	<1.0
SG517	***251***	<1.0	<1.0	<1.0	<1.0	<1.0	8.7	<1.0	<1.0	<1.0	4.1
SG518	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG519	39	<1.0	<1.0	7.4	<1.0	<1.0	191	<1.0	8.8	<1.0	9.0
SG520	75	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0
SG521	***162***	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	7.2	<1.0	22
SG522	8.0	<1.0	<1.0	<1.0	<1.0	<1.0	37	<1.0	2.1	<1.0	1.6
SG523	82	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	6.0
SG524	14	<1.0	<1.0	<1.0	<1.0	<1.0	13	<1.0	<1.0	<1.0	<1.0
SG525	23	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	<1.0	<1.0	<1.0	<1.0
SG526	42	<1.0	<1.0	<1.0	<1.0	<1.0	18	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
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TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - GROUND WATER											
W105	40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	13	<1.0	<1.0
W106	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	<1.0
W108	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W111	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W112	33	<1.0	<1.0	<1.0	<1.0	<1.0	9.0	<1.0	<1.0	<1.0	<1.0
W134	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W162	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W169	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W170	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W177	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W188	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W191	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W193	<1.0	<1.0	<1.0	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W204	1.2	<1.0	<1.0	19	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W205	4.3	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0
W206	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W215	3.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W216	13	<1.0	<1.0	25	<1.0	<1.0	11	<1.0	<1.0	<1.0	<1.0
W221	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W224	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W227	4.9	<1.0	<1.0	20	<1.0	<1.0	2.3	<1.0	<1.0	<1.0	<1.0
W229	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W232	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W234	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W235	3.2	<1.0	3.3	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W236	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W244	128	<7.5	<7.5	68	<7.5	<7.5	339	<7.5	<7.5	<7.5	<7.5
W245	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.9	<1.0	2.7
W249	4.7	<1.0	<1.0	3.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W250	12	<1.0	<1.0	4.8	<1.0	<1.0	3.7	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 30 - GROUND WATER (CONT.)											
W253	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W254	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W255	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W256	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W257	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W259	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W260	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	<1.0
W261	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W262	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W268	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W279	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
V282	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W286	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W287	<1.0	<1.0	<1.0	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SITE 30 - SOIL											
27S27	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
27S27A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.0
27GI05	<1.0	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
SITE 38 - SOIL GAS											
SG601	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG602	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG603	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG604	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG605	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG606	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG607	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG608	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG609	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG610	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

1DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
.12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 38 - SOIL GAS (CONT.)											
SG611	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.3
SG612	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0
SG613	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG614	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1
SG615	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG616	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	5.0	<1.0	1.4	<1.0	<1.0
SG617	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	2.3	<1.0	<1.0	<1.0	<1.0
SG618	3.8	<1.0	<1.0	<1.0	<1.0	<1.0	2.1	<1.0	<1.0	<1.0	<1.0
SG619	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG620	8.6	<1.0	<1.0	<1.0	<1.0	<1.0	8.5	<1.0	<1.0	<1.0	<1.0
SG621	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.3	<1.0	<1.0
SG622	4.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.1	<1.0	3
SG623	***148***	<1.0	<1.0	18	<1.0	<1.0	912	<1.0	8.1	<1.0	
SG624	2.4	<1.0	<1.0	<1.0	<1.0	<1.0	4.2	<1.0	1.6	<1.0	1.3
SG625	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	4.0	<1.0	8.7	<1.0	1.9
SG626	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG627	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0
SG628	26	<1.0	<1.0	<1.0	<1.0	<1.0	55	<1.0	7.5	<1.0	5.7
SG629	3.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	<1.0	2.2
SG630	5.9	7.8	<1.0	<1.0	12	<1.0	<1.0	<1.0	13	<1.0	2.6
SG631	10.0	<1.0	<1.0	<1.0	1.6	<1.0	<1.0	<1.0	30	<1.0	<1.0
SG632	***158***	<1.0	2.3	58	151	<1.0	145	<1.0	43	<1.0	26.0
SG633	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6
SG634	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG635	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	9.0	<1.0	3.3	<1.0	<1.0
SG636	9.6	<1.0	<1.0	4.8	<1.0	<1.0	1.0	<1.0	1.2	<1.0	3.0
SG637	3.2	<1.0	<1.0	3.4	<1.0	<1.0	1.2	<1.0	1.8	<1.0	<1.0
SG638	***121***	<1.0	<1.0	28	18	3.1	64	<1.0	27	<1.0	1.8
SG639	***84***	<1.0	<1.0	10	7.5	3.0	34	<1.0	8.9	<1.0	2.2
SG640	***106***	<1.0	<1.0	23	25	<1.0	37	<1.0	16	<1.0	6.6

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 38 - SOIL GAS (CONT.)											
SG641	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	3.0	<1.0	<1.0
SG642	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG643	6.8	3.4	<1.0	<1.0	3.8	<1.0	<1.0	<1.0	6.9	<1.0	3.5
SG644	1.9	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	1.2
SG645	3.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.5	<1.0	6.2
SG646	5.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10	<1.0	1.0
SG647	66	7.0	1.2	<1.0	95	1.1	2.8	<1.0	264	<1.0	3.3
SG648	20	<1.0	<1.0	<1.0	<1.0	<1.0	27	<1.0	10	<1.0	21
SG649	***151***	<1.0	<1.0	9.1	2.8	2.9	167	<1.0	90	<1.0	81
SG650	<1.0	<1.0	<1.0	51	73	1.7	858	<1.0	33	<1.0	52
SG651	***360***	<1.0	<1.0	83	10	4.0	3,371	<1.0	78	<1.0	1,127
SG652	***224***	<1.0	<1.0	13	46	9.7	181	<1.0	90	<1.0	52
SG653	***164***	<1.0	<1.0	7.0	14	12	88	<1.0	82	<1.0	38
SG654	46	<1.0	<1.0	7.8	16	3.0	17	<1.0	16	<1.0	6.2
SG655	***264***	<1.0	<1.0	2.6	<1.0	<1.0	76	<1.0	8.4	<1.0	28
SG656	***313***	88	<1.0	72	<1.0	<1.0	397	<1.0	20	<1.0	121
SG657	***155***	<1.0	<1.0	8.8	9.9	21	97	<1.0	158	<1.0	55
SG658	23	76	<1.0	<1.0	<1.0	1.1	4.5	<1.0	17	2.5	6.8
SG659	***194***	<1.0	<1.0	22	4.8	<1.0	40	<1.0	17	<1.0	5.9
SG660	40	<1.0	<1.0	20	13	<1.0	18	<1.0	26	<1.0	17
SG661	102	<1.0	<1.0	23	31	<1.0	21	<1.0	14	<1.0	8.7
SG662	29	<1.0	<1.0	5.8	<1.0	1.1	9.6	<1.0	4.4	<1.0	1.1
SG663	***205***	<1.0	<1.0	26	12	5.8	58	<1.0	16	<1.0	10
SG664	18	<1.0	<1.0	3.1	<1.0	<1.0	5.0	<1.0	4.9	<1.0	<1.0
SG665	7.8	<1.0	<1.0	5.4	4.1	<1.0	4.5	<1.0	22	<1.0	<1.0
SG666	14	<1.0	<1.0	3.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.8
SG667	17	<1.0	<1.0	6.2	<1.0	<1.0	2.2	<1.0	2.2	<1.0	2.9
SG668	4.3	<1.0	<1.0	1.4	<1.0	<1.0	2.0	<1.0	6.1	<1.0	2.2
SG669	15	<1.0	<1.0	10	<1.0	<1.0	3.5	<1.0	2.4	<1.0	4.4
SG670	4.4	<1.0	<1.0	<1.0	<1.0	<1.0	2.1	<1.0	<1.0	<1.0	1.7

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
.12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
SITE 38 - SOIL GAS (CONT.)											
SG671	2.9	<1.0	<1.0	<1.0	<1.0	<1.0	3.0	<1.0	<1.0	<1.0	1.7
SG672	10	<1.0	<1.0	1.1	<1.0	<1.0	7.7	<1.0	1.1	<1.0	1.1
SG673	87	<1.0	<1.0	9.8	<1.0	1.0	129	<1.0	7.6	<1.0	4.5
SG674	2.1	<1.0	<1.0	<1.0	<1.0	<1.0	4.7	<1.0	11	<1.0	2.9
SG675	2.9	<1.0	<1.0	<1.0	<1.0	<1.0	4.0	<1.0	4.6	<1.0	1.7
SG676	4.0	<1.0	<1.0	<1.0	<1.0	<1.0	4.2	<1.0	1.9	<1.0	<1.0
SG677	7.4	<1.0	<1.0	<1.0	<1.0	<1.0	6.2	<1.0	<1.0	<1.0	<1.0
SG678	31	1.0	<1.0	<1.0	<1.0	<1.0	3.7	<1.0	<1.0	<1.0	<1.0
SG679	***271***	<1.0	<1.0	91	<1.0	1.5	2,462	<1.0	24	<1.0	366
SG680	***166***	<1.0	<1.0	8.3	<1.0	<1.0	290	<1.0	18	<1.0	21
SG681	57	<1.0	<1.0	<1.0	<1.0	<1.0	88	<1.0	2.6	<1.0	6.[illegible]
SITE 38 - GROUND WATER											
W620	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
W622	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W623	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W625	1.7	<1.0	<1.0	2.0	<1.0	<1.0	6.1	<1.0	<1.0	<1.0	<1.0
W627	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W628	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W630	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5
W636	<7.5	<7.5	<7.5	188	70	<7.5	<7.5	<7.5	<7.5	<7.5	<7.5
W638	285	<15	<15	885	150	96	216	<15	2,721	<15	4,754
W639	195	<15	<15	128	<15	<15	63	<15	<15	<15	<15
W640	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	<1.0	<1.0
BUILDING 45 SITE - GROUND WATER											
W45-1	4.5	<1.0	6.9	16	3.4	<1.0	7.3	<1.0	<1.0	<1.0	<1.0
W45-2	<1.0	<1.0	4.5	<1.0	7.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W45-3	6.8	<1.0	16	<1.0	1,190	<1.0	<1.0	<1.0	86	<1.0	7.1
W45-4	<1.0	<1.0	<1.0	<1.0	11	<1.0	<1.0	<1.0	3.7	<1.0	<1.0
W45-5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
FIELD CONTROL SAMPLES											
B1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B11	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B12	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B13	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B14	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B15	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B16	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B17	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B19	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B21	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B22	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B23	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B24	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B26	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B27	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B28	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
FIELD CONTROL SAMPLES (CONT.)											
B31	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B32	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B33	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B34	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B35	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B37	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B38	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B39	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B41	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B42	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.[illegible]
B43	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
B44	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.
B45	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B46	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B47	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B48	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B49	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B51	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B52	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B53	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B54	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B55	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B56	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B57	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B58	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B59	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B60	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
FIELD CONTROL SAMPLES (CONT.)											
B61	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B62	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B63	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B64	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B65	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B66	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B67	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B68	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B69	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B70	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B71	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B72	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B73	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B74	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B75	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B76	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B77	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B600	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B601	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B602	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B603	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B604	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B605	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B606	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B607	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B608	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B609	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
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CHCl3 = chloroform
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CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
EQUIPMENT RINSEATE SAMPLES											
WB1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB11	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB12	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
WB13	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<
WB14	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB15	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB16	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB17	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB18	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB19	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB20	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB600	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB601	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W45-B1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W45-B2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LABORATORY DUPLICATE ANALYSIS											
SG10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG10R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG25	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG25R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG35	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG35R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG110	4.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG110R	4.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG128	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG128R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG149	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG149R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG157	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG157R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG176	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG176R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG194	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG194R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG209	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG209R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG217	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG217R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG227	<1.0	<1.0	<1.0	20	<1.0	<1.0	38	<1.0	<1.0	<1.0	<1.0
SG227R	1.9	<1.0	<1.0	20	<1.0	<1.0	38	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LABORATORY DUPLICATE ANALYSIS (CONT.)											
SG235	7.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG235R	7.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG239	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG239R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG249	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG249R	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG252	3.8	<1.0	<1.0	<1.0	<1.0	4.7	<1.0	<1.0	<1.0	<1.0	<1.0
SG252R	4.2	<1.0	<1.0	<1.0	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	<1.0
SG262	5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG262R	5.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<
SG272	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG272R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG282	2.3	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0
SG282R	2.4	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0	<1.0
SG289	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG289R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG303	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG303R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG410	17	<1.0	<1.0	<1.0	<1.0	<1.0	2.7	<1.0	<1.0	<1.0	3.3
SG410R	17	<1.0	<1.0	<1.0	<1.0	<1.0	2.8	<1.0	<1.0	<1.0	3.2
SG423	5.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG423R	5.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG431	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.3	<1.0	<1.0	<1.0	<1.0
SG431R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.4	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LABORATORY DUPLICATE ANALYSIS (CONT.)											
SG441	5.9	<1.0	<1.0	<1.0	<1.0	<1.0	49	<1.0	<1.0	<1.0	<1.0
SG441R	6.1	<1.0	<1.0	<1.0	<1.0	<1.0	49	<1.0	<1.0	<1.0	<1.0
SG456	1.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG456R	1.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG467	66	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG467R	66	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG477	30	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8
SG477R	29	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.7
SG486	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG486R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG496	58	<1.0	<1.0	<1.0	<1.0	<1.0	16	<1.0	1.7	<1.0	2.3
SG496R	58	<1.0	<1.0	<1.0	<1.0	<1.0	16	<1.0	2.0	<1.0	3.5
SG506	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG506R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG519	39	<1.0	<1.0	7.4	<1.0	<1.0	191	<1.0	8.8	<1.0	9.0
SG519R	38	<1.0	<1.0	6.0	<1.0	<1.0	182	<1.0	8.2	<1.0	8.3
SG610	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG610R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG620	8.6	<1.0	<1.0	<1.0	<1.0	<1.0	8.5	<1.0	<1.0	<1.0	<1.0
SG620R	8.6	<1.0	<1.0	<1.0	<1.0	<1.0	8.4	<1.0	<1.0	<1.0	<1.0
SG630	5.9	7.8	<1.0	<1.0	12	<1.0	<1.0	<1.0	13	<1.0	2.6
SG630R	5.7	7.8	<1.0	<1.0	10	<1.0	<1.0	<1.0	12	<1.0	2.5
SG649	***151***	<1.0	<1.0	9.1	2.8	2.9	167	<1.0	90	<1.0	81
SG649R	***152***	<1.0	<1.0	9.9	4.0	3.0	165	<1.0	87	<1.0	76

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LABORATORY DUPLICATE ANALYSIS (CONT.)											
SG659	***194***	<1.0	<1.0	22	4.8	<1.0	40	<1.0	17	<1.0	5.9
SG659R	***195***	4.3	<1.0	24	5.7	<1.0	40	<1.0	17	<1.0	5.8
SG679	***271***	<1.0	<1.0	91	<1.0	1.5	2,462	<1.0	24	<1.0	366
SG679R	***272***	<1.0	<1.0	92	<1.0	1.6	2,439	<1.0	24	<1.0	342
W111	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W111R	6.1	<1.0	<1.0	1.5	<1.0	<1.0	1.7	<1.0	<1.0	<1.0	<1.0
W232	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W232R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B13	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
B13R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
B15	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B15R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B21	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B21R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B48	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B48R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B71	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B71R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B77	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B77R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B603	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B603R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B606	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B606R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
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ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LABORATORY DUPLICATE ANALYSIS (CONT.)											
WB601	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB601R	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
LABORATORY BLANKS											
SG10B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG25B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG35B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG110B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG128B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG149B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG157B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG176B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG194B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG209B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG217B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG227B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG235B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG239B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG249B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG252B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG262B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG272B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG282B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG289B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG303B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG410B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG423B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG431B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG441B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 2

ANALYTE CONCENTRATIONS VIA GC/ECD (µg/l)

SAMPLE	11DCE/ TCTFA	CH2Cl2	t12DCE	11DCA	c12DCE	CHCl3	111TCA	CCl4	TCE	112TCA	PCE
REPORTING LIMIT	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
LABORATORY BLANKS (CONT.)											
SG456B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG467B	<1.0	<1.0	<1.0	<1.0	5.8	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG477B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG486B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG496B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG506B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG519B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
W232B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG610B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG620B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG630B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SG649B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1
SG659B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<[illegible]
SG679B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B13B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B15B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B21B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B48B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B71B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B77B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B603B	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B606B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
WB601B	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

11DCE/TCTFA = 1,1-dichloroethene/trichlorotrifluoroethane
CH2CL2 = methylene chloride
t12DCE = trans-1,2-dichloroethene
11DCA = 1,1-dichloroethane
c12DCE = cis-1,2-dichloroethene
CHCl3 = chloroform
111TCA = 1,1,1-trichloroethane
CCl4 = carbon tetrachloride
TCE = trichloroethene
112TCA = 1,1,2-trichloroethane
PCE = tetrachloroethene

TABLE 3

VINYL CHLORIDE CONCENTRATIONS IN HEADSPACE OF WATER VIA GC/FID (µg/l)

SAMPLE	VINYL CHLORIDE
REPORTING LIMIT	5.0
W45-1	7.4
W45-2	7.0
W45-3	25
W45-4	5.9
W45-5	<5.0
EQUIPMENT RINSEATE BLANKS	
W45-B1	<5.0
W45-B2	<5.0
DUPLICATE SAMPLE ANALYSIS	
W45-B2	<5.0
W45-B2D	<5.0
LABORATORY BLANKS	
W45-B2B	<5.0

MARYLAND SPECTRAL SERVICES, INC.
1500 CATON CENTER DRIVE, BALTIMORE, MD 21227

LABORATORY RESULTS

SAMPLE DATA SUMMARY PACKAGE

RESULTS OF GAS CHROMATOGRAPHY/MASS SPECTROMETRY
VOLATILE ORGANICS ANALYSIS OF

PROJECT MEPF2 WATER SAMPLE

SUBMITTED 11 AUGUST 1993

PREPARED FOR

TARGET ENVIRONMENTAL SERVICES, INC.
COLUMBIA, MD

18 AUGUST 1993

SAMPLE DATA SUMMARY PACKAGE

Table of Contents

1. Narrative
2. Sample Traffic Report
3. Results of Analysis of Samples
4. Surrogate Recovery Summary
5. Method Blank Summary
6. GC/MS Tuning and Mass Calibration
7. Initial and Continuing Calibration Check Summary
8. Internal Standard Area Summary
9. Chromatograms of Samples and Method Blanks Analyses

1. Narrative

NARRATIVE

Laboratory Name: Maryland Spectral Services, Inc. (MSS)

Date Samples Delivered to MSS Laboratory: 11 August 1993

Project: Target Environmental Services, Inc. --- MEPF2

Project Manager: Ms. Connie Thorne

Results for the following samples are included in this data package:

Client ID	MSS#	Matrix	Analysis
38MW09	930811-05	Water	Vinyl chloride
38MW09T1	930811-06	Water	Vinyl chloride

The samples were analyzed for Vinyl chloride as described by USEPA Method 8240, using capillary chromatography.

Surrogate recovery criteria were met for all analyses.

A table of results for the target compounds can be found in Section 3 of this report.

All samples were analyzed within acceptable holding times.

Sample chromatograms are provided, and are labeled for target compounds found (if any), together with Internal Standards (IS) and Surrogate Spiking Compounds (SS).

RELEASE OF THE DATA CONTAINED IN THIS HARDCOPY DATA PACKAGE HAS BEEN AUTHORIZED BY THE LABORATORY MANAGER OR HIS DESIGNEE, AS VERIFIED BY THE FOLLOWING SIGNATURE:

Kenneth K. Gill, Jr. DATE: 8/18/93

Kenneth K. Gill, Jr. 18 August 1993

2. Sample Traffic Report

Project manager: Connie

TARGET ENVIRONMENTAL SERVICES, INC.

CHAIN OF CUSTODY

To Ken Gill

JOB CODE: MEPF2

Type of analysis: FID ___ ECD ___ Other _____

Initial Analysis: Home Lab _____ Field Lab _____

Itemized Sample List

38MW09			MSS	# 93-0	811-05				
38MW09T1					06				
38MW09									
38MW09									

Type of Sample (circle one): Soil, Water, Soil Gas, Product

Mode of Transportation: _____

Sampler's Name: _____ Total No. Samples: 4

More samples to come _____ End of job _____

Relinquished by	Date/Time	Received by	Remarks
C. Bebe	8/11/93		For Vinyl Chloride
	8/11/93	Nancy Hammer	8/11/93 11:20AM

3. Results of Analysis of Samples

MARYLAND SPECTRAL SERVICES, INC.
1500 Caton Center Drive Baltimore, MD 21227

VOLATILE ORGANICS BY EPA GC/MS METHOD 8240

CLIENT SAMPLE ID:	38MW09	38MW09TI	VBLK0811A1
	MEPF2	MEPF2	
LAB SAMPLE ID:	93081105	93081106	METHOD BLANK
RECEIVED DATE:	08/11/93	08/11/93	
ANALYSIS DATE:	08/11/93	08/11/93	08/11/93
FILE NAME:	081105D	081106	0811VBLKA1
INSTRUMENT ID:	MSA	MSA	MSA
MATRIX:	WATER	WATER	WATER
UNITS:	UG/L	UG/L	UG/L
DILUTION FACTOR:	2.5	1.0	1.0
VOLATILE COMPOUNDS			
Vinyl Chloride	345	10 U	10 U

B - Detected in Lab Blank. U - Below Reported Quantitation Level. J - Estimated Value.

4. Surrogate Recovery Summary

2A
WATER VOLATILE SURROGATE RECOVERY

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: MEPF2

Lab Code: MSS Case No.: TG0811 SAS No.: SDG No.:

	EPA SAMPLE NO.	S1 (TOL)#	S2 (BFB)#	S3 (DCE)#	OTHER	TOT OUT
01	38MW09	97	94	95		0
02	38MW09TI	97	94	96		0
03	VBLK0811A1	100	94	97		0

		QC LIMITS
S1 (TOL)	= Toluene-d8	(88-110)
S2 (BFB)	= Bromofluorobenzene	(86-115)
S3 (DCE)	= 1,2-Dichloroethane-d4	(76-114)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogates diluted out

5. Method Blank Summary

4A
VOLATILE METHOD BLANK SUMMARY

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: MEPF2

ab Code: MSS Case No.: TG0811 SAS No.: SDG No.:

ab File ID: 0811VBLKA1 Lab Sample ID: METHOD_BLANK

ate Analyzed: 08/11/93 Time Analyzed: 1022

atrix: (soil/water) WATER Level: (low/med)

nstrument ID: MSA

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
01	38MW09	93081105	081105D	1322
02	38MW09TI	93081106	081106	1154

OMMENTS: VBLK0811A1 WATER METHOD BLANK
CAP COLUMN MSA

6. GC/MS Tuning and Mass Calibration

5A
VOLATILE ORGANIC GC/MS TUNING AND MASS
CALIBRATION - BROMOFLUOROBENZENE (BFB)

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: MEPF2

Lab Code: MSS Case No.: TG0811 SAS No.: SDG No.:

Lab File ID: 0701BFBA1 BFB Injection Date: 07/01/93

Instrument ID: MSA BFB Injection Time: 1210

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	25.3
75	30.0 - 60.0% of mass 95	50.8
95	Base peak, 100% relative abundance	100.0
96	5.0 - 9.0% of mass 95	7.2
173	Less than 2.0% of mass 174	0.0 (0.0)1
174	Greater than 50.0% of mass 95	63.3
175	5.0 - 9.0% of mass 174	4.6 (7.3)1
176	Greater than 95.0%, but less than 101.0% of mass 174	62.2 (98.3)1
177	5.0 - 9.0% of mass 176	4.4 (7.0)2

1-Value is % mass 174 2-Value is % mass 176

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	VSTD050	50PPB VOA	0701V2A1	07/01/93	1248
02	VSTD200	200-PPB-STD	0701V5A1	07/01/93	1536
03	VSTD150	150-PPB-STD	0701V4A1	07/01/93	1617
04	VSTD100	100-PPB-STD	0701V3A1	07/01/93	1658
05	VSTD020	20-PPB-STD	0701V1A1	07/01/93	1740

5A
VOLATILE ORGANIC GC/MS TUNING AND MASS
CALIBRATION - BROMOFLUOROBENZENE (BFB)

'ab Name: MD. SPECTRAL SERVICES, INC. Contract: MEPF2

Lab Code: MSS Case No.: TG0811 SAS No.: SDG No.:

: ab File ID: 0811BFBA1 BFB Injection Date: 08/11/93

Instrument ID: MSA BFB Injection Time: 0850

: atrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	20.9
75	30.0 - 60.0% of mass 95	41.0
95	Base peak, 100% relative abundance	100.0
96	5.0 - 9.0% of mass 95	8.1
173	Less than 2.0% of mass 174	0.0 (0.0)1
174	Greater than 50.0% of mass 95	61.4
175	5.0 - 9.0% of mass 174	4.1 (6.6)1
176	Greater than 95.0%, but less than 101.0% of mass 174	59.3 (96.5)1
177	5.0 - 9.0% of mass 176	4.7 (8.0)2

1-Value is % mass 174 2-Value is % mass 176

- ; TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	VSTD050	50PPB_VOA	0811V2A1	08/11/93	0925
02	VBLK0811A1	METHOD BLANK	0811VBLKA1	08/11/93	1022
03	38MW09TI	93081106	081106	08/11/93	1154
04	38MW09	93081105	081105D	08/11/93	1322

7. Initial and Continuing Calibration Check Summary

6A

VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: MEPF2

Lab Code: MSS Case No.: TG0811 SAS No.: SDG No.:

Instrument ID: MSA Calibration Date(s): 07/01/93 07/01/93

Matrix:(soil/water) WATER Level:(low/med) Column:(pack/cap) CAP

Min $\overline{RRF}$ for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF20 = 0701V1A1 RRF50 = 0701V2A1
RRF100= 0701V3A1 RRF150= 0701V4A1 RRF200= 0701V5A1

COMPOUND	RRF20	RRF50	RRF100	RRF150	RRF200	$\overline{RRF}$	% RSD
Chloromethane #	1.696	2.093	1.709	1.705	2.072	1.855	11.2#
Bromomethane	1.279	1.673	1.350	1.439	1.649	1.478	12.0
Vinyl Chloride *	1.856	2.991	2.127	2.270	2.701	2.389	19.0*
Chloroethane	0.830	1.006	0.785	0.864	0.943	0.886	10.0
Methylene Chloride	1.834	1.957	1.777	1.824	1.809	1.840	3.7
Acetone	0.532	0.510	0.550	0.570	0.521	0.537	4.4
Carbon Disulfide	4.593	5.828	4.829	5.256	5.456	5.192	9.5
1,1-Dichloroethene *	1.491	1.649	1.392	1.469	1.514	1.503	6.2*
1,1-Dichloroethane #	3.409	3.260	3.607	3.400	3.324	3.400	3.8#
1,2-Dichloroethene (total)	1.592	1.601	1.566	1.595	1.648	1.600	1.9
Chloroform *	3.178	3.041	3.016	3.105	3.060	3.080	2.1*
1,2-Dichloroethane	2.527	2.258	2.434	2.493	2.286	2.400	5.1
2-Butanone	0.130	0.116	0.135	0.145	0.123	0.130	8.6
1,1,1-Trichloroethane	0.577	0.556	0.546	0.565	0.571	0.563	2.2
Carbon Tetrachloride	0.501	0.509	0.478	0.506	0.537	0.506	4.2
Vinyl Acetate	0.578	0.984	1.248	1.189	1.113	1.022	26.2
Bromodichloromethane	0.703	0.688	0.717	0.712	0.714	0.707	1.7
1,2-Dichloropropane *	0.495	0.485	0.493	0.493	0.504	0.494	1.4*
cis-1,3-Dichloropropene	0.675	0.670	0.708	0.707	0.708	0.694	2.8
Trichloroethene	0.468	0.449	0.438	0.444	0.477	0.455	3.6
Dibromochloromethane	0.620	0.598	0.629	0.634	0.651	0.626	3.1
1,1,2-Trichloroethane	0.379	0.344	0.372	0.374	0.377	0.369	3.9
Benzene	1.054	1.012	1.024	1.026	1.049	1.033	1.7
trans-1,3-Dichloropropene	0.527	0.469	0.518	0.523	0.520	0.511	4.7
Bromoform #	0.472	0.458	0.489	0.502	0.498	0.484	3.8#
4-Methyl-2-Pentanone	0.878	0.774	0.930	0.938	0.809	0.866	8.4
2-Hexanone	0.401	0.374	0.454	0.463	0.368	0.412	10.8
Tetrachloroethene	0.398	0.420	0.374	0.404	0.422	0.404	4.8
1,1,2,2-Tetrachloroethane #	0.678	0.624	0.693	0.702	0.659	0.671	4.6#
Toluene *	0.754	0.768	0.744	0.749	0.763	0.756	1.3*
Chlorobenzene #	0.997	0.996	0.969	0.993	1.038	0.999	2.5#
Ethylbenzene *	0.473	0.482	0.461	0.509	0.508	0.487	4.4*
Styrene	0.943	0.948	0.948	0.981	1.023	0.969	3.5
Xylene (total)	0.576	0.579	0.566	0.588	0.610	0.584	2.8
Toluene-d8	1.133	1.100	1.085	1.081	1.115	1.103	2.0
Bromofluorobenzene	0.801	0.784	0.768	0.789	0.801	0.789	1.7
1,2-Dichloroethane-d4	1.914	1.824	1.839	1.912	1.720	1.842	4.3

7A

VOLATILE CONTINUING CALIBRATION CHECK

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: MEPF2

Lab Code: MSS Case No.: TG0811 SAS No.: SDG No.:

Instrument ID: MSA Calibration date: 08/11/93 Time: 0925

Lab File ID: 0811V2A1 Init. Calib. Date(s): 07/01/93 07/01/93

Matrix:(soil/water) WATER Level:(low/med) Column:(pack/cap) CAP

Min RRF50 for SPCC(#) = 0.300 (0.250 for Bromoform) Max %D for CCC(*) = 25.0%

COMPOUND		$\overline{RRF}$	RRF50	%D	
Chloromethane	#	1.855	1.680	9.4	#
Bromomethane		1.478	1.375	7.0	
Vinyl Chloride	*	2.389	2.509	-5.0	*
Chloroethane		0.886	1.010	-14.0	
Methylene Chloride		1.840	1.746	5.1	
Acetone		0.537	0.425	20.9	
Carbon Disulfide		5.192	5.003	3.6	
1,1-Dichloroethene	*	1.503	1.490	0.9	*
1,1-Dichloroethane	#	3.400	3.348	1.5	#
1,2-Dichloroethene (total)		1.600	1.820	-13.8	
Chloroform	*	3.080	2.837	7.9	*
1,2-Dichloroethane		2.400	1.738	27.6	
2-Butanone		0.130	0.136	-4.6	
1,1,1-Trichloroethane		0.563	0.464	17.6	
Carbon Tetrachloride		0.506	0.424	16.2	
Vinyl Acetate		1.022	0.978	4.3	
Bromodichloromethane		0.707	0.624	11.7	
1,2-Dichloropropane	*	0.494	0.504	-2.0	*
cis-1,3-Dichloropropene		0.694	0.668	3.7	
Trichloroethene		0.455	0.447	1.8	
Dibromochloromethane		0.626	0.532	15.0	
1,1,2-Trichloroethane		0.369	0.369	0.0	
Benzene		1.033	1.125	-8.9	
trans-1,3-Dichloropropene		0.511	0.460	10.0	
Bromoform	#	0.484	0.399	17.6	#
4-Methyl-2-Pentanone		0.866	0.748	13.6	
2-Hexanone		0.412	0.367	10.9	
Tetrachloroethene		0.404	0.401	0.7	
1,1,2,2-Tetrachloroethane	#	0.671	0.686	-2.2	#
Toluene	*	0.756	0.846	-11.9	*
Chlorobenzene	#	0.999	1.045	-4.6	#
Ethylbenzene	*	0.487	0.527	-8.2	*
Styrene		0.969	1.012	-4.4	
Xylene (total)		0.584	0.606	-3.8	
Toluene-d8		1.103	1.070	3.0	
Bromofluorobenzene		0.789	0.757	4.1	
1,2-Dichloroethane-d4		1.842	1.401	23.9	

8. Internal Standard Area Summary

8A

VOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: MD. SPECTRAL SERVICES, INC. Contract: MEPF2

Lab Code: MSS Case No.: TG0811 SAS No.: SDG No.:

Lab File ID (Standard): 0811V2A1 Date Analyzed: 08/11/93

Instrument ID: MSA Time Analyzed: 0925

Matrix:(soil/water) WATER Level:(low/med) Column:(pack/cap) CAP

		IS1(BCM) AREA #	RT	IS2(DFB) AREA #	RT	IS3(CBZ) AREA #	RT
	12 HOUR STD	29900	15.04	135000	16.34	124000	20.89
	UPPER LIMIT	59800		270000		248000	
	LOWER LIMIT	14950		67500		62000	
	EPA SAMPLE NO.						
01	38MW09	28200	14.99	122000	16.29	110000	20.84
02	38MW09TI	28900	15.00	128000	16.29	119000	20.84
03	VBLK0811A1	29400	14.99	131000	16.27	117000	20.82

IS1 (BCM) = Bromochloromethane
IS2 (DFB) = 1,4-Difluorobenzene
IS3 (CBZ) = Chlorobenzene

UPPER LIMIT = + 100% of internal standard area.
LOWER LIMIT = - 50% of internal standard area.

Column used to flag internal standard area values with an asterisk

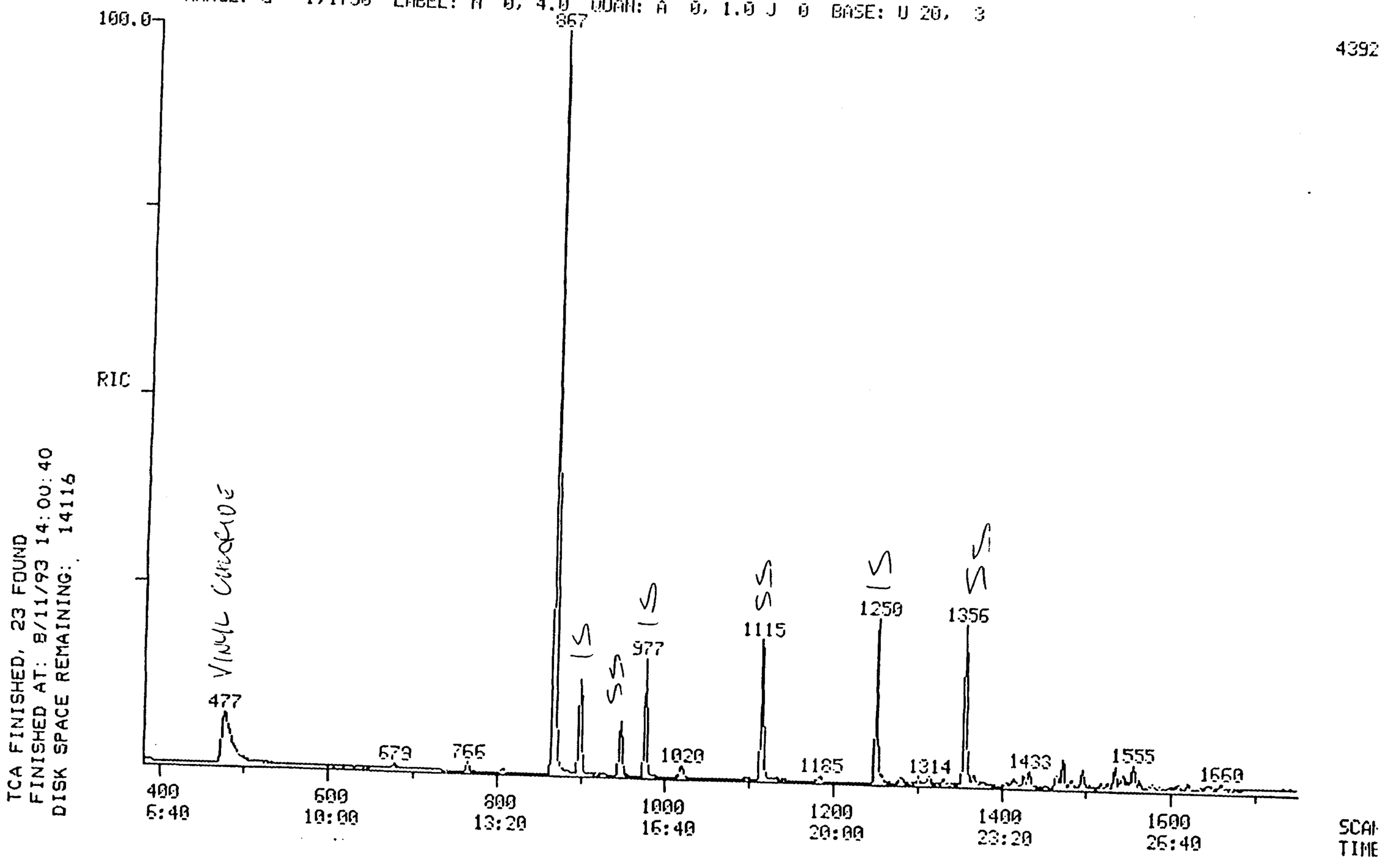
9. Chromatograms of Samples and Method Blanks Analyses

RIC
08/11/93 13:22:00
SAMPLE: 38MW09 MFP2, 2.0ML/5.0ML (X2.5)
CONDS.: CAP COLUMN MSA
RANGE: G 1,1750 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3

DATA: 0811050 #1
CALI: 0811050 #2

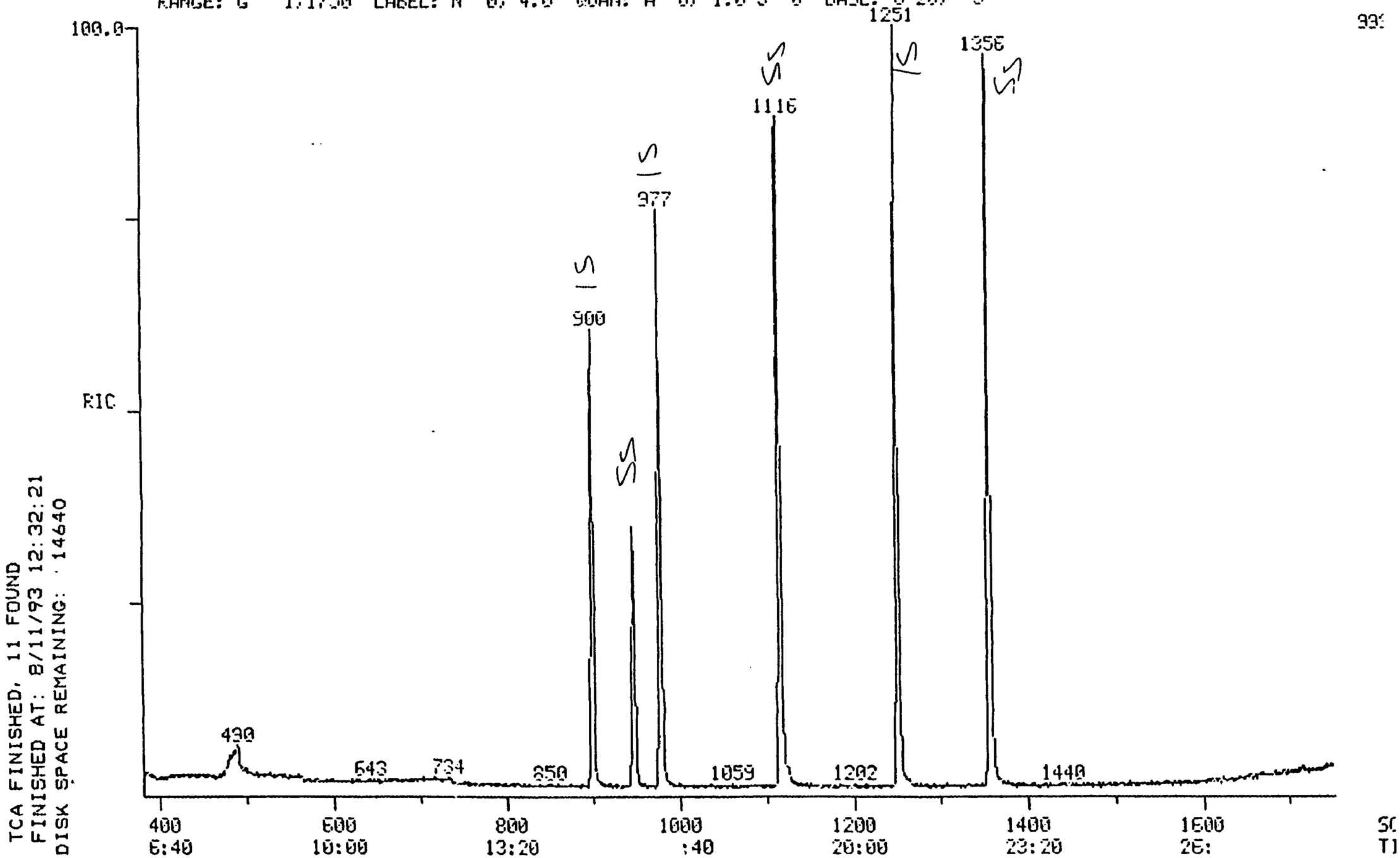
SCANS 380 TO 1750

4392



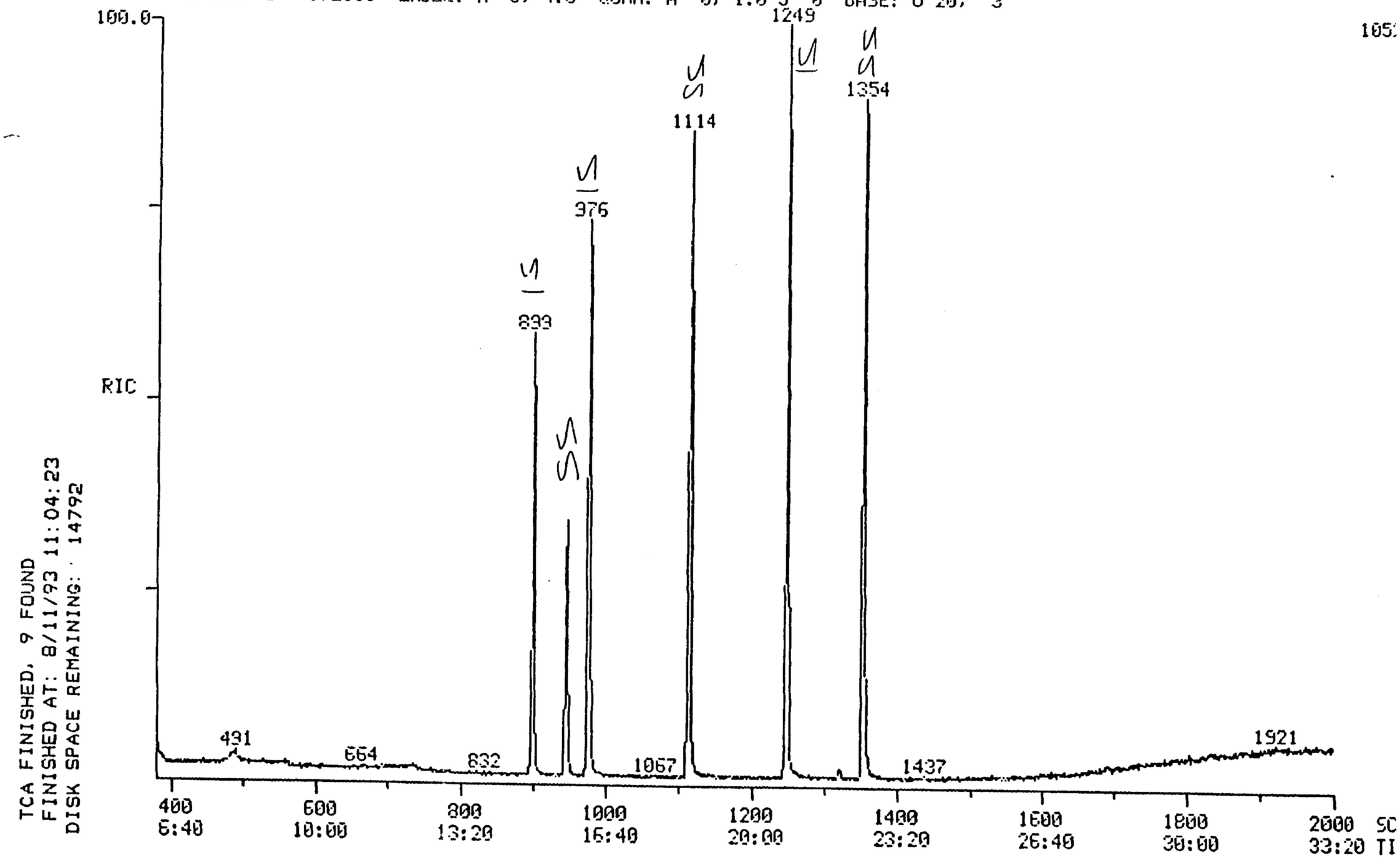
TCA FINISHED, 23 FOUND
FINISHED AT: 8/11/93 14:00:40
DISK SPACE REMAINING: 14116

RIC DATA: 081106 #1 SCANS 380 TO 1750
08/11/93 11:54:00 CALI: 081106 #2
SAMPLE: 38MW03T1 MEPF2 TRIP BLANK
CONDS.: CAP COLUMN MSA
RANGE: G 1,1750 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3



RIC
08/11/93 10:22:00
SAMPLE: VBLK0811A1 WATER METHOD BLANK
CONDS.: CAP COLUMN MSA
RANGE: G 1,2000 LABEL: N 0, 4.0 QUAN: A 0, 1.0 J 0 BASE: U 20, 3

DATA: 0811VBLKA1 #1 SCANS 380 TO 2000
CALI: 0811VBLKA1 #2



TCA FINISHED, 9 FOUND
FINISHED AT: 8/11/93 11:04:23
DISK SPACE REMAINING: 14792

Appendix D

Radiation Survey

TECHNICAL MEMORANDUM

Results of Radiological Investigations, Sites 25 and 27
Naval Air Station Pensacola
Pensacola, Florida

Prepared by:

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On Behalf of:

The U.S. Navy
CLEAN Contract #N62467-89-D-0318
CTO 59

July 1996

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EXECUTIVE SUMMARY

Investigations for radium-paint contamination of soil and groundwater have been performed at Sites 25 and 27, Naval Air Station Pensacola, Pensacola, Florida. Formerly the site had been used for painting aircraft instruments with luminous radium paint, and later for removal of paint from instruments.

The investigation shows that soil contamination is limited to a 30-foot by 50-foot area, where radium-paint waste appears to have been spilled or dumped. The contamination is confined to the top foot of soil and appears to have formed an immobile slug. Outside this limited area, no significant soil contamination was detected anywhere on the site from the surface down to a 65-foot deep confining clay layer. No significant radium contamination was observed in shallow, intermediate, or deep groundwater samples obtained across the site.

A limited soil removal in the sole zone of contamination is recommended, since the soil may pose a threat to human health. Following this, there is no reason to investigate this site further for radiological problems.

1.0 INTRODUCTION

Sites 25 and 27 have been used for painting and stripping of radium-doped paint on luminous aircraft instruments since the 1940s. These operations have generated liquid and solid wastes, some of which were disposed of in the sewer lines or released directly to soil. Several previous environmental studies have suggested radium contaminants in soil and groundwater. As a part of the remedial investigation (RI) at Site 25/27, EnSafe/Allen & Hoshall (E/A&H) has performed a comprehensive radiological study. The objectives are:

- Determine the sources, nature, magnitude, and extent of any soil or groundwater radionuclide contamination.
- Facilitate the evaluation of human health and ecological risk posed by contaminated media onsite.
- Propose methods for cleaning up contaminants of concern.

The present investigation involved the following actions:

- Investigation of past disposal practices.
- High-resolution geophysical mapping of near-surface gamma radiation.
- Followup sampling of surface soil for key radioactive isotopes, including Radium-226, and integration of this information with the geophysical data.
- Sampling of soil from the surface to the silty clay aquiclude at about 65 feet.
- Sampling of groundwater.

- Integration of all results to establish areas where environmental impact or potential exposure is of concern.

2.0 IONIZING RADIATION

2.1 History and Uses of Radium

Discovered by Pierre and Marie Curie in 1898, radium was first isolated from uranium ore in 1904. Almost immediately a ready market was established for the refined radium. In medicine, it was quickly accepted as a new wonder drug. Radium injections seemed to provide an effective treatment for cancer, and treatment centers sprung up all over the world. In aviation, radium's phosphorescence suddenly provided nighttime visibility of aircraft instruments, significantly enhancing the capabilities of the fledgling industry. The heavy demands of these two markets and the difficulty of the manufacturing process soon pushed the price of pure radium to the astronomical level of 10 million present-day dollars per gram, making it the most expensive mined material in history.

Despite widespread early optimism about the curative powers of radium and radon, disturbing reports began to appear in the 1920s which suggested a high casualty rate from radium ingestion and handling. Classic studies were later performed showing a high cancer rate among those employed to paint aircraft instruments and watches. Because of the fine detailing required in this work, it had been common practice for workers to tip the paint brushes on the tongue. Once ingested, radium was concentrated in the bones, where its ionizing effects were highly toxic. The magnitude of the problem was not well-appreciated until the 1940s, when the use of radium paint was sharply curtailed. Even after cessation of dial painting operations, radium continued to pose a health risk to those employed to strip old radium-painted instruments for repainting with nonradioactive phosphorescent materials. In addition, the stripping process generated radioactive waste, which posed both exposure risks and disposal problems. Given the 1,600-year half-life of Radium-226 (^{226}Ra), the disposal problem is significant.

2.2 Radioactive Decay

A radioactive isotope is an element whose nucleus contains more neutrons than its nonradioactive equivalent. This increases its mass and makes it atomically unstable. The result is a decay of a "parent" isotope to a series of successively less massive "daughter" isotopes, culminating in a stable lead isotope.

Each radioactive decay is accompanied by the emission of energy in the form of a particle and/or a photon. Emitted particles may be an alpha (α) particle, which is a helium nucleus (two protons and two neutrons), or a beta (β) particle, which is a high-energy electron. Radioactively emitted photons are high-energy quanta known as gamma (γ) rays. Every decay event emits a particle, but only some decays emit a gamma ray. Depending on the dissimilarity of spin quantum numbers in the parent and daughter nuclei, the decay may pass through a high-energy ("excited state") of the daughter, which then transits to a "ground state," thereby emitting a gamma ray.

The decay of a parent to a daughter isotope is a statistical, exponential process. One can define the *half-life* of the parent as the time it takes for half of its radioactive nuclei to decay. The half-life of naturally occurring isotopes varies from 10^{+10} years to tiny fractions of a second.

Radioactive materials in the earth come from one of three sources: (1) a naturally occurring parent isotope formed during the creation of the planet, or the daughter products of the parent isotope; (2) an isotope caused by natural bombardment of cosmic radiation or introduced by infall of interplanetary debris; (3) man-made fission products. In the absence of fission products, naturally occurring isotopes are the only ones found in any abundance.

For an isotope to exist abundantly in nature, it must either have a half-life not much shorter than the age of the earth (some 5×10^9 years) or it must be a daughter product of such an isotope.

Very few parent isotopes have the requisite long half-life to remain in detectable amounts in the earth. The most common among these are uranium (^{238}U) and thorium (^{232}Th).

Table 1 summarizes the decay processes and accompanying radiation of the ^{238}U and ^{232}Th decay series. Isotopes are listed in order of decay, starting with the parent at the top of the table and ending with the last, stable daughter. The shading encompasses the two radium isotopes ^{226}Ra and ^{228}Ra and their daughters, which are the subject of this investigation.

Radium paint is refined from uranium ore, which originally contains ^{238}U and ^{232}Th. However, once refined, the paint effectively has ^{226}Ra and ^{228}Ra as its effective parent isotopes. ^{226}Ra has a long half-life (1,620 years) and an extremely high activity rate (3.7×10^{10} disintegrations per second per gram), making it comparatively hazardous. However, ^{228}Ra has a shorter half-life (6.7 years), and although it would have posed a health risk for the original dial painters, most of it has now decayed to stable lead (^{208}Pb). The health hazard comes not only from ionizing gamma radiation, but also from radon gas, a daughter of ^{226}Ra.

Many of the gamma emitters listed in Table 1 produce gamma rays at two or more energy levels. Gamma ray energies are expressed in millions of electron volts (MeV). One eV is the energy imparted to an electron when it is accelerated through a potential difference of 1 volt. The ^{226}Ra gamma ray, for example, has an energy of 0.186 MeV, while ^{214}Bi has 23 gamma rays varying in energy from 0.609 to 2.448 MeV. The intensities, defined as the fraction of the isotope disintegrations which result in a gamma ray emission, also vary widely. Using the same example, the ^{226}Ra gamma ray has an intensity of 3.3 percent, while the ^{214}Bi gamma rays vary up to 46 percent in intensity. High energy coupled with a high intensity makes a particularly potent gamma source.

Concentrations of an isotope are expressed in various units, depending primarily upon the type of investigation. For characterizing the *physical quantity* present, the Curie (Ci) is often used.

Table 1
The ^{238}U and ^{232}Th Decay Series

^{238}U Series

Isotope	Half-Life (yrs)	Radiation
^{238}U	4.5×10^{9}	α
↓		
^{234}Th	6.6×10^{-2}	β,γ
↓		
^{234}Pa	2.3×10^{-6}	β,γ
↓		
^{234}U	2.5×10^{5}	α
↓		
^{230}Th	7.5×10^{4}	α
↓		
^{226}Ra	1.6×10^{3}	α,γ
↓		
^{222}Rn	1.0×10^{-2}	α
↓		
^{218}Po	5.9×10^{-6}	α
↓		
^{214}Pb	1.3×10^{-5}	β,γ
↓		
^{214}Bi	3.8×10^{-5}	β,γ
↓		
^{214}Po	5.1×10^{-12}	α
↓		
^{210}Pb	2.2×10^{2}	β,γ
↓		
^{210}Bi	1.4×10^{-2}	β
↓		
^{210}Po	1.1×10^{-1}	α
↓		
^{206}Pb	Stable	Stable

^{232}Th Series

Isotope	Half-Life (yrs)	Radiation
^{232}Th	1.4×10^{10}	α
↓		
^{228}Ra	6.7×10^{0}	β
↓		
^{228}Ac	7.0×10^{-4}	β,γ
↓		
^{228}Th	1.9×10^{0}	α,γ
↓		
^{224}Ra	1.0×10^{-2}	α,γ
↓		
^{220}Rn	1.8×10^{-6}	α
↓		
^{216}Po	5.2×10^{-9}	α
↓		
^{212}Pb	1.2×10^{-3}	β,γ
↓		
^{212}Bi	1.0×10^{-4}	β,γ
↓		
^{212}Po	9.8×10^{-15}	α
↓		
^{208}Tl	6.0×10^{-6}	β,γ
↓		
^{208}Pb	stable	stable

Notes:
One minute is 1.9x10-6 yrs, one second is 3.2x10-8 yrs.
Shading indicates radium and its daughter products derived from radium paint.

One Curie is equivalent to 3.7×10^{10} disintegrations per second. For soil concentrations of a radioisotope, the common unit is picoCuries per gram, abbreviated (10^{-12} Ci/g); for water concentrations, the unit is pCi/l. Recently a new unit, the Bequerel (Bq) has been adopted as standard (1 Bq = 27 pCi), but the Curie is still widely used in the environmental field and is maintained in this report. For characterizing the *health risk*, radiation several types of measurements are common. The Gray (Gy) is the unit of absorbed dose, or radiation per unit mass, with 1 Gy = 6.242×10^{15} eV/g (1 J/kg, where J is the energy in joules). The Gray replaces the older unit of the Rad. The Sievert (SV) is used to express the dose equivalent, which estimates the risk to human tissue by considering the emitted energy, the type of radiation, the mass of the organism receiving the dose, and a variety of weighting factors based upon relative ionization hazards to various types of tissue and organs. The Gray replaces the earlier unit of the rem.

2.3 Gamma Ray Penetration in Earth Materials

A gamma ray is a discrete electromagnetic energy packet (photon) with an energy E related to its frequency ν by

$$E = \hbar\nu$$

where $\hbar = 6.5819 \times 10^{-16}$ eV-sec is Planck's constant. Energies are expressed in electron volts (eV). Gamma rays have energies varying from 40 keV to 4 MeV.

As particles or gamma rays pass through a material, they interact with its interstitial molecules, atoms, and particles. These collisions eventually lead to annihilation. It is useful to define the penetration or *mean free path* of these particles and photons in a given medium. For the particles with a classically defined mass (alpha and beta), the mean free path ℓ is

$$\ell \approx \frac{1}{n\pi(r_1+r_2)^2}$$

where n is the number of molecules in the path of the particle, and r_1 and r_2 are the radii of the particle and the molecules through which it passes. In air, the mean free path of an alpha particle is a few centimeters, and nearly zero in sandy soil. The smaller probability cross-section of the beta particle results in greater penetration of about a meter in air, but it is still nearly zero in soil. Hence, alpha and beta radiation from subsurface contaminants is not readily detectable unless they are very close to the surface.

In contrast, the high-energy gamma photon has a penetration rate which is statistically determined. For a beam of N_0 photons passing through a material, the number of remaining photons N at a depth ℓ into the material is given by

$$N = N_0 e^{-\mu\ell}$$

where μ is the absorption coefficient due to the combined effects of the photoelectric effect, Compton scattering, and pair production, and where ℓ is essentially the mean free path. For example, the *half-thickness* at which the photons are attenuated by 50 percent is $\ell = \ln(2)/\mu$. The absorption coefficient depends upon a number of factors, including the gamma ray energy. For ^{226}Ra, the half-thickness reported by various sources is typically:

50 m in air

20 cm in concrete

5 cm in water

2 cm in rock

One would also have to consider the half-thickness of the daughter products, in particular ^{214}Pb and ^{214}Bi, which have higher-energy gamma rays, some of which are relatively intense.

Of particular interest is the half-thickness in sandy soil at Site 25/27, because it controls the effective penetration depth of a surface geophysics survey. This determination is a complex function of many factors, such as soil density, soil moisture, gamma characteristics, instrument factors, etc. Previous experience (Auxier & Associates, 1993) suggests that only radioactive sources shallower than half a meter would be detectable with the screening instruments used at this site. Note that the half-thickness in concrete would make gamma detection difficult over the old Building 709 foundation, even if soil contamination lies directly beneath the concrete slab.

3.0 RADIOLOGICAL HISTORY AT SITE 25/27

3.1 Typical Radium Operations

Site 25/27 has, since the World War II era, been used for a number of industrial operations, including electroplating, painting aircraft parts, assembling and testing airplane parts, electronics and radio repairs, and engineering. A relatively small operation, in terms of personnel involvement and quantity of waste generated, has been a program of painting and stripping radium-doped paint on aircraft instruments. However, this small operation has posed a large environmental concern at this site.

Typical procedures — The painting of luminescent instruments involved one to two employees starting in 1940 and possibly continuing through 1950. The workers mixed a radium-enriched liquid compound with paint and applied the paint with brushes. The compound consisted of a radium sulfate which was formed in the refining process by co-precipitation of radium with barium.

Stripping worn and damaged instruments was a more significant operation in terms of radium waste generated. Paint stripping has been done continuously since 1940, starting in Building 709 and moving to Building 780 when 709 was demolished. The Naval Energy and Environmental Support Activity (NEESA, 1983) reports that during the 1940s and 1950s, stripping involved soaking the instruments in benzene, scraping in a benzene or water bath, and perhaps dry scraping under a ventilation hood. The report states that in recent decades instruments have been scanned for radium, then stripped using paint stripper; if necessary, the work also required use of lye and nitric acid solutions, "Turco" acid solution, or scrubbing with a wire brush. Former Building 709 workers interviewed by E/A&H during the RI fieldwork on June 8, 1993 mentioned the use of benzene, dichloroethene (DCE), and trichloroethene (TCE) solvents in the Instrument Shop, where some of the radium-related work may have been done.

Waste disposal practices — Initially, liquid waste from painting and stripping operations was disposed of down the sewer drains or in drums. Until the construction of a sewage waste treatment plant in 1948, all sewer waste was discharged directly to Pensacola Bay. Solid waste, consisting of wiping papers, brushes, dried paint, etc., was containerized and stored temporarily in the Radium Paint Equipment Building (since this building was constructed in 1949, it is not clear where the solid waste was put between 1941 and 1949). By the 1970s, possibly after the operations were transferred to Building 780, at least part of the liquid waste was drummed. After 1975, approximately one drum of solid waste and two drums of liquid waste were generated each year. These were stored in the storage shed in the northeast section of Building 780. Periodically they were removed to an offsite location.

In 1978 low-level radium paint waste spilled from a corroded drum onto the concrete floor of the storage area near Building 780 (NEESA, 1983). About 25 gallons of waste were spilled. The waste was reported to have been cleaned up, placed in a secure container, and sent to a proper disposal site. The exact location of the spill, the details of the cleanup operation, and

a clear statement as to whether the waste reached unpaved soil have not been determined from the existing records.

Locations of disposal sites — E/A&H, through document searches and personnel interviews, has been unable to confirm the exact location or locations in Building 709 where radium painting and stripping were actually done. Pre-construction drawings of Building 709 show a small "Radium Paint Room" in the instrument shop, but it is not known if the room was actually used for that purpose. This room had a sink or tank hooked up to the drain lines leading to sewer manhole K-7 north of Building 709. In 1948, cold and hot water tanks were added to the Carburetor Shop, and degreasing and cleaning tanks may have been added then. Caldwell and Joyner (1993) recall that the "Radium Dial Shop" stripping occurred there, although no documents have been found which confirm this. They also believed that the drain line from this shop ran along the north wall of Building 709; site drawings do not show this line.

3.2 Results of Previous Investigations

Nine environmental investigations have been performed in the Site 25/27 area, five of which have reported radiological data.

In 1976 the Radiological Affairs Support Office (RASO) issued a report on radium contamination in the drain lines at Building 709 (Site 27). Attempts to locate this document have been unsuccessful. Bill Hill, contacted by E/A&H in September 1993, indicated that Dan Tanner at RASO/NEESA could not locate a copy. Hence the following information consists of accounts of the document by NEESA (1983). According to these accounts, RASO personnel surveyed the demolished Building 709 area in 1976, finding radioactive portions of the drain pipe, linoleum floor, walls, and wood flooring within the "dial painting shop." No contamination was found in adjacent areas, surrounding grounds, or in ventilation ducts. RASO personnel are reported to have supervised removal of the contaminated materials for disposal. Quoting from NEESA (1983): "The contaminated drain pipe was excavated to a depth of 18 inches during the

dismantling operations. The remaining underground portion was capped and abandoned. 'The dose rate from the pipe before refilling the hole with concrete was 1.2 mR/hr.' (Radiological Affairs Support Office, 1976). Normal background is about .02 mR/hr. RASO had recommended that the contaminated pipe outfall be located and checked for contamination, but there was no evidence available at the time of the IAS that this had been done."

In 1983 NEESA issued its Initial Assessment Study of NAS Pensacola (NEESA, 1983, 1985). The study reviewed historical documents and aerial photographs, and conducted personnel interviews and site inspections. It identified 29 sites of potential contamination, none of which were thought to represent an immediate threat to human health or the environment. Seven sites, including Site 27 but excluding Site 25, were recommended for a confirmation study of suspected contaminants. The report contains the only available source of information on the radium paint spill at Site 25; the site was added to the list of concerns purely on the basis of the 1978 spill.

In 1984 Geraghty & Miller issued a Verification Study (G&M, 1984). This followup to the NEESA report involved the installation of a number of monitoring wells and piezometers throughout NAS Pensacola. One well (GM-2, renamed 027GG002 in the present report) was drilled at Site 27. The data showed gross alpha radiation below the Florida drinking water standards. A second verification study (G&M, 1986) installed a well in the main producing zone of the Surficial Aquifer. Site 27 was recommended for no further action.

In 1991 Radian Corporation/ABB Environmental Services (ABB, 1991) performed radiological analyses as a part of evaluating soil north of former Building 709. No radioactivity was found. A cold storage facility was constructed there in 1995.

In 1992 Ecology & Environment (E&E, 1992) performed a Phase I study of Sites 25 and 27. The fieldwork involved a geophysical screening of surface radiation, a soil headspace survey,

drilling and sampling shallow borings, and installation of temporary monitoring wells. The soil analyses showed isolated areas of ^{226}Ra contamination, the main one located near the south wall of Building 709. Groundwater was reported to have ^{226}Ra exceeding U.S. Environmental Protection Agency (USEPA) and Florida standards in one well south of Building 709 and in all five wells installed at Site 25. The findings for groundwater in particular required the present study.

3.3 Source Summary

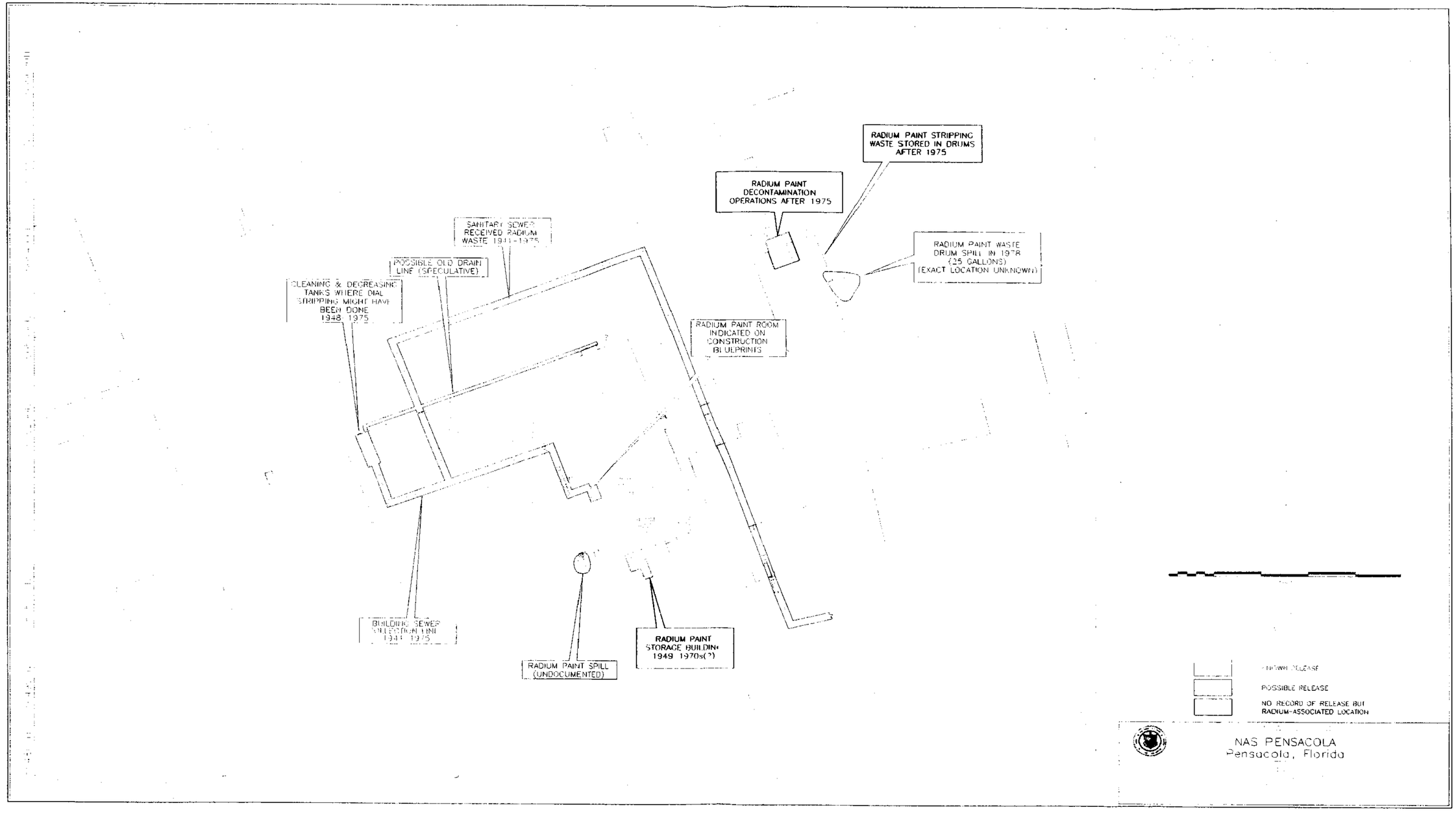
Figure 1 shows the known and suspected sources of radium contamination at Site 25/27, based upon historical information and previous investigations. The room labels (in green) within Building 709 are from pre-construction drawings, and do not necessarily indicate their final use. All features are shown as they existed at the time of the RI fieldwork in 1993.

4.0 GEOPHYSICS INVESTIGATION

4.1 Field Methods

Earlier work (E&E, 1991) and preliminary radiation scans by E/A&H in early 1993 indicated several radioactive pockets in soil adjacent to Building 709. To characterize all near-surface radioactive sources, a geophysical survey was performed. Field work utilized the UltraSonic Ranging And Data System (USRADS) technology. Originally developed at Oak Ridge National Laboratories (Nyquist and Blair, 1991; Berven et al., 1991), USRADS has been transferred to the private sector by exclusive license to Chemrad Tennessee Corporation, a private contractor retained by E/A&H for this project.

The system is essentially a radiation detector linked to a position-finding system, with an ability to telemeter data to a central computer for real-time monitoring and control of data density and quality. The field deployment requires three sets of equipment: a receiver network, an instrument backpack, and a master receiver. The receiver network has several stationary positioning receiver units are distributed around the edges of the parcel to be surveyed. Each


RADIUM PAINT STRIPPING WASTE STORED IN DRUMS AFTER 1975
RADIUM PAINT DECONTAMINATION OPERATIONS AFTER 1975
RADIUM PAINT WASTE DRUM SPILL IN 1978 (25 GALLONS) (EXACT LOCATION UNKNOWN)
SANITARY SEWER RECEIVED RADIUM WASTE 1941-1975
POSSIBLE OLD DRAIN LINE (SPECULATIVE)
CLEANING & DEGREASING TANKS WHERE DIAL STRIPPING MIGHT HAVE BEEN DONE 1948-1975
RADIUM PAINT ROOM INDICATED ON CONSTRUCTION BLUEPRINTS
BUILDING SEWER COLLECTION LINE 1944-1975
RADIUM PAINT SPILL (UNDOCUMENTED)
RADIUM PAINT STORAGE BUILDING 1949-1970s(?)
KNOWN RELEASE
POSSIBLE RELEASE
NO RECORD OF RELEASE BUT RADIUM-ASSOCIATED LOCATION
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receiver unit consists of an ultrasonic receiver, a radio transmitter-receiver, and a battery pack, all mounted as a unit on a tripod. The instrument backpack, which couples one or more geophysical instruments to an ultrasonic transmitter, is carried by the operator within the parcel to be surveyed. The master receiver, linked to a computer, is mounted in a truck outside the grid.

Once per second the backpack obtains the geophysical signal digitally, transmits the data to the master receiver, and transmits an ultrasonic "trigger" signal to the stationary receivers. The trigger signal causes all the stationary receivers to transmit an ultrasonic signal to the master receiver. The travel time from backpack to each receiver will be different, depending on their separation. This principle is used to calculate the position of the backpack with respect to the receiver grid (the different travel times between each fixed receiver and the fixed master receiver is essentially calibrated out during the grid setup). Thus the master receiver obtains a data point and associates it with a calculated ground position. The data record is added to the cumulative data base in the onsite computer, and displayed in real time on a monitor. The color display shows the plan view locations of the data points, with color representing the magnitude of the response.

The positions of the stationary receivers are located in an absolute sense by referencing to a known grid or in a relative sense by self-referencing. At least four receivers are required, and 10 to 15 may be employed at some sites. As presently configured, the system's ranging is limited to parcels some 200-feet by 200 feet in size; larger grids must integrate the results of multiple parcels.

Data were obtained simultaneously from a scintillometer and a dose rate meter. Both instruments and their corresponding detectors were factory calibrated two months prior to field work, and each was checked daily for accuracy with a ^{137}Cs check source.

The scintillometer was a Ludlum Model 3 coupled to a high-energy gamma scintillator detector with a 2.5-cm sodium iodide crystal. The detector is designed for gamma radiation detection in the .06 to 2 MeV energy range. Data (counts per minute) were summed over discrete one-second integration intervals and transmitted to the master receiver. The probe was held about 15 cm above the ground surface and swung sideways like a pendulum as the operator walked forward. Thus the data are an integrated average response over the swing length and the traverse length during each second — a procedure which essentially provides a low-pass smoothing filter of local noise. The area of influence for each data point was a square approximately 2.5 meters by 2.5 meters in size, with increasing response sensitivity toward the center of the square.

The dose rate meter was a Ludlum Model 19 Micro-R Meter with an internal 2.5-cm sodium iodide crystal detector. The unit was mounted 1 meter high on the backpack frame, thus approximating the effective dose rate per second to a person of average height walking at a slow pace.

Data were collected in subgrids about 200 feet by 200 feet in size. The operator moved at a slow, steady rate in a straight line. As he exited the grid boundary, he would reverse direction and start another, parallel line about 5 feet away. In this way the whole grid would be completed. With setup times and necessary breaks from the weather, each grid took approximately two hours to complete.

The data provide only near-surface information due to the limited penetration of gamma rays in soil. Areas of thick surface material such as concrete, for which penetration is more restricted, were generally not surveyed.

4.2 Data Processing

The geophysics work required 11 subgrids. The data were integrated to a single data set by the subcontractor and delivered to E/A&H. Quality checking identified a block of erroneous data which was eliminated from the database.

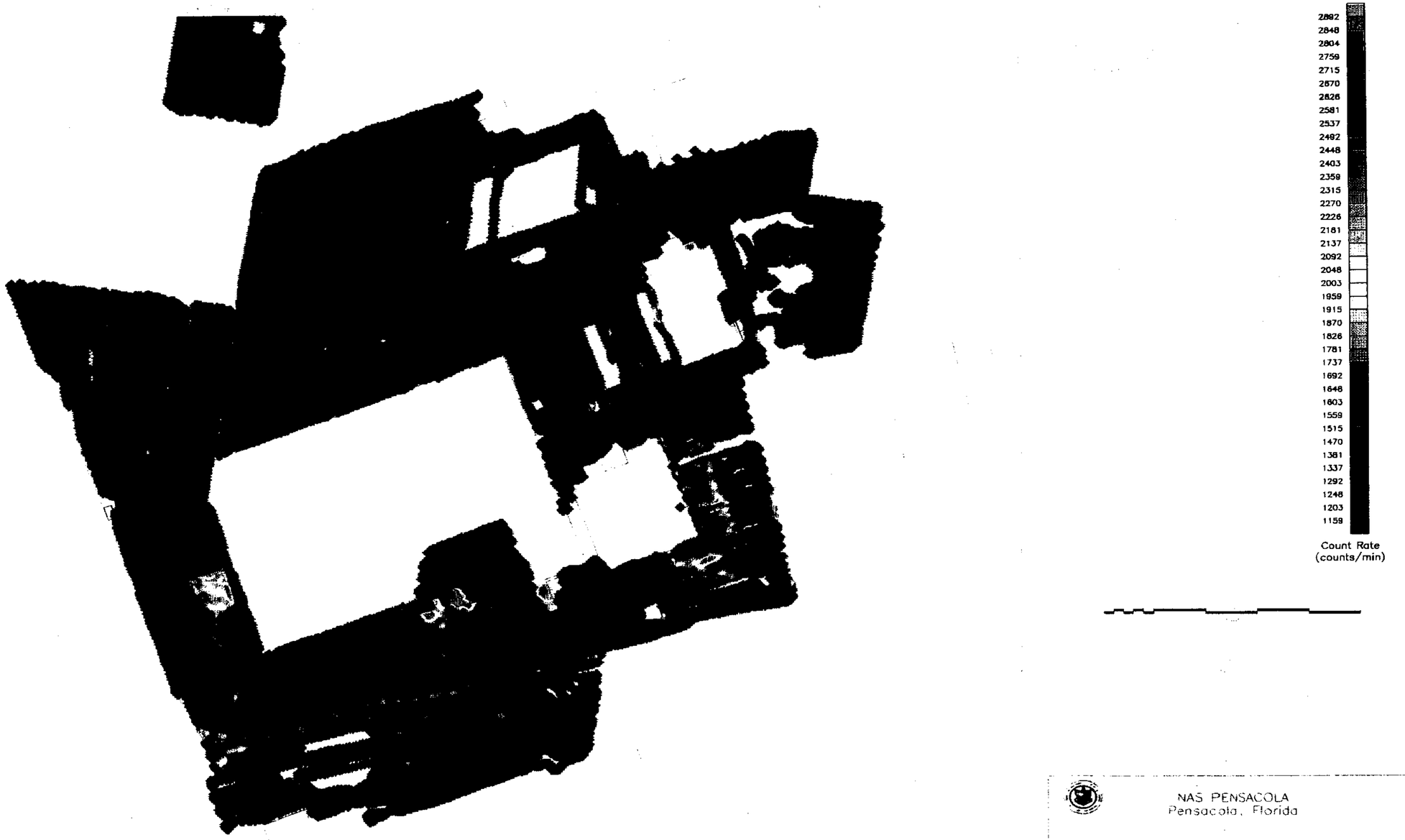
Since the data subgrids had been aligned with an arbitrarily referenced grid system, several key grid nodes were surveyed to transform the data to state plane coordinates.

4.3 Data Interpretation

Figure 2 shows the count rate data, processed and colored to emphasize the more significant anomalies, which are assigned letter designations to facilitate discussion. Data gaps (white spaces) indicate places where no data were obtained over a 5-foot or larger zone. The larger gaps occur at parked cars, buildings, thick concrete, and other impediments. The plot shows a large area of "background" responses (dark blue) upon which are superimposed several moderately anomalous zones (light blue to green) and several locally intense anomalies (red to magenta).

Anomalies A, B, C, F, and H are associated with asphalt pavement or patches in pavement; Anomalies G and I are linear features within Anomaly H. These features are discussed later. However, the double-lobed anomaly (D and E) on the south-center edge of Building 709 is not over asphalt, but soil, suggesting followup sampling. Note the absence of anomalies in the vicinity of the Site 25 drum spill east of Building 780. Anomalies observed next to buildings are attributed to radioactive "shine" from bricks used in construction.

Some data were obtained over the concrete foundation of Building 709 near and south of the Radium Paint Room indicated on construction drawings. Data are lower than background for existing soil. In addition, a 2.5-cm sodium iodide crystal was moved very slowly at slab level



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over concrete joints and cracks to look for "shine" from below; none was detected. High gamma ray attenuation through concrete appears to have prevented a glimpse of sub-foundation radioactivity.

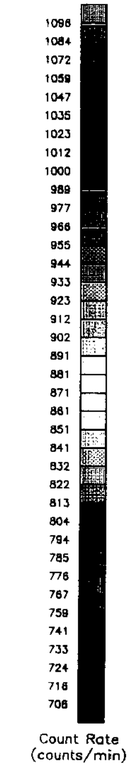
The data were also processed to emphasize subtle, low-amplitude anomalies, with the intent of identifying radioactive sewer lines and other features related to radium waste disposal. Figure 3 shows the results. Moderate- and high-amplitude anomalies, such as those along asphalt pavement, are saturated in magenta on this representation to bring out the low-amplitude features. There is no hint of an anomaly over the sewer line north and east of Building 709 — an expected result due to high gamma ray attenuation through 6 feet of soil cover. There is no clear linear response along the north side of Building 709; thus the data do not indicate the radioactive drain line suspected by Joyner and Caldwell (1993).

Of academic interest are the rather pronounced rectangular-shaped patterns on the north side of Figure 3. At the time of the study, this was an open, grassy area. The geometric precision and perfect alignment with site features suggests that these are "ghost" anomalies from former buildings in this area. It is possible that the building footprints may have prevented dispersal of slightly radioactive materials, while walkways between them would have accumulated such materials. The materials may have been construction-related or, possibly, low-level atmospheric fallout from the atomic era. In any case, the anomalies are very low in amplitude, as can be appreciated by comparing to Figure 2.

5.0 SOIL SAMPLING

5.1 Sampling Strategy

Soil sampling locations were selected for optimal sampling of Contract Laboratory Program (CLP) constituents as well as radiological isotopes. However, the radiological aspects required the following specific sampling strategy:



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- "Background" sampling in areas where radium contamination was deemed unlikely, based upon a study of the site history, previous environmental studies, and the geophysics study. The purpose was to establish a baseline of comparison for the data set as a whole.

- "Hot spot" target sampling of known or suspected radium sources, such as sewage collection drain lines in Building 709, sewer lines and connections, possible floor spills at suspected radium operations, small anomalies outlined in the surface geophysics, the spill area at Site 25, etc.

- Sampling of asphalt over significant geophysical anomalies to distinguish radium from naturally radioactive constituents in asphalt.

- Systematic small-grid sampling where moderate to high geophysical responses were observed over soil. This was done for risk-assessment purposes.

5.2 Drilling and Sampling Methodology

Surface samples (0 to 15 cm) were collected by driving a stainless-steel sleeve into the ground and capping it at both ends with a Teflon liner. Generally three adjacent sleeves were collected at each sampling site. Some shallow samples below 15 cm were collected with a hand auger. Auger samples were extracted, composited in a bowl, and collected into stainless-steel sleeves.

Drilling was done with hollow-stem augers. Soil samples were collected in split spoons lined with four 15-cm stainless-steel sleeves. The sleeves were extracted from the spoons, checked with a photoionization detector (PID), then encapsulated with Teflon-lined endcaps. The method does not lend itself to compositing the samples but preserves volatiles well. In general the first three sleeves had good sample recovery which was representative of the geology, while the fourth (lower) sleeve often had poor recovery with collapse sediments from the borehole walls above it. Sleeve 1 was usually designated for full scan analysis (FSA); sleeves 2 and 3 were

used for gamma spectroscopy. Duplicate and matrix spike material came from sleeves 2 or 3 in most cases.

Risk-assessment grids were established at 10-meter intervals on the south side of Building 709, where geophysics anomalies were prevalent. Because of the tight sampling space, the grids were forced to align with building walls and could not be placed arbitrarily. To partially compensate for biased sampling in the small geophysics anomalies, a systematic composite-sampling approach was adopted. Samples were obtained at five points within each grid and composited by mixing and quartering in a stainless-steel bowl. The composited soil was then placed in three stainless-steel sleeves and capped for shipment to the laboratory.

Each soil sample was screened for radiation with a Victoreen Model 190 rate meter connected to a pancake probe. Although carefully conducted, the screening process was only modestly effective, producing a positive but very noisy correlation between screening count number and lab-determined radioactivity concentration. In general, screening could reliably identify samples with ^{226}Ra values above about 10 pCi/g. Samples with values above background were automatically sent to the laboratory. Additional samples, regardless of radiation-screening values, were submitted according to the following criteria:

- All 14 background samples in the 0 to 0.5 foot range.
- All composited risk-assessment grid samples.
- All samples in the 0 to 4 foot depth range, in order to provide data for defining contaminant nature and extent.
- All depth intervals in drillholes at or near suspected radium sources or within a geophysical anomaly.

- Samples of the low permeability zone to see if radium is adhering to the confining clays.

- Several highly biased samples of contaminated strata to investigate the vertical distribution of contaminants.

5.3 Analysis Procedures

Soil samples were analyzed by gamma spectroscopy using a modified version of USEPA Method 901.1. Samples were counted for two hours each, producing an energy spectrum within acceptable error bounds.

^{226}Ra was determined by measuring its daughter isotope ^{214}Bi, ^{228}Ra by its daughter ^{228}Ac, and ^{238}U by its daughter ^{234}Th. After the first sampling results came back, it was clear that the ^{234}Th values were too noisy, and E/A&H requested that ^{238}U data be reported in terms of ^{234}Pa, which had a much lower detection limit. Other common isotopes were also searched for; only ^{137}Cs was found, and only in a few samples.

5.4 Sampling Results

Regulatory benchmarks — Neither USEPA nor the state of Florida has set regulatory standards for maximum contaminant concentrations of radionuclides in soil, with the sole exception of uranium. USEPA has established a risk-based criterion of 230 milligrams per kilogram (mg/kg) for uranium salts, which, at 35 pCi/g, is approximately 8,050 pCi/g. The Florida Department of Environmental Protection (FDEP) has a cleanup standard of 120 mg/kg (4,200 pCi/g) for uranium.

The U.S. Department of Energy (DOE) specified permissible radiation exposure limits in its February 8, 1990 DOE Order 5400.5 titled *Radiation Protection of the Public and the Environment*. This document is based upon an exposure limitation (effective dose equivalent) of 100 mrem/year from all exposure pathways and a dose of less than 5 rem/year for a single

acute exposure. To promote these goals, the order states a generic guideline for soil contaminant concentration in regard to remedial action. The maximum-contaminant guideline for ^{226}Ra, ^{228}Ra, ^{230}Th, or ^{232}Th is: 5 pCi/g for the top 15 cm of soil; and 15 pCi/g averaged over 15-cm thick layers for soil below 15 cm in depth. The standard is loosened somewhat for small "hot spots" by considering averaged dose rates over areas of 25 m^2 or smaller.

The DOE order was binding between DOE and Martin Marietta for work done at Oak Ridge and other facilities, but was not binding on other contracts. Specifically, it is not a binding regulatory limit for this project. However, it is reasonable to apply this standard to the present data set to help identify data suggesting an exposure risk. The approach taken in this document is to apply a conservative interpretation of the DOE order and identify every local exceedance of the standards, regardless of spatial size. Thus, no averaging of a small hot spot over a broader 25 m^2 area, as allowed by the order, is done in this document. Nonexceedances of the DOE standards are treated as an insignificant risk to human health and the environment; Exceedances are evaluated further by a risk assessment presented elsewhere in this document.

For purposes of this report, the DOE standard for radium contamination of soil will be referred to as DOEG (Department of Energy guideline). Note that the standard changes with depth.
Determination of background radiation — Fourteen onsite locations were preselected to establish background radionuclide levels in the 0 to 6-inch depth range. Although the DOEG is the standard used to judge the sampling results, background data are useful in establishing the significance of low-level trends. The background sampling locations, shown in Figure 4, were selected in areas of relatively undisturbed soil away from known or suspected radiological contaminant sources.

Table 2 summarizes a statistical analysis performed on background sampling data. Nondetect values were not considered in the calculations. The data for ^{214}Bi show a broad, asymmetric distribution which is intermediate between normal and log-normal. The highest values are well

Table 2
Analysis of Background Radiation in Surface Soil

Daughter Peak Analyzed	^{234}Th	^{214}Bi	^{228}Ac	^{137}Cs
Isotope	^{238}U	^{226}Ra	^{228}Ra	^{137}Cs
Applicable Samples*	0	14	8	11
Range (pCi/g)	—	0.15 to 0.56	0.06 to 0.66	0.07 to 0.42
Mean (pCi/g)	—	0.289±0.131	0.314±0.203	0.235±0.126
Coefficient of Variation *cv*	—	0.45	0.65	0.54
Background (pCi/g)**	—	**0.683**	**0.922**	**0.612**

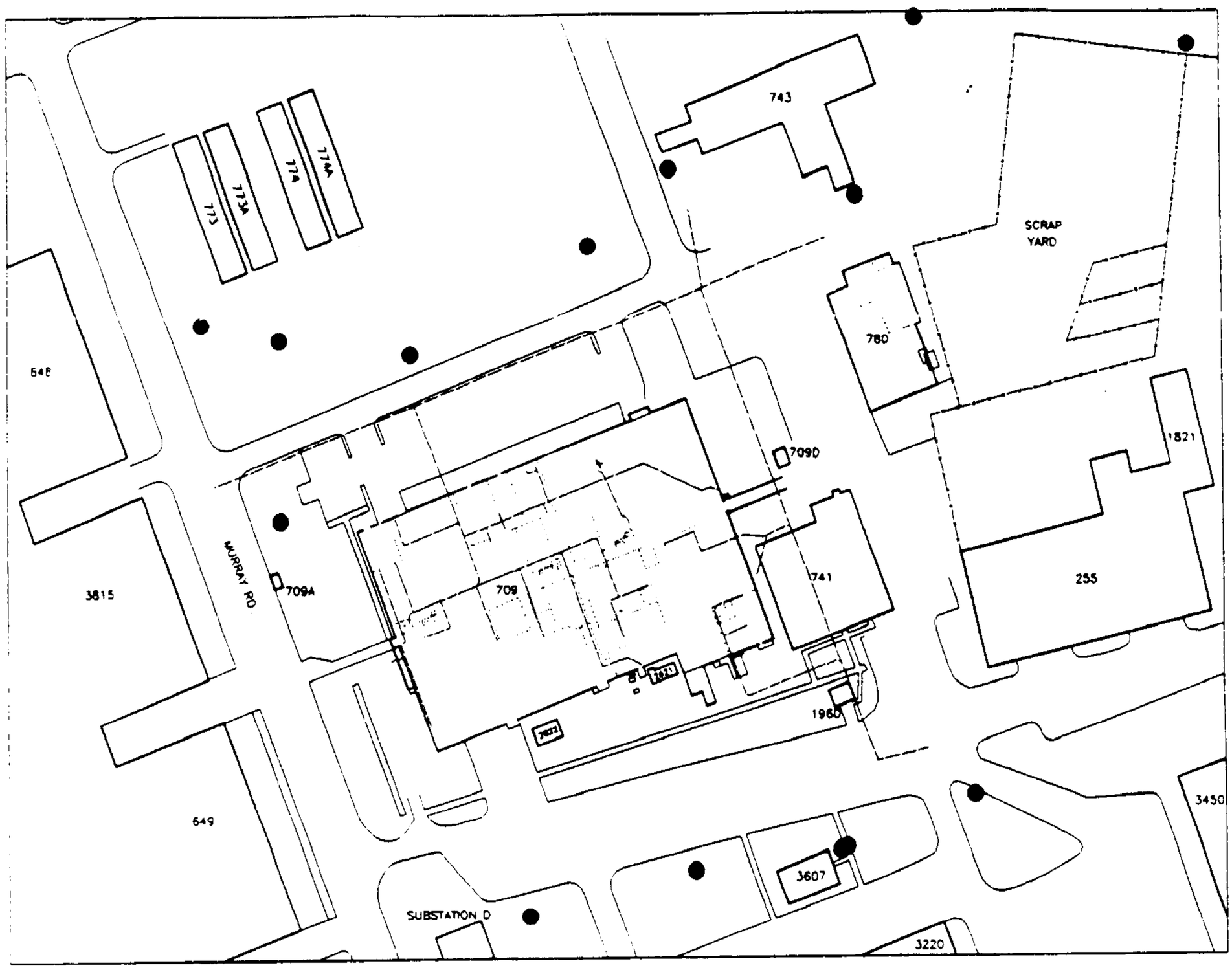
Notes:
* Nondetects and outliers were rejected for background determinations.
** Mean plus three standard deviations.

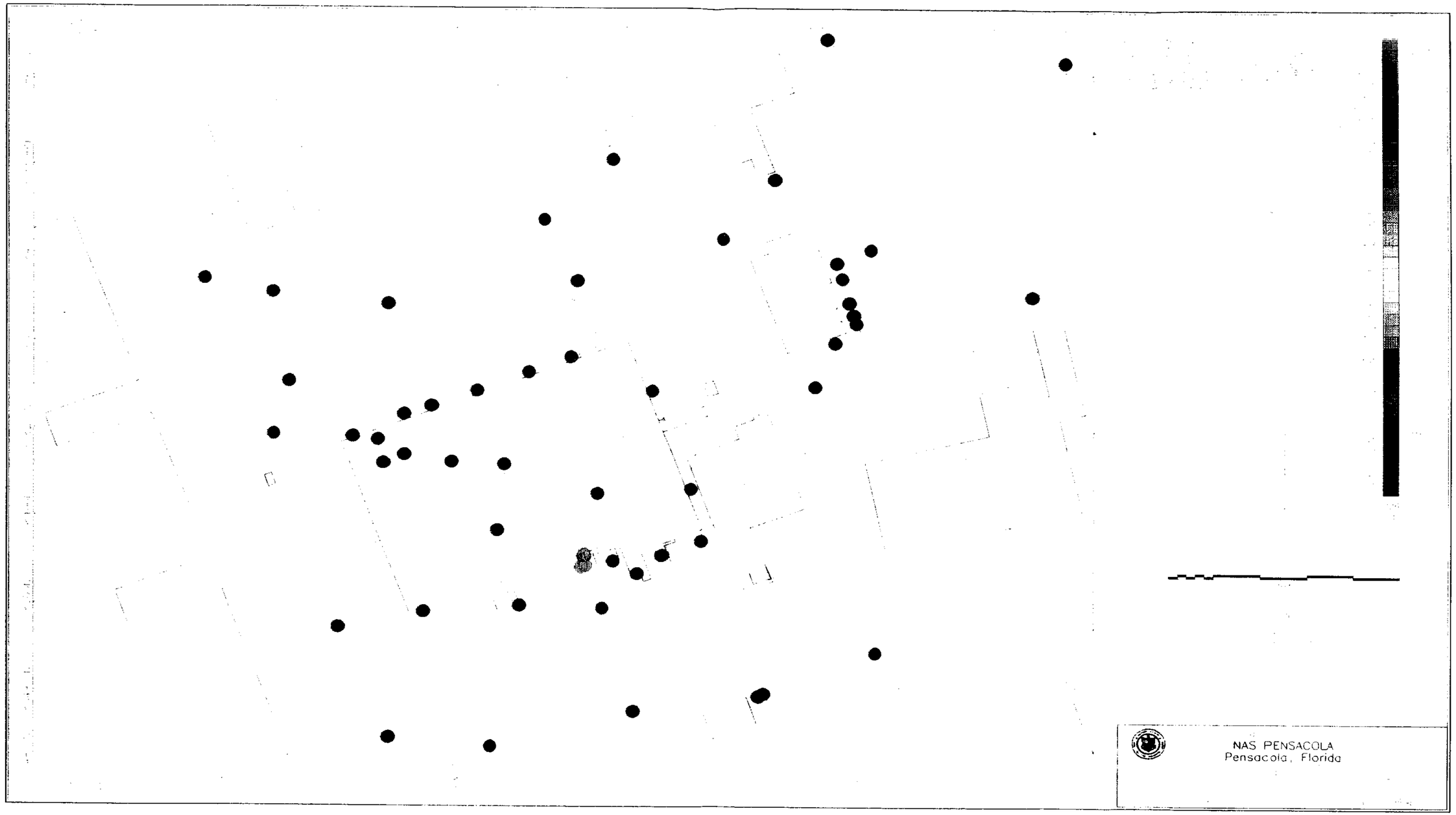
within three standard deviations of the mean and do not qualify as outliers. Therefore, all the data are retained for the background determination. The ^{228}Ac and ^{137}Cs data show a broad distribution without a distinct normal peak. The ^{234}Th data were mostly nondetects, and the three remaining values had errors nearly as large as or larger than the data values. Hence the background value is undefined for this isotope.

Background numbers were calculated for each isotope by summing the mean and three standard deviations. This is only an approximation, since none of the distributions is strictly normal.

Soil sampling results — Figure 5 shows the ^{226}Ra data for surface soil (0 to 6 inches deep). Note the 5 pCi/g DOEG for this depth interval is at the top (magenta) portion of the color key; the background benchmark ("BKGD") is in the blue-green color range. The background benchmark is exceeded by six of the 56 samples (11 percent), all but one of which (027S0052, 0.70 pCi/g) are at geophysical Anomaly E. The DOEG is exceeded by five samples collected from Anomaly E; the highest value (246.30±11.03 pCi/g) was obtained at boring 027S0055, located deliberately at the anomaly peak. Soil at or near every known or suspected radium source noted

Figure 4
Background Sampling Locations

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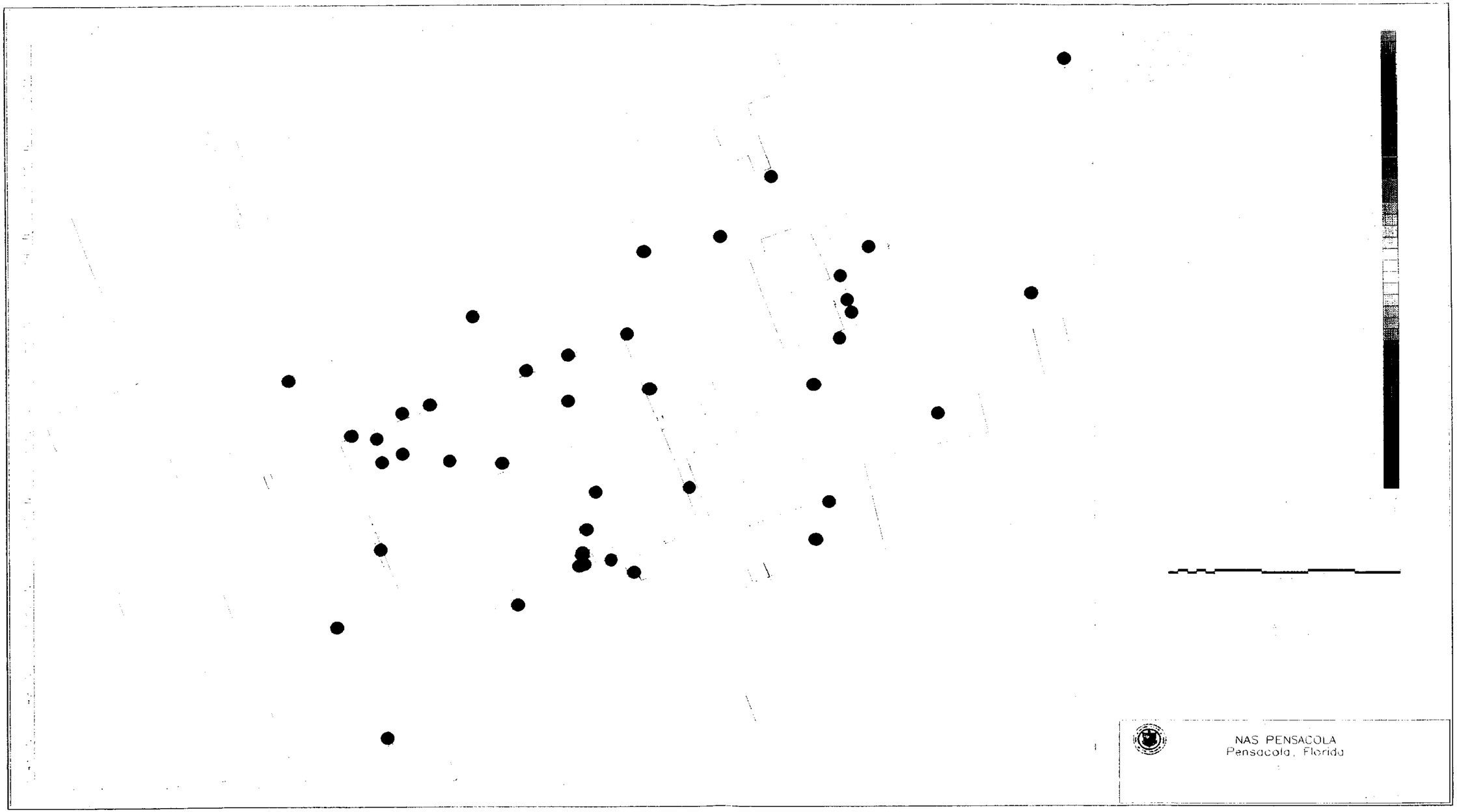
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in Figure 1 was tested; aside from those just mentioned, no samples exceed one-fifth of the DOEG.

Figure 6 shows the ^{226}Ra data for soil in the 1- to 2-foot interval, for which the DOEG is 15 pCi/g. The highest value recorded in this depth interval is 1.63±0.17 pCi/g at borehole 027S0055, far below the DOEG. Outside Anomaly E, all values are below the background level previously established for surface soil. Thus, no exceedances occur in this depth range.

Among the 109 samples analyzed in the 4- to 20-foot depth range (not represented by a figure), the highest recorded value was 0.7 pCi/g. Thus, no exceedances occur in this depth range.

Figure 7 shows the ^{226}Ra data for the silty-clay layer at about 60 to 65 feet deep. The highest value is 1.27±0.22 pCi/g (025S0008), which is 8 percent of the DOEG.

Other radionuclides — The highest recorded value for ^{228}Ra is 0.78 pCi/g (025S0015 and 027S0019, 0-15 cm deep), which is well below the DOEG. High values related to radium paint would be unexpected due to the short half-life of this isotope.

The maximum recorded value of ^{238}U is 4.25 pCi/g, far below the USEPA and FDEP standards for this isotope.

The maximum ^{137}Cs value was 1.46±0.14 pCi/g (025S0015, 0-15 cm depth).

Asphalt samples — Five asphalt and asphalt base samples at three locations were analyzed to determine if construction materials may have contributed to some of the geophysics anomalies. The results are shown in Table 3. Asphalt radiation exceeding the background for soil are found in all three locations in the ^{234}Th, ^{214}Bi, and ^{228}Ac isotopes. The radiation concentration is lower

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in the red asphalt base layer, and is very low in the immediately underlying soil. Geophysics anomalies A and F, from which these samples were obtained, are of the same shape and size as new asphalt patches observed on the ground during the fieldwork. These findings indicate that the anomalies are caused by uranium and thorium contained within the asphalt, and cannot be attributed to a radium spill. Although radium is present, it is likely the daughter isotope of the parent ^{238}U in the asphalt. Note that no regulatory standards used in this report are exceeded in any isotope in any of the media shown in Table 3.

Table 3
Analysis of Radiation in Asphalt Samples

Daughter Peak Analyzed	^{234}Th	^{214}Bi	^{228}Ac	^{137}Cs
Isotope	^{238}U	^{226}Ra	^{228}Ra	^{137}Cs
Background Benchmark for Soil (pCi/g)	—	0.683	0.963	0.612
Anomaly A				
Samples 027S015AS/AB				
Asphalt (pCi/g)	3.31±0.98	1.42±0.17	3.65±0.37	ND
Asphalt Base (pCi/g)	< 0.87	0.65±0.12	1.47±0.23	ND
Soil, 1-2 ft. (pCi/g)	0.49±0.53	0.16±0.07	0.15±0.10	ND
Anomaly F				
Samples 027S022AS/AB				
Asphalt (pCi/g)	2.42±1.08	1.30±0.19	3.49±0.42	ND
Asphalt Base (pCi/g)	< 0.98	0.70±0.14	1.40±0.29	ND
Soil, 0-0.5 ft. (pCi/g)	< 0.66	0.16±0.10	< 0.07	< 0.01
Anomaly F south				
Sample 27S22BAS				
Asphalt (pCi/g)	1.97±0.79	0.74±0.11	1.53±0.20	0.03±0.03
Asphalt Base (pCi/g)	ND	ND	ND	ND
Soil, 0-2 ft. (pCi/g)	ND	ND	ND	ND

Correlation with geophysics results — A correlation was done between the geophysics and laboratory data sets. The geophysics data, ascribed to discrete points, were radially weighted according to their distance from the sample point, and a weighted-average value was calculated.

The laboratory ^{226}Ra data for the 0 to 6 inch depth range were used for the correlation. Excluded from the database are three samples beneath uranium-thorium enriched asphalt, and two peculiarly low laboratory measurements determined to be outliers (025S01800 and 027S01400). Risk-assessment grid data are included.

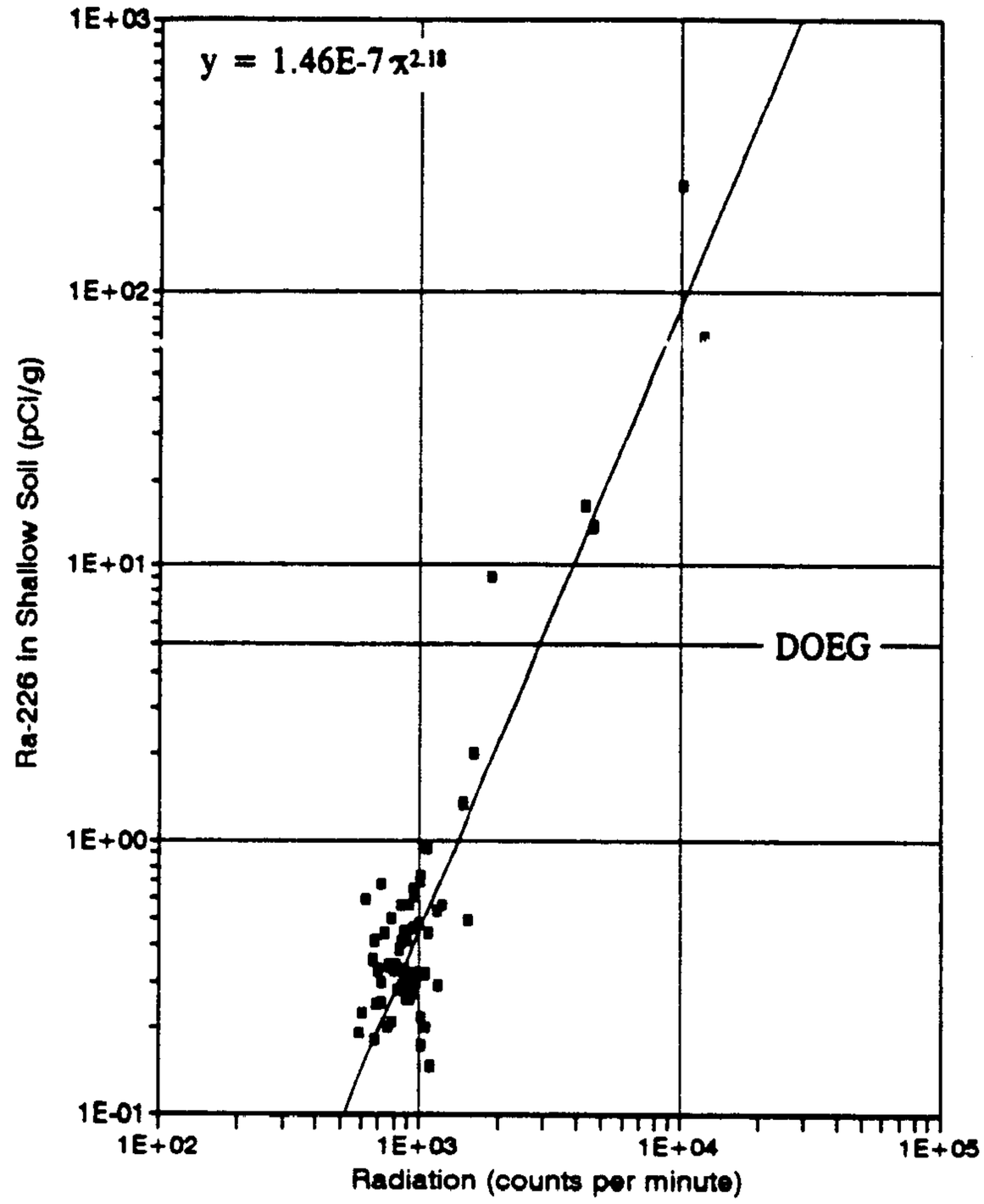
Figure 8 shows that the data are well-correlated, with a correlation coefficient $r=0.91$. Given the strength of the correlation between the two data sets, it can be argued that the geophysics data are a good indicator of the presence or absence of radium contamination, and can be used to "fill in the gaps" between borehole samples. This determination can be quantified. For example, the intersection of the horizontal line representing the DOEG and the sloping line from the least-squares power fit defines a geophysics value at which a regulatory exceedance would occur. This value is 2,892 counts per minute. However, data scatter evident in Figure 8 might cause some geophysical measurements to mis-estimate the actual radium contamination at that point. To prevent this kind of an error, a more conservative estimate of the geophysical threshold is needed. Half the 2,892 limit, or 1,446 counts per minute, is sufficiently conservative that it would correctly predict a DOEG exceedance for every data point in Figure 8. Thus, a geophysical anomaly exceeding 1,446 cpm is a potentially *significant anomaly*.

Figure 2 shows that, aside from small, spatially discontinuous responses, only anomalies A through I may be considered to be significant by the criterion defined above. It is worthwhile to consider the interpretation of each of these anomalies.

Anomaly A shows no soil contamination but a high ^{238}U and ^{232}Th content from the overlying asphalt materials. The match between the geophysics anomaly shape and the shape of an asphalt patch at that position strongly indicates that this anomaly is caused by asphalt and not radium associated with the industrial operations.

Figure 8

Correlation of Geophysics to Ra-226
Shallow Soil Data



Anomaly B is a linear extension of Anomaly A which follows an asphalt driveway to the south. It is barely significant by the criterion set forth above. No samples were collected over this weak anomaly but it is likely that, like Anomaly A, it is caused by the asphalt material.

Anomaly C is the broad feature along the paved street (Farrar Road) south of Building 709. The match between the anomaly shape and the pavement shape leaves little doubt that it is due to uranium-thorium in the asphalt material.

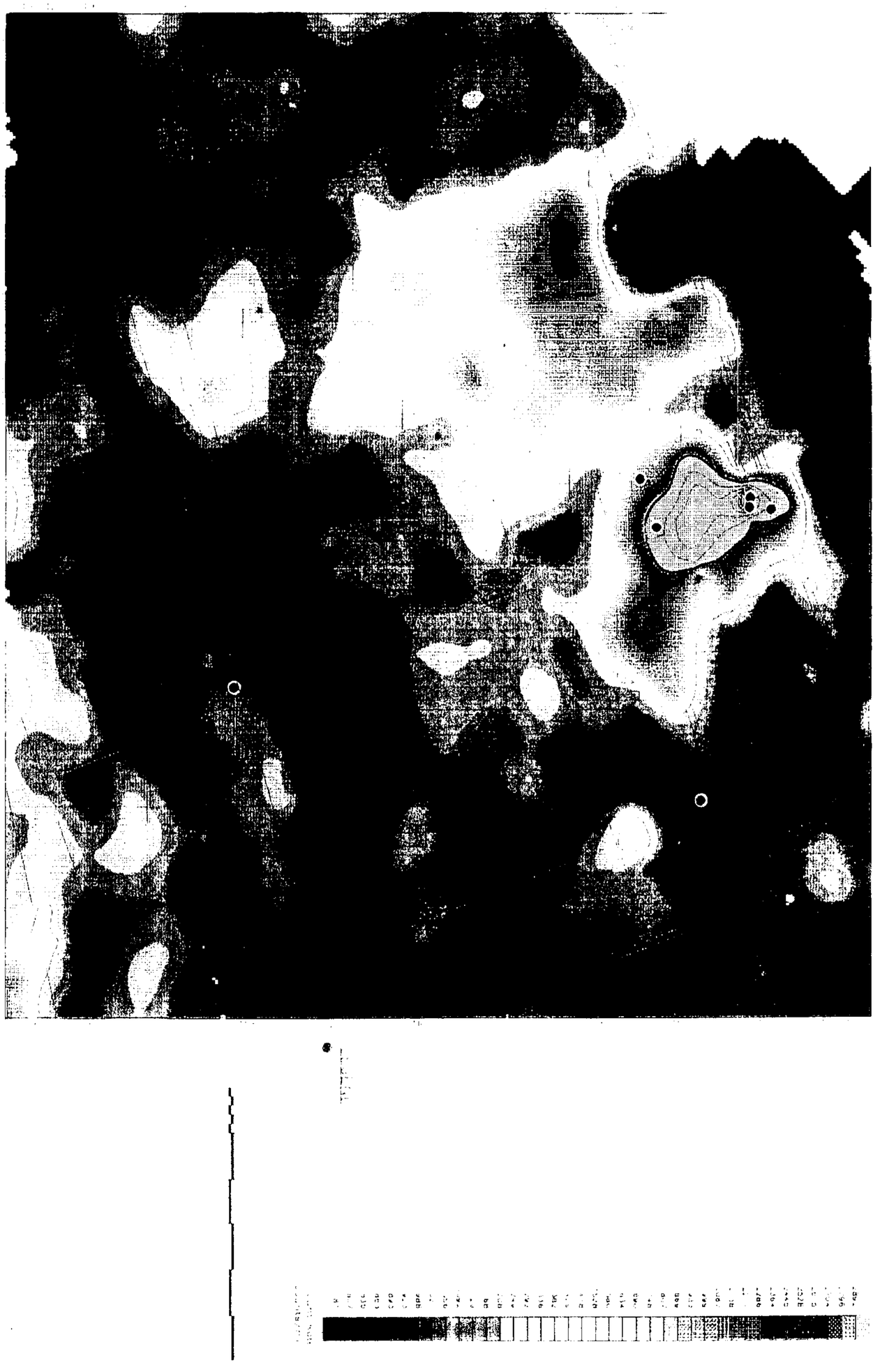
Anomalies D and E are the result of radium contamination, and are discussed later.

Anomaly F is over asphalt near a former loading dock. The uranium-thorium content of the asphalt, the correspondence in shape between the asphalt and the geophysics anomaly, and the lack of radium contamination in the soil beneath the asphalt all indicate that this anomaly is not due to radium-paint contamination.

Anomaly H occurs along an asphalt access road. No asphalt samples were collected, but four soil borings within the anomaly showed no radium contamination in shallow soil. Within this larger anomaly are two linear trends. *Anomaly G* is a short feature oriented ENE; *Anomaly I* runs NNW. No utilities related to sewage collection lines are evident on the documents examined during this investigation. It is possible that these features are associated with asphalt patches applied over the years. However, patches were not specifically indicated in the field notes.

5.5 Analysis of Radium Contamination (Anomalies D and E)

Figure 9 shows a closeup map of Anomalies D and E and the sampling points. The dashed contour separating green from yellow denotes the significant-anomaly threshold value of 1,446 counts per minute. The risk-assessment grids (discussed later) are also shown. Keep in mind that the spatial locations of geophysics anomalies are blurred slightly due to the averaging



effect of the acquisition process, and that there may be a minor misregistration of the site features and geophysics data due to small ambiguities in the coordinate transformation process; thus, the map should be inspected for general patterns and not minute nuances.

The area delineated by the significant-anomaly threshold is about 30 feet by 50 feet in size and encompasses Anomalies D and E. The most intense part lies immediately beneath the west side of an elevated concrete porch and steps at a former building entryway. The intensity decreases radially away from the point of maximum intensity, forming a plume-like feature elongated in a topographically downhill direction (south). This is the pattern one would expect from casual dumping of small buckets of radium paint waste from the porch to the ground below. alternatively, this could be a spill from temporarily stored waste containers at the corner of the porch and building. Concrete blocks still present in this area could have been used to support some sort of storage platform. In any case, this is clearly a spill of radium paint or paint waste.

Anomaly D also appears to be a spill or dump. The highest values occur in two spots, east and south of an elevated concrete porch. The anomaly pattern suggests that paint or paint waste was dumped over the porch railings by workers in the building. That two spots exist could be explained as simply as the difference in the way right-handed and left-handed people might dump paint buckets.

At least 18 years had elapsed since any disposal actions and the RI fieldwork, yet the spatial boundaries of the anomalies are sharply defined. Small, rapidly attenuated plume-like features are observed only a limited distance from the "hot spots." In fact, regardless of the intensity of the localized anomaly, the plume seems to move about 25 feet downgradient and stop. Apparently the horizontal mobility of radium in the surface soil is restricted.

Restricted mobility is also indicated in the vertical dimension. Figure 10 shows a vertical profile of ^{226}Ra values for all five borings within geophysical Anomaly E. Each boring was designed for a unique purpose, so none was continuously sampled from surface to depth; however, despite amplitude shifts caused by boring placement with respect to the geophysical "hot spot," all five profiles exhibit a similar character. Radium peaks in the 5 to 15 cm depth range and declines rapidly with depth. In fact, contamination drops below the DOEG by the time a depth of 1 foot is reached.

These results indicate an immobile slug which has hardly moved since the spill incident which must have caused it. Although pure radium is highly mobile in coarsely textured soil, the radium paint mixture was originally manufactured in the form of a radium sulfate compound, which has a low solubility in water (Molinari & Snodgrass, 1990). Mobility is also reduced in the presence of divalent calcium, which forms an insoluble complex with radium and beryllium; consequently, a high-calcium environment may "trap" radium.

Radium shares similar properties of substitution and chemical mobility with divalent calcium and barium. Figure 11 shows the vertical variation of ^{226}Ra and these cations at borehole 027S0019, supplemented by deep data at collocated borehole 027S0020. Beryllium remains flat, but the other metals show a decrease with depth similar to that observed for radium. At depth, they increase again at the silty clay layer, presumably because of the layer's mineralogy, but radium remains low. Thus, at the surface, radium behaves like calcium and barium in terms of vertical mobility, but it is not trapped in the clay layer by cation substitution because it apparently never reached that depth. This favors the argument that ^{226}Ra has never moved below the near-surface soil where it is trapped.

Risk-assessment grids — Figure 12 shows the locations of the risk-assessment grids and sample locations. The results, tabulated in Table 4, show that five grids have ^{226}Ra values exceeding background, but none exceed the DOEG.

Figure 10

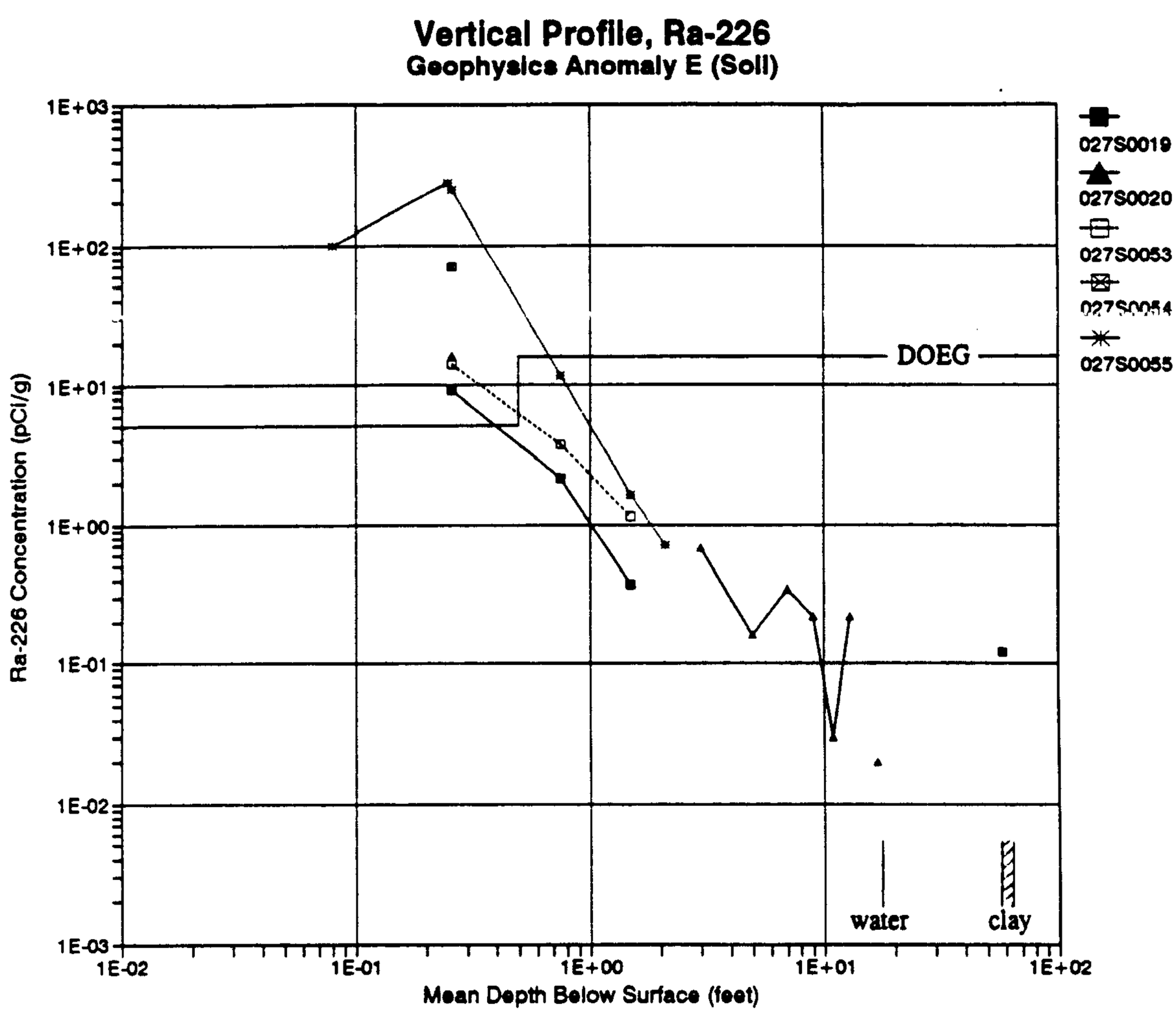
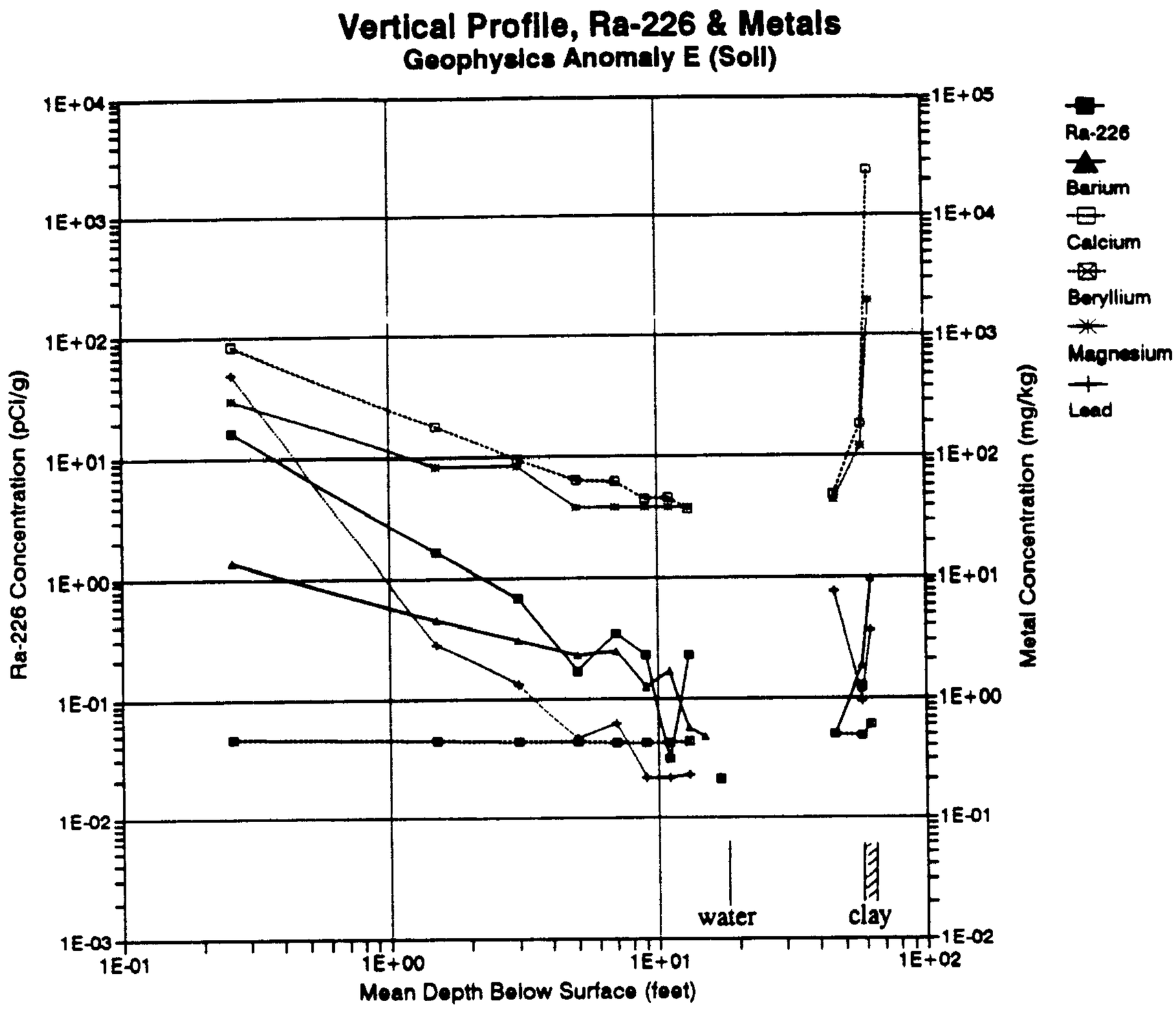

Vertical Profile, Ra-226
Geophysics Anomaly E (Soil)
Ra-226 Concentration (pCi/g)
1E+03
1E+02
1E+01
1E+00
1E-01
1E-02
1E-03
1E-02
1E-01
1E+00
1E+01
1E+02
Mean Depth Below Surface (feet)
DOEG
water
clay
027S0019
027S0020
027S0053
027S0054
027S0055

Figure 11


Vertical Profile, Ra-226 & Metals
Geophysics Anomaly E (Soil)
Ra-226 Concentration (pCi/g)
Metal Concentration (mg/kg)
Mean Depth Below Surface (feet)
1E+04
1E+03
1E+02
1E+01
1E+00
1E-01
1E-02
1E-03
1E+05
1E+04
1E+03
1E+02
1E+01
1E+00
1E-01
1E-02
1E-01
1E+00
1E+01
1E+02
water
clay
Ra-226
Barium
Calcium
Beryllium
Magnesium
Lead

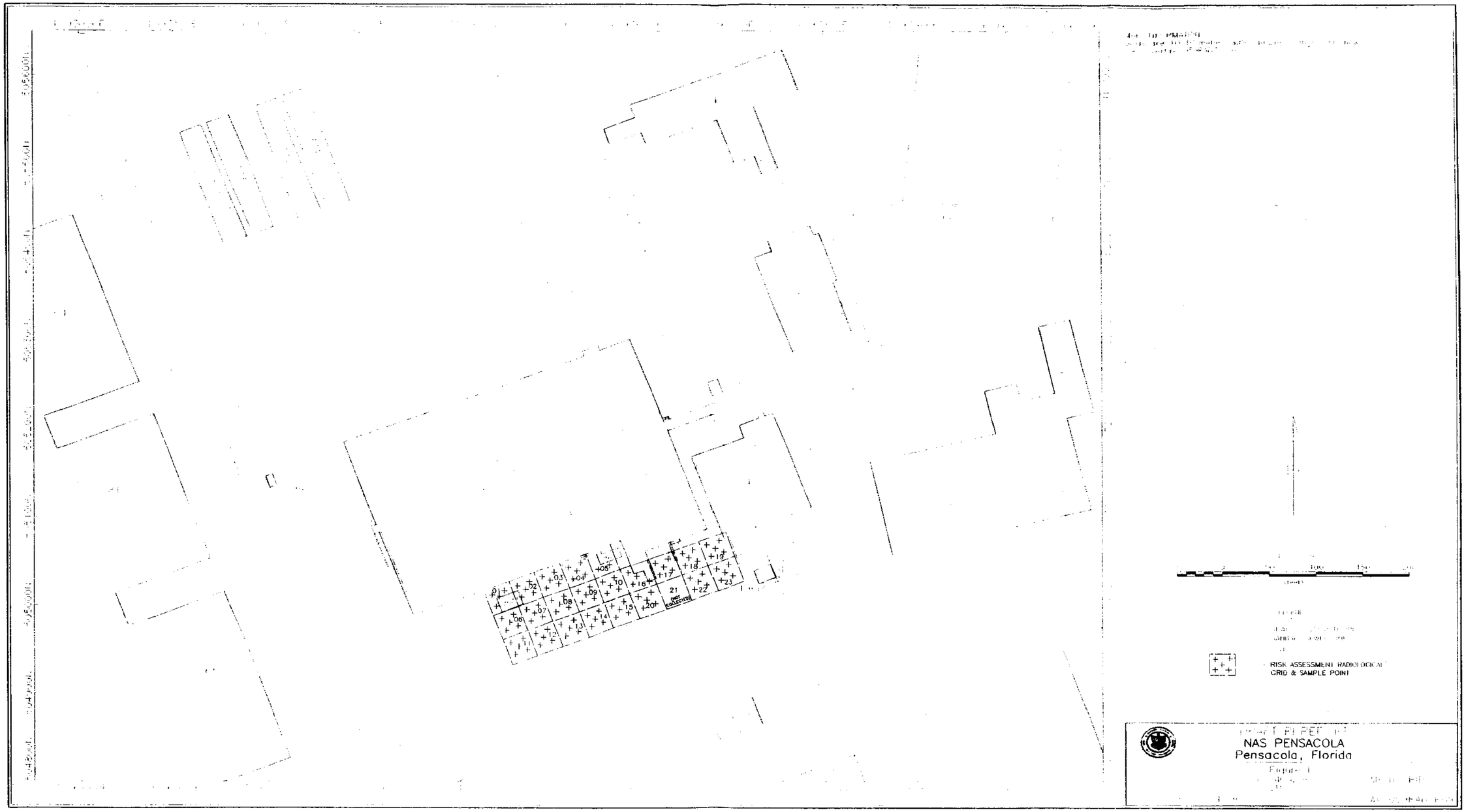

RISK ASSESSMENT RADIOLOGICAL
GRID & SAMPLE POINT
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Table 4
Results of Risk-Assessment Grid Sampling
(all data in pCi/g)

Daughter Peak Analyzed	^{234}Th	^{214}Bi	^{228}Ac	^{137}Cs
Isotope	^{238}U	^{226}Ra	^{228}Ra	^{137}Cs
DOEG or other standard	4,200**	5	5	none
Background*	—	0.683	0.963	0.612
Grid 27SS01	1.13±0.67	0.45±0.11	0.51±0.15	0.25±0.08
Grid 27SS02	<0.54	0.42±0.10	0.36±0.15	0.87±0.09
Grid 27SS03	<0.77	0.56±0.12	0.53±0.14	0.43±0.10
Grid 27SS04	<1.35	2.00±0.25	0.66±0.27	<0.03
Grid 27SS05	<0.54	1.32±0.14	0.34±0.14	0.34±0.07
Grid 27SS06	<0.81	0.61±0.12	0.57±0.14	0.24±0.08
Grid 27SS07	<0.86	0.46±0.11	0.56±0.15	0.40±0.08
Grid 27SS08	1.50±0.92	0.44±0.11	0.67±0.19	0.21±0.10
Grid 27SS09	<0.78	0.94±0.14	0.51±0.18	0.22±0.11
Grid 27SS10	<0.74	0.69±0.12	0.31±0.12	0.26±0.10
Grid 27SS11	<0.49	0.29±0.09	<0.08	0.23±0.07
Grid 27SS12	<0.74	0.29±0.11	0.23±0.10	0.30±0.07
Grid 27SS13	<0.70	<0.06	0.37±0.12	0.24±0.08
Grid 27SS14	0.72±0.60	0.33±0.10	<0.07	0.37±0.08
Grid 27SS15	<0.70	0.74±0.14	0.36±0.14	0.28±0.08
Grid 27SS16	0.78±0.62	0.41±0.09	0.28±0.08	0.45±0.06
Grid 27SS17	<0.73	0.49±0.08	0.49±0.10	0.11±0.05
Grid 27SS18	<0.63	0.29±0.09	0.22±0.11	0.35±0.08
Grid 27SS19	<0.47	0.31±0.11	0.19±0.13	0.11±0.08
Grid 27SS20	<0.76	0.30±0.09	0.35±0.14	0.33±0.08
Grid 27SS21	not sampled	not sampled	not sampled	not sampled
Grid 27SS22	1.26±0.89	0.50±0.12	0.30±0.13	0.29±0.10
Grid 27SS23	<0.56	0.34±0.09	0.32±0.15	0.26±0.09

Notes:
* Mean plus three standard deviations
** Approximate concentration equivalent of USEPA/FDEP standards

6.0 GROUNDWATER SAMPLING RESULTS

6.1 Drilling and Sampling Methodology

Monitoring wells were installed, developed, and sampled as described elsewhere in this report. Samples for radiological analysis were preserved in nitric acid in 1-liter amber bottles and were shipped to the laboratory with the full-scan samples.

6.2 Analysis Procedure

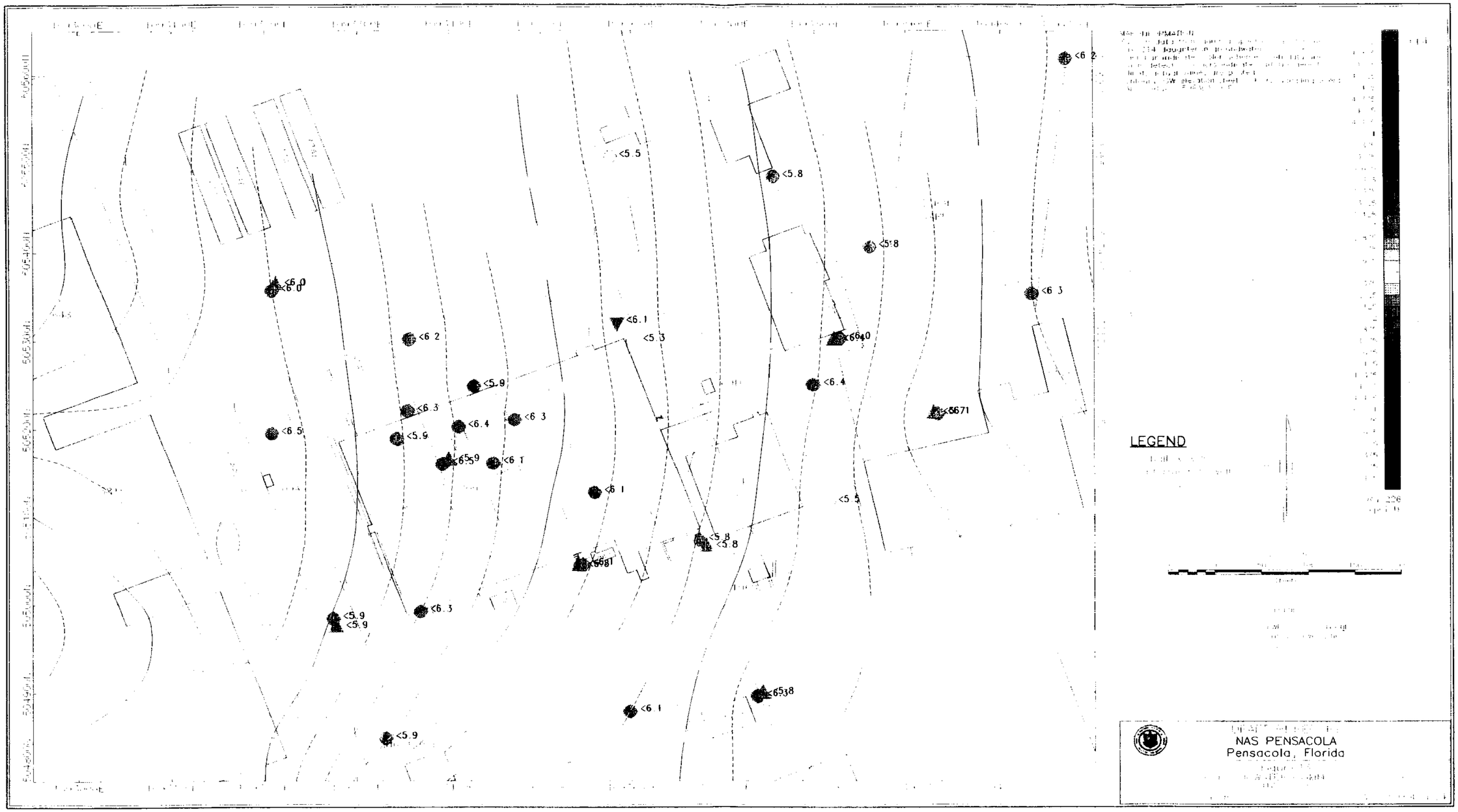
At the laboratory, samples were transferred to 500 ml marinelli beakers, sealed, and analyzed by gamma spectroscopy using a modified version of USEPA Method 901.1. ^{226}Ra was determined by measuring its daughter isotope ^{214}Bi, ^{228}Ra by its daughter ^{228}Ac, and ^{238}U by its daughter ^{234}Pa. Other common isotopes were also sought but not found.

6.3 Sampling Results

Regulatory standards — FDEP maintains a primary groundwater standard for radium of 5 pCi/l, and this is the standard applied to the present data set. The USEPA had set its maximum contaminant level (MCL) at 5 pCi/l for either ^{226}Ra or ^{228}Ra during the fieldwork. In 1993, this was changed to 20 pCi/l; in 1995 the value was lowered to 5 pCi/l.

Results for ^{226}Ra — All ^{214}Bi data were nondetects. The detection limit varied slightly among samples due to counting statistics, but in all cases it was slightly above the FDEP guideline. Figure 13 shows the data, differentiated by depth of the well. Half the detection limit was used to set the color scale for the symbols, following industry convention; however, the actual reported data are posted next to the symbols. Contours indicate the groundwater potentiometric pattern (true groundwater elevation) at the time of the sampling; flow is to the east.

The lack of any data above the detection limit suggests that widespread ^{226}Ra contamination may not exist in groundwater. To confirm this, followup sampling was done at five key wells using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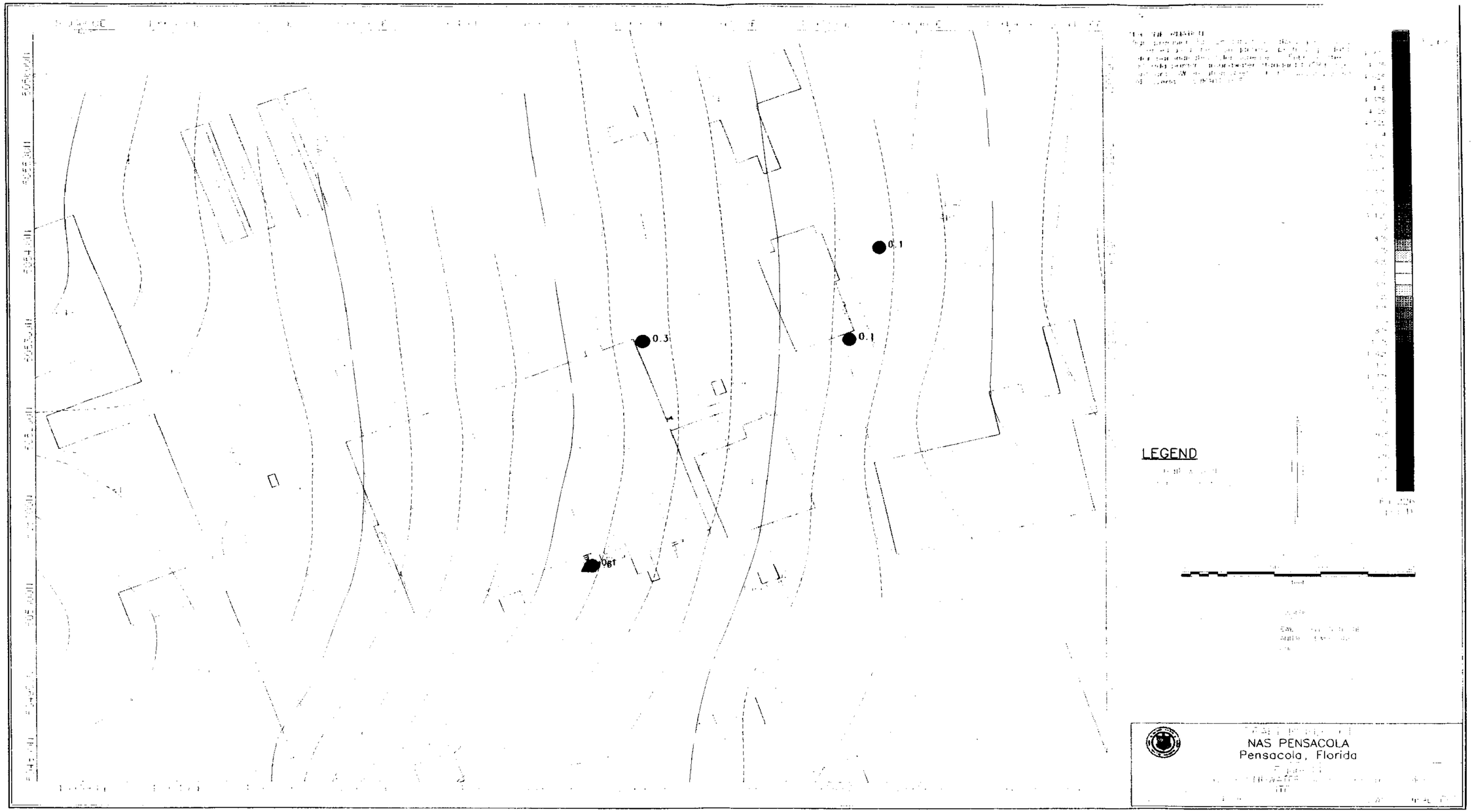
alpha spectroscopy, which has a much lower detection limit than gamma spectroscopy. Followup work searched solely for ^{226}Ra. The wells selected for resampling were at geophysical soil Anomaly D/E, in the heart of the Site 25 groundwater problem reported by E&E (1992), and upgradient from Site 25.

Figure 14 shows the results for the alpha spectroscopy data. No data exceed the FDEP guideline for radium. The shallow wells returned very low values below typical numbers for Florida as a whole and far below, for example, concentrations measured by Walters (1995) in Sarasota County, Florida. The sole intermediate well tested had radium at 1.56±0.16 pCi/l, which is statistically higher than concentrations found in the shallow wells. If there is a vertical gradient of radium, increasing with depth, this well, which is screened at the top of the clay aquiclude, should have measured the maximum contamination. Note, however, that this value is still only 31% of the FDEP standard.

The data from this project suggest that there is no ^{226}Ra problem in the groundwater onsite. This contradicts the E&E data, which showed contamination at all wells measured at Site 25. The E&E data are insufficiently documented to permit an explanation of this discrepancy, but the current study clearly indicates that the E&E conclusions are not presently true for this site.

Results for other isotopes — All ^{234}Pa values were nondetects, except for a handful of high values accompanied by large standard deviations. The largest nondetect was <7.83 pCi/l (027GS0002). This is far below the USEPA MCL of 20 pCi/l for uranium.

Most of the ^{228}Ac data were nondetects, the largest of which was <11.60 pCi/l (025GS0009). All detection limits were above the FDEP limit for ^{228}Ra in groundwater. However, it can be argued that the limit is not exceeded. Assuming an original radium-paint contaminant source, the short half-life of ^{228}Ra would have reduced its population to 1.2 percent of its original value (under the conservative assumption that the last paint batch was manufactured in 1950). This


0.1
0.3
0.1
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would put its present-day concentration far below that of ^{226}Ra. As observed earlier, the ^{226}Ra values suggested by gamma spectroscopy and confirmed by alpha spectroscopy are well below the FDEP standard. Therefore, ^{228}Ra resulting from any radium-paint operations must also be lower than the FDEP limit.

A few wells had high ^{228}Ac, but their standard deviations were also high, rendering them statistically insignificant. A single well had a statistically significant high number — 43.8 ± 11.2 pCi/l (027GS0006). The well is on the south-central side of the property, and is not downgradient from any known radium contamination source. Given that uranium and ^{226}Ra are low there ($^{234}Pa = < 4.44$ pCi/l, $^{214}Bi = < 6.13$ pCi/l), and considering the short half-life of ^{228}Ra compared to ^{226}Ra, this single high value cannot be interpreted to be caused by a radium paint source. Adjacent wells both up- and downgradient had lower ^{228}Ac.

7.0 CONCLUSIONS

The only soil samples exceeding the DOEG were obtained in a localized area believed to be a paint spill or dump at the side of Building 709. The contamination appears lie within a 30-foot by 50-foot area and is entirely confined to the top 15 inches of soil. Outside this single spill area, all surface-soil samples show low radium values far below the DOEG. In all samples obtained between 2 and 65 feet, radium values are low with no exceedances. This conclusion is true for samples over the entire vadose zone and within the clay aquiclude separating intermediate and deep aquifers. Radium contamination was not observed at geophysics anomalies (other than the two noted) or in the vicinity of any suspected source of radium storage or release. Thus, the study shows that there is but one area of concern in soil.

Finally, not one groundwater sample from the shallow, intermediate, or deep zones was found to have radium contamination exceeding the FDEP groundwater standard. The spatial density of the sampling strongly argues that there is no significant radium contamination in the groundwater onsite.

In conclusion, with the sole exception of the paint spill, the results of this investigation suggest that this site does not have a radium contamination problem in either soil or groundwater media.

The small area defined by geophysical anomalies D and E represents a potential health hazard and should be cleaned up. A simple excavation and removal of the top 2 feet of soil, followed by limited confirmatory sampling for ^{226}Ra, is recommended. Appropriate protective clothing and a respirator will be needed to protect against skin exposure or breathing radium-contaminated dust or radon gas. Following this action, there is no need to investigate Site 25/27 any further for radiological problems.

8.0 REFERENCES

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