Comprehensive Long-Term Environmental Action Navy (CLEAN) II
Contract No. N62742-94-D-0048
Contract Task Order No. 0078

Final Work Plan

Pre-Design Investigation

Operable Unit 2C, Landfill Sites 3 and 5
Former Marine Corps Air Station
El Toro, California

Prepared for

Department of the Navy
Commander, Southwest Division
Naval Facilities Engineering Command
San Diego, California 92132-5190

Prepared by

Earth Tech, Inc.
700 Bishop Street, Suite 900
Honolulu, Hawaii 96813

March 2002

interim

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/0278
March 22, 2002

Ms. Triss Chesney
State of California Environmental Protection Agency
Department of Toxic Substances Control
Base Closure Unit – Southern California Operations
5796 Corporate Avenue
Cypress, CA 90630-4700

Dear Ms. Chesney:

Subject: INTERIM FINAL WORK PLAN AND HEALTH AND SAFETY PLAN, PRE-DESIGN INVESTIGATION, OPERABLE UNIT 2C, LANDFILL SITES 3 AND 5, FORMER MARINE CORPS AIR STATION (MCAS), EL TORO, CALIFORNIA

Provided for your review are the subject documents, dated March 2002. The majority of the information in the Interim Final Work Plan has been previously reviewed as part of the August 2000 Draft Project Work Plan for pre-design activities at IRP Sites 3 and 5. Also, we have addressed all comments and significant issues on the Draft Project Work Plan, in our Response to Comments that were reviewed and approved in December 2001. The Work Plan is being submitted as an interim document rather than a final document, however, at the request of the BCT, as there is new information, which was not formerly addressed in the Draft Work Plan. We request that you review the Interim Final Work Plan and Health and Safety Plan, and provide any additional comments by 22 April 2002.

The Interim Final Work Plan and Health and Safety Plan detail the objectives and procedures for the collection of data to support the remedial design for IRP Sites 3 and 5, including APHO 46 and MSCR 2, at MCAS El Toro. We will also provide an overview of the strategy to include APHO 46 and MSCR 2 into the remedial design for Sites 3 and 5 at the March 27, 2002 BCT meeting.

Should you have any questions regarding the enclosed documents, please call the Remedial Project Manager, Ms. Kyle Olewnik, at (619) 532-0789, or myself at (619) 532-0765.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/0278
March 22, 2002

Ms. Patricia Hannon
California Regional Water Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-3339

Dear Ms. Hannon:

Subject: INTERIM FINAL WORK PLAN AND HEALTH AND SAFETY PLAN, PRE-DESIGN INVESTIGATION, OPERABLE UNIT 2C, LANDFILL SITES 3 AND 5, FORMER MARINE CORPS AIR STATION (MCAS), EL TORO, CALIFORNIA

Provided for your review are the subject documents, dated March 2002. The majority of the information in the Interim Final Work Plan has been previously reviewed as part of the August 2000 Draft Project Work Plan for pre-design activities at IRP Sites 3 and 5. Also, we have addressed all comments and significant issues on the Draft Project Work Plan, in our Response to Comments that were reviewed and approved in December 2001. The Work Plan is being submitted as an interim document rather than a final document, however, at the request of the BCT, as there is new information, which was not formerly addressed in the Draft Work Plan. We request that you review the Interim Final Work Plan and Health and Safety Plan, and provide any additional comments by 22 April 2002.

The Interim Final Work Plan and Health and Safety Plan detail the objectives and procedures for the collection of data to support the remedial design for IRP Sites 3 and 5, including APHO 46 and MSCR 2, at MCAS El Toro. We will also provide an overview of the strategy to include APHO 46 and MSCR 2 into the remedial design for Sites 3 and 5 at the March 27, 2002 BCT meeting.

Should you have any questions regarding the enclosed documents, please call the Remedial Project Manager, Ms. Kyle Olewnik, at (619) 532-0789, or myself at (619) 532-0765.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

DEPARTMENT OF THE NAVY
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132-5190

5090
Ser 06CC.DG/0278
March 22, 2002

Ms. Nicole Moutoux
U.S. Environmental Protection Agency, Region IX
Hazardous Waste Management Unit (SFD 8-2)
75 Hawthorne Street
San Francisco, CA 94105-3901

Dear Ms. Moutoux:

Subject: INTERIM FINAL WORK PLAN AND HEALTH AND SAFETY PLAN, PRE-DESIGN INVESTIGATION, OPERABLE UNIT 2C, LANDFILL SITES 3 AND 5, FORMER MARINE CORPS AIR STATION (MCAS), EL TORO, CALIFORNIA

Provided for your review are the subject documents, dated March 2002. The majority of the information in the Interim Final Work Plan has been previously reviewed as part of the August 2000 Draft Project Work Plan for pre-design activities at IRP Sites 3 and 5. Also, we have addressed all comments and significant issues on the Draft Project Work Plan, in our Response to Comments that were reviewed and approved in December 2001. The Work Plan is being submitted as an interim document rather than a final document, however, at the request of the BCT, as there is new information, which was not formerly addressed in the Draft Work Plan. We request that you review the Interim Final Work Plan and Health and Safety Plan, and provide any additional comments by 22 April 2002.

The Interim Final Work Plan and Health and Safety Plan detail the objectives and procedures for the collection of data to support the remedial design for IRP Sites 3 and 5, including APHO 46 and MSCR 2, at MCAS El Toro. We will also provide an overview of the strategy to include APHO 46 and MSCR 2 into the remedial design for Sites 3 and 5 at the March 27, 2002 BCT meeting.

Should you have any questions regarding the enclosed documents, please call the Remedial Project Manager, Ms. Kyle Olewnik, at (619) 532-0789, or myself at (619) 532-0765.

Sincerely,

DEAN GOULD
Base Realignment and Closure
Environmental Coordinator
By direction of the Commander

M60050.002613
MCAS EL TORO
SSIC NO. 5090.3

CONFIDENTIAL RECORD

PORTIONS OF THIS RECORD ARE CONSIDERED CONFIDENTIAL AND ARE NOT FOR PUBLIC VIEWING

PRIVATE CITIZENS' HOME ADDRESSES HAVE BEEN REDACTED IN ACCORDANCE WITH THE PRIVACY ACT

QUESTIONS MAY BE DIRECTED TO:

DIANE C. SILVA
RECORDS MANAGEMENT SPECIALIST
SOUTHWEST DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 532-3676

5090
Ser 06CC.DG/0278
March 22, 2002

Enclosures: 1. Interim Final Work Plan, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station (MCAS), El Toro, California
2. Interim Health and Safety Plan, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 and 5, Former Marine Corps Air Station (MCAS), El Toro, California

Copy to:
Ms. Triss Chesney
California Environmental Protection Agency
Department of Toxic Substances Control
Base Closure Unit
Southern California Operations
5796 Corporate Avenue
Cypress, CA 90630-4700

Ms. Patricia Hannon
California Regional Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-3339

Ms. Polin Modanlou
Environmental Remediation Manager
MCAS El Toro
Local Redevelopment Authority
Building 83
P.O. Box 53010
Irvine, CA 92619-3010

Commander
Mr. Wayne D. Lee
Marine Corps Air Bases, Western Area –
AC/S Environment Code 5AU
MCAS Miramar
P.O. Box 452013
San Diego, CA 92145-2013

Mr. Jerry Werner (1 copy)
Restoration Advisory Board Co-Chair

Ms Marcia Rudolph
Restoration Advisory Board
Subcommittee Chair

EARTH TECH

A tyco INTERNATIONAL LTD. COMPANY

DOCUMENT TRANSMITTAL

Contract No. N62742-94-D-0048

To: Remedial Project Manager
Naval Facilities Engineering Command
Southwest Division
Kyle Olewnik
1230 Columbia Street, Suite 870
San Diego, CA 92101-8517

DATE: March 26, 2002
CTO #: 078
LOCATION: MCAS, El Toro

FROM: Crispin G. Wanyoike

DESCRIPTION: Interim Final Work Plan and Health and Safety Plan, Pre-Design Investigation, Operable Unit 2C, Landfill Sites 3 & 5 and APHO 46 & MSCR-2, Former MCAS El Toro

TYPE: _____ Contract Deliverable (Cost) _____ CTO Deliverable (Technical) ___✓___ Other

VERSION: _____ REVISION #s: _____

ADMIN RECORD: Yes _____ No _____ Category _____ Confidential _____
(PM to Identify)

NUMBER OF COPIES SUBMITTED: 16/13C/3E

COPIES TO (Include Name, and No of Copies):

Ms. Nicole Moutoux – USEPA (1C)	Ms Diane Silva – SWDIV (3C)	
Ms. Triss Chesney – DTSC (1C)	Earth Tech PMO – (1C)	
Ms. Patricia Hannon – RWQCB (1C)		
Mr. Wayne D. Lee, Commander, MCAS Miramar (1C)		
Ms. Polin Modanlou - County of Orange (1C)		
Mr. Jerry Werner – RAB Co-Chair (1C)		
Ms. Marcia Rudolph – RAB Subcommittee Co-Chair (1C)		
Mr. Scott Kehe – CSO-MCAS El Toro (1C)		
Ms. Marge Flesch – MCAS El Toro (1C)		

O = Original
C = Copy
Enclosed
Unbound

Final Work Plan
Pre-Design Investigation
Operable Unit 2C, Landfill Sites 3 and 5
Former MCAS El Toro, California

Contract No. N62742-94-D-0048
Contract Task Order No. 0078

Reviews and Approvals:

V. Saravanan

Eli Vedagiri
Project Engineer
Earth Tech, Inc.

Date: 22 MARCH 2002

Crispin Wanyoike, P.E.
CTO Manager
Earth Tech, Inc.

Date: March 22, 2002.

Ken Vinson, P.E.
Program Quality Manager
Earth Tech, Inc.

Date: March 22, 2002

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENTS

FIGURES

ACRONYMS AND ABBREVIATIONS

µg/kg	micrograms per kilogram
µg/L	micrograms per liter
Air SWAT	air quality solid waste assessment test
APHO	aerial photograph anomaly
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
BCT	BRAC Cleanup Team
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
CARB	California Air Resources Board
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CPT	cone penetration test
COPC	chemical of potential concern
COPEC	contaminant of potential ecological concern
CRWQCB	California Regional Water Quality Control Board, Santa Ana Region
CTO	Contract Task Order
DCE	dichloroethene
DHS	(California) Department of Health Services
DOT	Department of Transportation
DoN	Department of the Navy
DRMO	Defense Reutilization and Marketing Office
DTSC	Department of Toxic Substances Control
Earth Tech	Earth Tech, Inc.
EPA	Environmental Protection Agency
FFA	Federal Facilities Agreement
FML	flexible membrane liner
FS	feasibility study
FSP	field sampling plan
FWEC	Foster Wheeler Environmental Corporation
GCL	geosynthetic clay liner
IAS	initial assessment study
ICPMS	inductively coupled plasma mass spectrometry
IRP	Installation Restoration Program
JEG	Jacobs Engineering Group, Inc.
L	liter
LLNL	Lawrence Livermore National Library
LRA	Local Redevelopment Authority
MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MSCR	miscellaneous refuse
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OCWD	Orange County Water District

OU	operable unit
PACNAVFACENGCOM	Pacific Division, Naval Facilities Engineering Command
PCE	tetrachloroethene
pCi/L	picoCuries per liter
pH	negative log of the hydrogen ion concentration
ppmv	parts per million-volume
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QAPP	quality assurance project plan
RAO	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	record of decision
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SOP	standard operating procedure
SVOCs	semivolatile organic compounds
SWDIV	Southwest Division, Naval Facilities Engineering Command
TC	terrain conductivity
TCE	trichloroethene
TEPH	total extractable petroleum hydrocarbons
TIMS	thermal ionization mass spectrometry
TPH	total petroleum hydrocarbons
TVPH	total volatile petroleum hydrocarbons
U.S.	United States
U.S. EPA	U.S. Environmental Protection Agency
VOCs	volatile organic compounds

1. INTRODUCTION

This work plan details the objectives and procedures for the collection of data to support the remedial design for Installation Restoration Program (IRP) Site 3 - Original Landfill and IRP Site 5-Perimeter Road Landfill at the Former Marine Corps Air Station (MCAS), El Toro, California. These two landfill sites are contained in Operable Unit (OU)-2C. These data, primarily pertaining to the verification of the landfill boundaries and evaluation of geotechnical parameters, will be used to supplement existing data to complete the design. This work plan also addresses the data collection requirements for the Aerial Photograph Anomaly (APHO) 46 and possible landfill area designated as miscellaneous refuse area (MSCR) 2.

This work plan incorporates comments received on the *draft Work Plan* that was prepared by Foster Wheeler Environmental Corporation (FWEC) (FWEC 2000). A response to comments was prepared and submitted to the reviewers and is included in Appendix B.

This work plan was prepared by Earth Tech, Inc. (Earth Tech) on behalf of the United States (U.S.) Department of the Navy (DoN), Southwest Division, Naval Facilities Engineering Command (SWDIV), as authorized by the U.S. Navy, Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) under Contract Task Order (CTO) number 0078 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract number N62742-94-D-0048. It complies with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) in Title 40 of the Code of Federal Regulations (CFR), Part 300.

The Sampling and Analysis Plan (SAP) is presented as Appendix A of this work plan. It includes the elements of a field sampling plan (FSP) and a quality assurance project plan (QAPP) for this investigation.

1.1 PURPOSE AND SCOPE OF THE WORK PLAN

The purpose and scope of this work plan is to collect data from exploratory trenching, visual observation of landfill material, and laboratory analysis of soil samples for soil physical parameters (and chemical analyses, if required). The data collection plan will focus on achieving the following site-specific objectives:

- Verification of currently demarcated boundaries of the landfills (including operational and uncontrolled dumping areas) at Sites 3 and 5, by exploratory trenching.
- Collection of in situ soil samples during exploratory trenching for geotechnical evaluation.
- Establishment of revised landfill boundaries at areas where there is a variance with current demarcation.
- Assess if there are releases associated with removal of previously identified near surface debris pile within APHO 46.
- Verification by geophysical survey that no anomalies indicative of waste placement are present at MSCR2.
- Installation of perimeter soil gas monitoring wells at Sites 3 and 5 and collection of soil gas samples on a quarterly basis for one year.

1.2 FORMER MCAS EL TORO – DESCRIPTION AND BACKGROUND

Former MCAS El Toro is located in a semi-urban, agricultural area of southern California, approximately 8 miles south of Santa Ana and 12 miles northeast of Laguna Beach (Figure 1-1). MCAS El Toro covers approximately 4,738 acres. Land use around the MCAS includes commercial, light industrial, and residential. MCAS El Toro closed on 2 July 1999, as part of the Base Realignment and Closure (BRAC) Act.

Initial work conducted by the DoN at Former MCAS El Toro included an Initial Assessment Study (IAS) during 1985 (James M. Montgomery Engineers, Inc. 1988) and a Site Inspection Plan of Action during 1987 and 1988 (Brown and Caldwell 1986).

Former MCAS El Toro was added to the National Priorities List (NPL) of the Superfund Program on 15 February 1990, due to volatile organic compounds (VOCs) contamination at the Former MCAS boundary and in the agricultural wells west of Former MCAS. A Federal Facilities Agreement (FFA) was signed by the Marine Corps/DoN in October 1990 with the United States Environmental Protection Agency (U.S. EPA) Region 9, California Department of Health Services (part of which is currently the California Department of Toxic Substances Control (DTSC)), and the California Regional Water Quality Control Board, Santa Ana Region (CRWQCB).

In March 1993, MCAS El Toro was placed on the list of military facilities scheduled for closure under the BRAC Act. A BRAC Cleanup Team (BCT) consisting of representatives from SWDIV, U.S. EPA, DTSC, and CRWQCB was formed to oversee implementation of the FFA.

Subsequent work at Former MCAS El Toro to implement the FFA included the following investigations and studies: Air Quality Solid Waste Assessment Test (Air SWAT), Phase I remedial investigation (RI), Phase II RI, and Feasibility Study (FS). Groundwater sampling is conducted station-wide as a component of the CERCLA Long-Term Groundwater Monitoring Program (BNI 1999a).

SENSITIVE RECORD

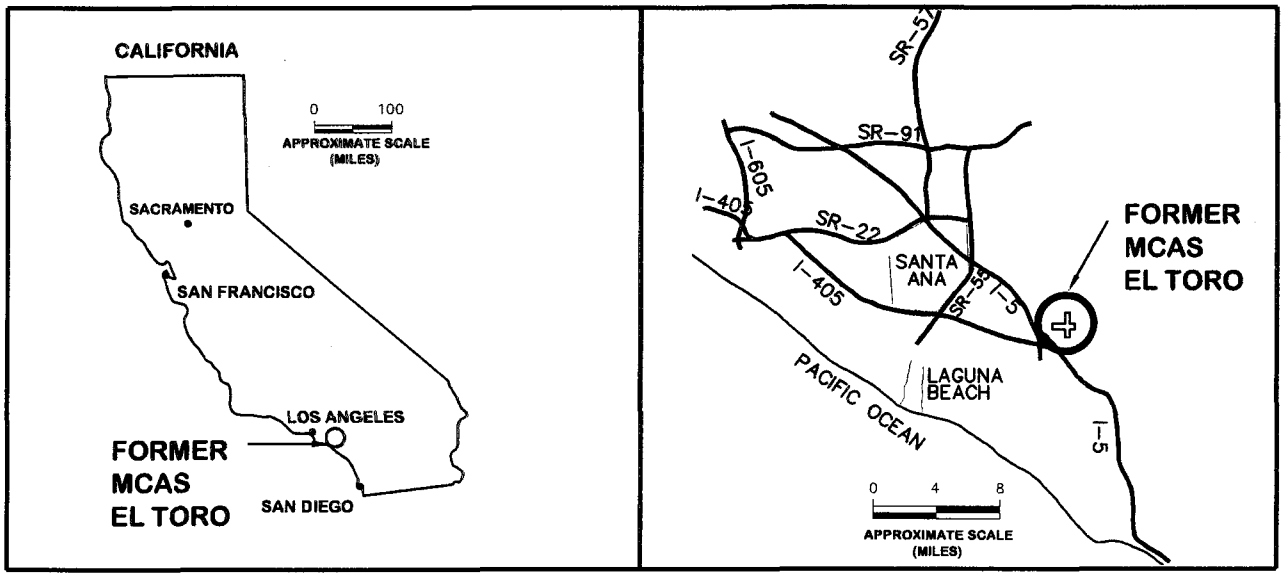
PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

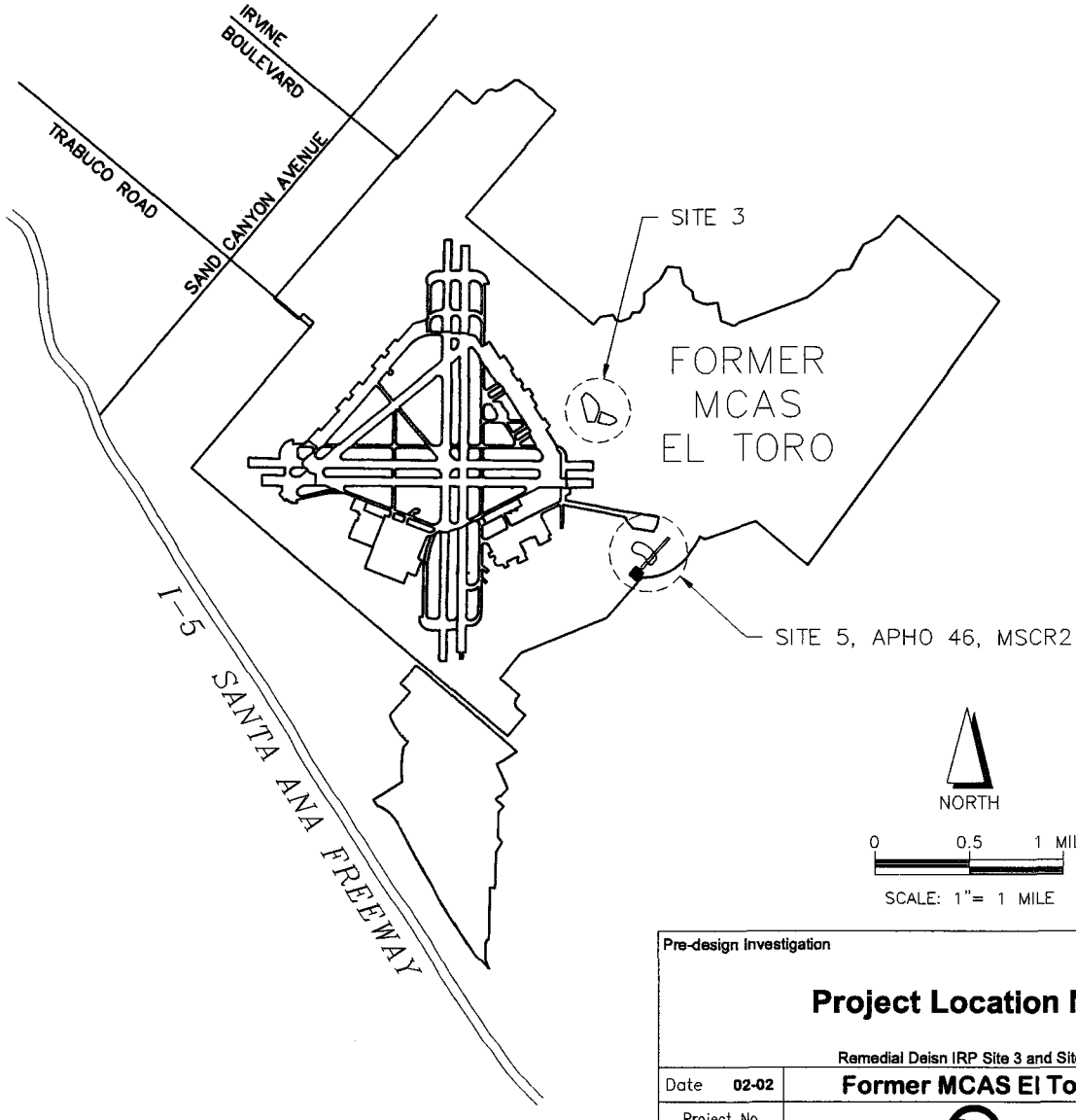
PROJECT LOCATION MAP

FOR ADDITIONAL INFORMATION, CONTACT:

DIANE C. SILVA, RECORDS MANAGER
NAVAL FACILITIES ENGINEERING COMMAND, SOUTHWEST
1220 PACIFIC HIGHWAY
SAN DIEGO, CA 92132

TELEPHONE: (619) 556-1280
E-MAIL: diane.silva@navy.mil





Pre-design Investigation — Final Work Plan

Project Location Map

Remedial Deisn IRP Site 3 and Site 5

Date 02-02	Former MCAS El Toro	Figure 1-1
Project No. 37380	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	

2. SITE BACKGROUND AND EVALUATION

2.1 LOCATION AND DESCRIPTION

2.1.1 Site 3

Site 3 is located in the eastern portion of Former MCAS El Toro (Figure 2-1). Site 3 encompasses approximately 11 acres (BNI 1999b) and is located between Irvine Boulevard and North Marine Way. Irvine Boulevard, Desert Storm Road, and North Marine Way form the approximate northern, eastern, and southern boundaries, respectively, of the site. An unlined channel (Agua Chinon Wash) crosses the site from north-northeast to south-southwest. In the area west of Agua Chinon Wash, the subsurface consists of compacted soil and gravel and was used as an office, staging, and decontamination area by the Station remediation contractor (BNI 1999b). Building 746, the Flight Simulator Building, is located next to the boundary of Site 3 on the west side of the wash and is a prominent feature of the area. Exposed soil areas contain non-native grasses. However, most of the site is not conducive to vegetation that would provide a habitat for wildlife.

The Site 3 Landfill was active from 1943 until 1955. It was the original landfill for Former MCAS El Toro, and was operated as a cut-and-fill disposal facility. Wastes were burned at a former incinerator to reduce volume prior to burial. Typical of municipal landfills, Site 3 contains a variety of materials disposed at assorted locations within the landfill. Reportedly, almost any waste that was generated on the Station may have been disposed at Site 3. The disposed materials are likely to have included metals, incinerator ash, solvents, paint residues, hydraulic fluids, engine coolants, construction debris, oily wastes, municipal solid waste, and various inert solid wastes (Brown and Caldwell 1986).

The operational portion of the Site 3 landfill is shown as Units 1 and 4 on Figure 2-1. Unit 1 was the principal area of the Marine Corps landfill operations. This area comprises approximately 11 acres and is located to the east and west of Agua Chinon Wash. Review of the aerial photographs showed that waste disposal occurred sporadically over time at several locations within Unit 1. Approximately 163,500 to 243,000 cubic yards of waste may be contained in this area. Unit 4 is the site of the former incinerator. This unit contains landfill wastes to a depth of approximately 9.5 feet and is estimated to contain approximately 1,110 cubic yards of waste material, which would be consolidated within Unit 1 (BNI 1999b) during the implementation of the remedy.

Units 2 and 3 were not part of the operational landfill but were included in the Site 3 study area boundary of the Phase II RI. Unit 2 consists of an unlined channel (Agua Chinon Wash). This wash crosses Unit 1 and does not contain landfill wastes. Unit 2 was included in the Feasibility Study (FS) because erosion in this unit could impact the integrity of landfill wastes in Unit 1. Unit 3 is a solvent spill area. This area comprises approximately 0.5 acres and does not contain landfill wastes. Unit 3 is not a part of the operational landfill, and no chemicals detected at Unit 3 exceeded risk-based concentrations (BNI 1996a).

2.1.2 Site 5

Site 5 is located in the eastern portion of Former MCAS El Toro and on the Tustin Plain near the foothills of the Santa Ana Mountains, approximately 300 feet northwest of Borrego Canyon Wash (Figure 2-2). The site occupies approximately 1.8 acres (BNI 1999b). Elevations range from 400 feet to 440 feet above mean sea level (MSL). Perimeter Road runs parallel to the site as seen on Figure 2-2. The landfill is "no longer in use," and has become overgrown with non-native grasses. A soil cover of unknown thickness has been placed over the landfill.

The Site 5 landfill was active from approximately 1955 until the late 1960s. It was operated as a cut-and-fill disposal facility. Wastes were typically burned to reduce volume prior to burial. Typical of municipal landfills, Site 5 contains a variety of materials disposed within the landfill. Reportedly, almost any wastes generated at the Station may have been disposed of at Site 5. The wastes are likely to have included burnable trash, municipal solid waste, cleaning fluids, scrap metals, paint residues, and unspecified fuels, oils, and solvents (Brown and Caldwell 1986).

Site 5, which is the operational landfill area, is approximately 60 feet in width by 1,200 feet in length. The depth of the landfill is approximately 15 feet below ground surface (bgs). Volume of waste is estimated to be approximately 40,000 cubic yards in the landfill trench.

During the Phase II RI, the study area of Site 5 was designated as Unit 1 and encompassed an area surrounding the operational trench. A waste storage facility which was 200 feet wide by 450 long and defined by a 2-feet-high earthen berm was used to contain investigation-derived soils generated during the Phase II RI. This area was designated as Unit 2. Based on the findings of the RI, Unit 1 was revised to include the operational landfill only. In 1997, subsequent to the Phase II RI, the Unit 2 investigation-derived soils were graded over the landfill trench, and Site 5 consisted of just the operational landfill area (BNI 1999b).

2.1.3 APHO 46

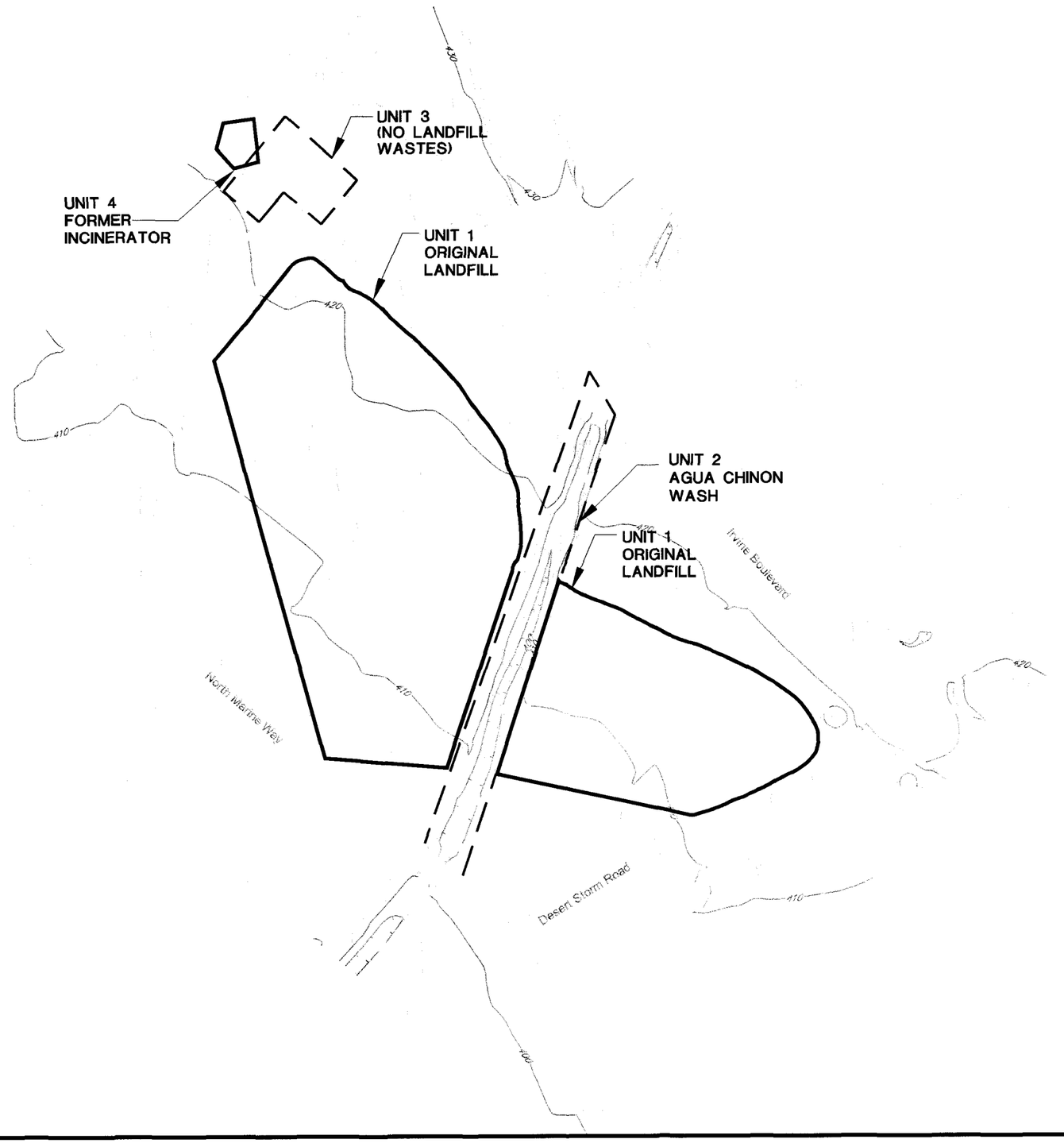
APHO 46 is an aerial photograph anomaly identified during the aerial photograph survey conducted by Science Applications International Corporation (SAIC 1993). It is located to the southeast of the Defense Reutilization and Marketing Office (DRMO), Yard 3, and northeast of the Golf Course Hole Number 5. APHO 46 overlaps the southwest portion of Site 5 and extends approximately 500 feet northwest. APHO 46 is located within a parcel tentatively identified as a future golf course according to *The Preferred Land Use Plan* (County of Orange 1999). In the aerial photograph dated 4 February 1979, APHO 46 appears to be a large impoundment area and a fill area. It was observed that during 1979, the northwestern portion of APHO 46 appeared to be a fill area with facilities under construction. Excavations that form two impoundments surrounded by berms occupied the remainder of the site. Two open trenches in the southwestern area of the site were also identified in the photograph.

The geophysical survey (conducted on a 12-acre area, including the southwestern portion of Site 5) conducted at APHO 46 detected an anomaly which was identified as a trench in the southwestern portion of Site 5; otherwise, no other subsurface anomalies or trench features were at APHO 46. Construction debris, including concrete and metallic debris were observed during visual inspection of the APHO 46 area. The location of APHO 46 with respect to Site 5 is shown on Figure 2-2.

Based on the findings of the *Summary Report* (SWDIV 2000), SWDIV recommended that the construction debris observed on the ground surface within the APHO 46 investigation area would be managed during the implementation of the final remedy for Site 5 and a "no further action" status be assigned for the APHO 46 in the next business plan update.

The summary report was submitted to DTSC and CRWQCB. DTSC reviewed the report and in a letter dated 26 February 2001, stated the following: "DTSC does not concur with the recommendation of no further action to APHO 46 until the proposed management of APHO 46 with remedial activities for Site 5 are properly documented in the Draft Final Record of Decision (ROD) for Sites 3 and 5." CRWQCB also reviewed the report. In a letter dated 30 October 2000, CRWQCB stated that with visual inspections and geophysical techniques, a geophysical anomaly was identified and described as having rubbish, trash, and waste material at the surface. Therefore, in order to

SOURCE OF MAP INFORMATION
RI REPORT; BNI 1996a



LEGEND

- BUILDING
- IMPROVED ROADS
- FENCE
- 560 — ELEVATION CONTOURS (10' INTERVAL)
- ELEVATION CONTOURS (2' INTERVAL)
- STREETLIGHT
- LANDFILL BOUNDARY
- EXISTING WASH

NORTH

0 100 200 FEET

SCALE: 1" = 200'

Pre-Design Investigation — Final Work Plan

Site 3: Original Landfill - Site Plan

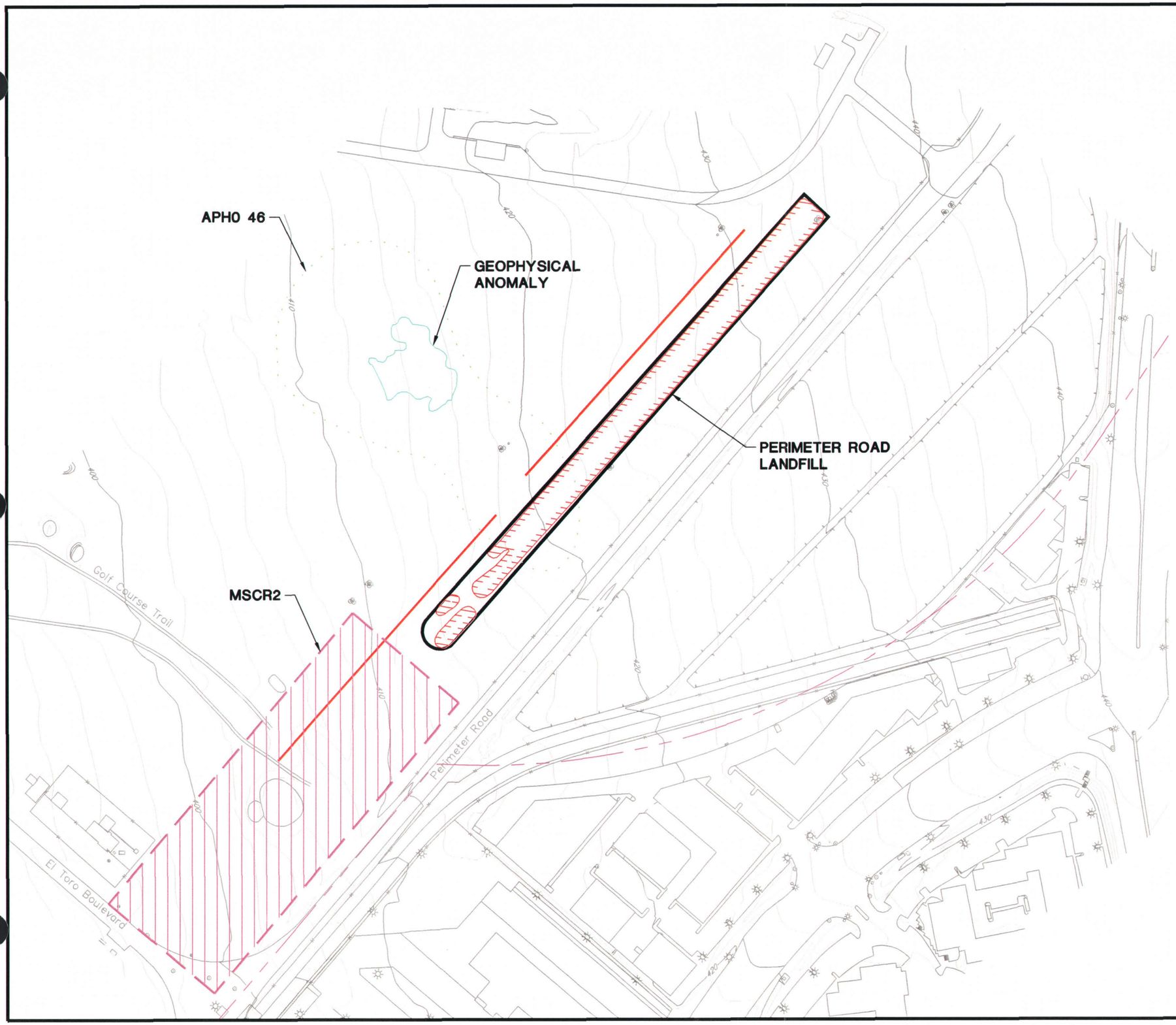
Remedial Design IRP Site 3 and Site 5

Date: 02-02	Former MCAS El Toro	Figure 2-1
Project No. 37380	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	

L:\NAVCLEAN\Sites 3 & 5 Pre-Design Investigation\Workplan\Draft Final\Figures\Site 3 Figures.dwg, 03/22/2002 03:36:03

PAGE NO. 2-4

THIS PAGE INTENTIONALLY LEFT BLANK



SOURCE OF MAP INFORMATION
RI REPORT; BNI 1996a

LEGEND

- BUILDING
- IMPROVED ROADS
- FENCE
- 440 — ELEVATION CONTOURS (10' INTERVAL)
- ELEVATION CONTOURS (2' INTERVAL)
- STREETLIGHT
- MCAS EL TORO BOUNDARY
- PREVIOUSLY IDENTIFIED DISPOSAL TRENCH
- PERIMETER ROAD LANDFILL BOUNDARY (1950's–1960's)
- INFERRED UTILITY LINES (PHASE II RI; BNI 1996b)
- GEOPHYSICAL ANOMALY: APPROXIMATE AREA OF SCATTERED, SMALL, SHALLOW BURIED METALLIC DEBRIS (DEBRIS PILE) (GEOVISION 2000)
- APHO 46
- APPROX. LOCATION OF MSCR2. AREA BASED ON FINAL EBS REPORT (SWDIV 1995)
- EBS — ENVIRONMENTAL BASELINE SURVEY

NORTH

0 100 200 FEET

SCALE: 1" = 200'

Pre-Design Investigation — Final Work Plan

Site 5: Perimeter Road Landfill - Site Plan

Remedial Design IRP Site 3 and Site 5

Date: 02-02	Former MCAS El Toro	Figure 2-2
Project No. 37380	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	

L:\NAVCLEAN\Sites 3 & 5 Pre-Design Investigation\Workplan\Draft Final\Figures\Site 5 Figs.dwg, 03/22/2002 03:36:58 PM

PAGE NO. 2-6

THIS PAGE INTENTIONALLY LEFT BLANK

manage the surficial debris at APHO 46, this area is included in the pre-design investigation activities at Site 5.

2.1.4 MSCR2

The *Final Environmental Baseline Survey Report* (JEG 1995) reported the presence of a former refuse area as a possible landfill area and designated it as MSCR2. Its location was identified as an area at the southwestern end of Site 5 northwest of El Toro Boulevard (also known as Trabucco Road). The general location of MSCR2 is shown on Figure 2-2.

This refuse area was identified during personnel interviews conducted as a part of the Environmental Baseline Survey. The *Final Environmental Baseline Survey Report* (JEG 1995) states, "According to the interview panel, landfilling activities occurred in an area located south of the current boundaries defined for the Perimeter Road Landfill. This newly identified landfill area extended from the currently defined southern tip of Perimeter Road Landfill south to include the Station Golf Course's fifth hole tee box and fourth hole green. Access to this area was via an unpaved road that led from about the intersections of El Toro Road and Perimeter Road. Landfilled material consisted of general construction debris. Hazardous substances are believed not to have been disposed of into this fill area."

Portions of MSCR2 were also evaluated as part of the investigation conducted at APHO 46. This pre-design investigation will evaluate the remaining portions of the site. The response action for this area will be incorporated into the remedial action for the Site 5 Landfill.

2.2 LANDFILL BOUNDARIES

The lateral extent (Figures 2-1 and 2-2) of the Sites 3 and 5 landfills, and APHO 46 and MSCR2 was evaluated based on the following:

- Visual mapping,
- Surface geophysics,
- Trenching,
- Soil borings,
- Topographic and station maps,
- Aerial photograph review, and
- Interviews with MCAS El Toro personnel.

2.2.1 Site 3

The initial assessment study (IAS) conducted in 1986 identified a disposal pit (elevated pad located east of Building 746) 15 feet to 25 feet deep. Three additional trenches (two located on the west side of the Agua Chinon Wash, and one trench located on the east side of the wash), each approximately 300 feet to 400 feet wide and 20 feet to 25 feet deep were also identified during the IAS.

The phase I RI geophysical investigation area was approximately 6.5 acres. The phase I RI identified four anomalies interpreted as buried waste and three anomalies possibly related to buried waste. Their locations are shown on Figure 2-3.

The phase II RI geophysical survey identified two anomalies to the west of the Agua Chinon Wash and one anomaly to the east of the wash. The geophysical survey was performed along a 50-foot by

50-foot grid spacing across the Site 3 study area. Survey results indicated low terrain conductivity (TC) within the perimeter of Unit 1. Two anomalies to the west of Agua Chinon Wash and one anomaly to the east appeared to coincide roughly with the locations of trenches from the IAS report and with the elevated pad located to the east of Building 746.

Trenches were excavated to evaluate the geophysical anomalies, areas of surface wastes, and boundaries of exposed wastes. A total of six soil boreholes were advanced, primarily to install monitoring wells during the Phase I RI. Eighteen soil borings and three lysimeter borings were advanced during the Phase II RI and are shown on Figure 2-3. Eight soil borings (03SB11 through 03SB15, and 03SB17 through 03SB19) and three lysimeter borings (03LYS1 through 03LYS3) were drilled during the Phase II RI in and around Site 3-Unit 1. Landfill material, including brick fragments, melted glass, and debris were reported in soil borings 03SB3, 03SB4, and 03SB5 to a depth of 6.5 feet, 8.5 feet, and 4 feet, respectively. All three soil borings were located in Unit 4, the former incinerator area. Soil boring 03SB17, located northeast of Building 746 in Unit 1, also revealed landfill material at depths of 6 feet to 17 feet. Waste material consisted of porcelain, glass, and paper with coarse-grained sand and gravel.

2.2.2 Site 5

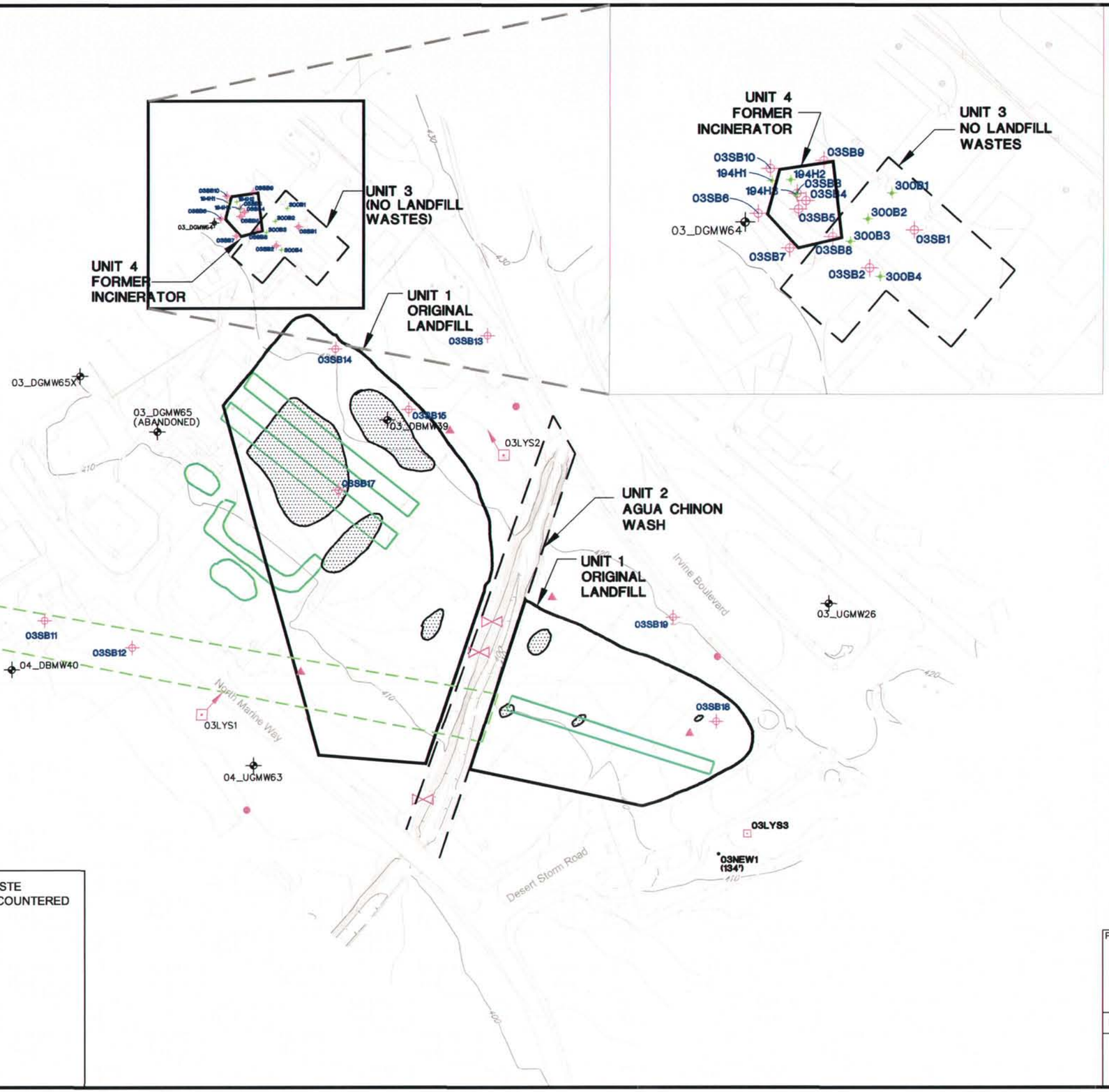
Geophysical survey results indicated low terrain conductivity for most of the survey area with the exception of the utility line located parallel to the buried wastes, a concrete slab and metal grate located west of Building 840, and a portion of the adjacent golf course. Geophysical anomalies that were detected in the survey areas were further investigated by trenching.

A total of three trenches were excavated in lengths varying from 15 feet to 175 feet and depths ranging from 5 feet to 8.5 feet. These trenches were located in areas of geophysical anomalies to determine whether the anomalies were landfill materials (Figure 2-4). Trench 05TR1 was positioned perpendicular to and south of the Site 5 disposal trench area described in the Phase I RI. This trench was approximately 175 feet long and 5 to 7 feet deep. No buried wastes were encountered. Trench 05TR2 was positioned north of the Site 5 waste trench area and east of Building 840. No buried wastes were encountered. Trench 05TR3 was positioned north of the Site 5 waste trench area and west of Building 840. No buried wastes were encountered in the central portion of the landfill.

A total of six soil boreholes were advanced at Site 5, primarily to install monitoring wells and also to further delineate the extent of buried waste. Three boreholes were located outside the Phase II study area boundary and three were within the boundary. Three lysimeter borings were also advanced at Site 5. No wastes were encountered in any of the boreholes.

2.2.3 APHO 46

A geophysical investigation was conducted during April and May 2000 to detect buried metallic debris and/or areas of non-native fill material. The survey area was larger than the APHO 46 investigation area, approximately 12 acres, and encompassed the entire southwestern region of Site 5, extending further southwest to part of MSCR2. The survey identified an area of possible construction debris in the northwestern section of APHO 46. Construction debris, including metallic debris and pieces of asphalt and glass, was observed on the ground surface by the survey team (SWDIV 2000). No evidence of buried metallic debris, areas of filled excavations or significant subsurface anomalies were identified with the exception of the trench that forms the southwestern portion of Site 5.



SOURCE OF MAP INFORMATION
RI REPORT; BNI 1996a

LEGEND

- BUILDING
- IMPROVED ROADS
- FENCE
- 560 — ELEVATION CONTOURS (10' INTERVAL)
- ELEVATION CONTOURS (2' INTERVAL)
- STREETLIGHT
- ESTIMATED LANDFILL BOUNDARY (BNI 1997a)
- EXISTING WASH
- "BORE-SIGHTING RANGE" FROM 1943
- 1986 INITIAL ASSESSMENT STUDY LANDFILL FEATURES
- 1991 GEOPHYSICAL SURVEY ANOMALIES
- 03_UGMW26 — PHASE I MONITORING WELL
- 03NEW1 (134') — CPT PUSHED TO DEPTH SHOWN
- 03SB19 — PHASE II SOIL BORING
- 03LYS3 — VERTICAL LYSIMETER
- 03LYS1 — ANGLE LYSIMETER SHOWING DIRECTION DRILLED
- SURFACE FLUX SAMPLE LOCATION
- AMBIENT AIR SAMPLE LOCATION
- 03AIN3 — PERIMETER OF INTEGRATED SURFACE SAMPLE LOCATION
- PHASE I SURFACE WATER AND SEDIMENT SAMPLE
- 300B4 — RCRA FACILITY ASSESSMENT BORING
- CPT — CONE PENETROMETER TEST BORING
- RCRA — RESOURCE CONSERVATION AND RECOVERY ACT

BORING/WELL NUMBER	DEPTH (FEET)	WASTE ENCOUNTERED
03_UGMW26	285	NO
03_UGMW39	276	NO
03_UGMW64	294	NO
03_DGMW65X	279	NO
03_DGMW65	266	NO
04_DBMW40	275	NO
04_UGMW63	281	NO
04_DGMW66	296	NO
03LYS1	86.6	NO
03LYS2	86.6	NO
03LYS3	88.3	NO

Pre-Design Investigation — Final Work Plan

Site 3: Previous Sampling Locations

Remedial Design IRP Site 3 and Site 5

Date: 02-02

Former MCAS El Toro

Project No. 37380

EARTH TECH
A tyco INTERNATIONAL LTD. COMPANY

Figure 2-3

L:\NAVCLEAN\Sites 3 & 5 Pre-Design Investigation\Workplan\Draft Final\Figures\Site 3 Figures.dwg, 03/22/2002 03:35:48

PAGE NO. 2-10

THIS PAGE INTENTIONALLY LEFT BLANK

SOURCE OF MAP INFORMATION
RI REPORT; BNI 1996a

05TR3
05TR2
05_PG01
05_UGMW27
05SB1
05LYS1
APH0 46
GEOPHYSICAL ANOMALY
05_DGMW67
05_DBMW41
05_DGMW68
05_PG02
PERIMETER ROAD LANDFILL
05LYS2
05_PG03
05LYS3
MSCR2
05NEW1
05TR1
Golf Course Trail
Perimeter Road
El Toro Boulevard

LEGEND

- BUILDING
- IMPROVED ROADS
- FENCE
- 440 — ELEVATION CONTOURS (10' INTERVAL)
- ELEVATION CONTOURS (2' INTERVAL)
- STREETLIGHT
- MCAS EL TORO BOUNDARY
- PREVIOUSLY IDENTIFIED DISPOSAL TRENCH
- OPERATIONAL LANDFILL BOUNDARY (1950's–1960's)
- INFERRED UTILITY LINES (PHASE II RI; BNI 1996b)
- BOUNDARY OF PREVIOUS GEOPHYSICAL SURVEY AREA (GEOVISION 2000)
- GEOPHYSICAL ANOMALY: APPROX. AREA OF SCATTERED, SMALL SHALLOW BURIED METALLIC DEBRIS (DEBRIS PILE) (GEOVISION 2000)
- 05TR1 — PREVIOUS TRENCH LOCATIONS (PHASE II RI; BNI 1996b)
- 05_DGMW68 — MONITORING WELL
- 05SB1 — SOIL BORING LOCATION
- 05LYS3 — VERTICAL LYSIMETER
- 05LYS1 — ANGLE LYSIMETER SHOWING DIRECTION DRILLED
- APHO 46
- APPROX. LOCATION OF MSCR2. AREA BASED ON AERIAL PHOTOGRAPH REVIEW.
- PERIMETER GAS MIGRATION SAMPLE LOCATION

NORTH

0 100 200 FEET

SCALE: 1" = 200'

Pre-Design Investigation — Final Work Plan

Site 5: Previous Sampling Locations

Remedial Design IRP Site 3 and Site 5

Date: 02-02	Former MCAS El Toro	Figure 2-4
Project No. 37380	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	

L:\NAVCLEAN\Sites 3 & 5 Pre-Design Investigation\Workplan\Draft Final\Figures\Site 5 Figs.dwg, 03/22/2002 03:36:48 PM

PAGE NO. 2-12

THIS PAGE INTENTIONALLY LEFT BLANK

No trenching activity has taken place in the general vicinity of the APHO 46 area.

2.2.4 MSCR2

No prior investigation was conducted at MSCR2. This possible landfill area is being evaluated to confirm whether refuse/waste disposal occurred within this area. Trench 05TR1, advanced as part of the Site 5 RI activities, was located at the northern edge of the MSCR2 area (south of Site 5). No waste was encountered in this trench.

2.3 SITE CHARACTERIZATION (PHASE I AND II RI)

2.3.1 Geology and Hydrogeology

Former MCAS El Toro lies on the southeastern edge of the Tustin Plain, a gently sloping surface of alluvial fan deposits derived primarily from the Santa Ana Mountains. Silts and clays predominate in the central and northwestern portion of Former MCAS El Toro, and sands predominate in areas near the foothills. The sands are generally well graded and commonly contain clays. Sandstone and siltstone bedrock crops out in the foothills, including Site 3.

Former MCAS El Toro is located within the Irvine Groundwater Subbasin Forebay, which has been designated by the CRWQCB as a public water supply source (CRWQCB 1995). The aquifer located directly beneath Former MCAS El Toro is not currently used for a municipal water supply; however, it is used for irrigation.

A detailed description of the geology and hydrogeology at Sites 3 and 5 is presented in the respective *Phase II RI Reports* (BNI 1996a,b).

2.3.1.1 SITE 3

Site 3 lies near the eastern margin of the Tustin Basin, which is filled with Quaternary alluvial deposits. Sandstone bedrock was encountered to the east of the site across Irvine Boulevard. Quaternary deposits consist of unconsolidated sand and gravel with interlayered beds of silt and clay. Groundwater is encountered at approximately 200 feet to 220 feet below ground surface (bgs).

The groundwater gradient direction is toward the northwest at approximately 0.0083 foot per foot to 0.12 foot per foot. Groundwater gradients to the west of Site 3 decrease to approximately 0.0036 foot per foot. The calculated average linear flow velocity ranges from 0.62 feet per day upgradient of Site 3 to 0.0095 feet per day in the center of Site 3.

Well 03_UGMW26 is upgradient from Site 3 and Wells 03_DBMW39, 04_DBMW40, 04_UGMW63, 03_DGMW64, 03_DGMW65, 03_DGMW65X, and 04_DBMW66 are downgradient. Well 03_DBMW39 is located within Unit. Monitoring well 03_DGMW64 is associated with Unit 4 of the Site 3 landfill. Well 03_DGMW65 is an abandoned well (Figure 2-3).

2.3.1.2 SITE 5

These three sites are located on a broad alluvial fan that originates on the northeastern edge of the Tustin Plain where Borrego Canyon Wash exits from the foothills of the Santa Ana Mountains. Site 5 lies on Quaternary marine and alluvial sediments. The sediments consist of unconsolidated sand and gravel with discontinuous interbedded deposits of silt and clay.

Well 05_UGMW27 is an upgradient well, whereas wells 05_DBMW41, 05_DGMW67, 05_DGMW68, and 05NEW1 are downgradient wells. Well 05_DBMW41 is located along the northwest landfill boundary of Site 5. Well 05_ DGMW68 is located within the general vicinity of

the APHO 46 anomaly. Monitoring well 05NEW1 is located immediately north of the possible landfill MSCR2 (Figure 2-4).

Groundwater is encountered at approximately 160 feet to 170 feet bgs, and the gradient is toward the northwest at an average of 0.038 foot per foot. Average linear velocities are estimated to range from 0.02 to 1.9 feet per day.

2.3.2 Surface Hydrology

Surface drainage at Former MCAS El Toro generally flows toward the southwest following the slope of the land. Several washes originate in the foothills northeast of Former MCAS El Toro and flow through or adjacent to the Former MCAS boundary en route to San Diego Creek.

Site 3 is located in the lower portion of the Agua Chinon Wash. The downstream extent of this wash crosses the landfill site in a man-made channel. The main portion of the landfill is northwest of the man-made channel, although landfill materials are located on both sides of the wash. Surface water enters the site through a concrete box culvert that is located under Irvine Boulevard. Surface runoff from Irvine Boulevard is discharged into the culvert upstream of Site 3. Surface water exits the site through another concrete box culvert located under North Marine Way. The portion of Agua Chinon Wash within Site 3 is unlined and is about 800 feet long. The wash shows evidence of erosion upstream of the site.

No significant surface drainages occur at or adjacent to Site 5. Borrego Canyon Wash is the closest surface water channel and is located approximately 600 feet east of the site.

2.3.3 Chemical Analysis Results

Analytical results for air, soil vapor, soil, and groundwater samples are presented briefly and qualitatively in this section. Detailed information can be obtained from the RI reports for Sites 3 and 5 (BNI 1996a,b, respectively).

2.3.3.1 SITE 3

Previous sampling locations are shown on Figure 2-3.

Air. Air sampling conducted during the Phase I and Phase II remedial investigation indicated that low concentrations of methane and VOCs are being emitted from the surface of the landfill. Concentrations of VOCs were found to exceed the California Air Resources Board (CARB) median values, but were below the CARB maximum values.

Soil Vapor. Soil vapor samples collected during the Phase II RI were analyzed for VOCs. Both shallow and deep soil vapor surveys indicated that VOCs were at concentrations above the CARB median values but below the maximum values.

- Forty-seven shallow soil vapor samples were collected at 36 locations (up to depths of 15 feet bgs) at Unit 1;
- Five deep soil vapor samples were collected from 3 lysimeter boreholes (reaching to a depth of 87 feet bgs) at Unit 1;
- Four soil vapor samples (depths ranging from 11.5 feet to 15 feet bgs) were collected from four locations at Unit 2;
- Soil vapor samples (depths at 15 feet bgs) were collected from 73 locations at Unit 3; and

- Soil vapor samples (depths at 15 feet bgs) were collected at five Unit 4 locations.
- Perimeter soil vapor samples for Site 3 were collected at four locations at depths ranging from 10 feet to 40 feet.

The results are as follows:

- None of the samples had total VOC concentrations exceeding the hot-spot threshold established by the BCT to designate principal threat wastes (BNI 1995) of 300 micrograms per liter (µg/L).
  - Several samples collected near Unit 1 were reported with low concentrations of 1,1-dichloroethene (1,1-DCE), and one sample collected near Unit 1 had low concentrations of toluene.
  - VOCs were detected in one of the four samples near Unit 2 and included benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds.
  - Chlorofluorocarbon (CFC)-113 was reported in soil vapor samples at 11 sampling locations near Unit 3.
  - CFC-113 and PCE were reported in the soil vapor samples collected near Unit 4.
- Methane concentrations migrating from the landfill were evaluated at four perimeter vapor sample locations during the Phase II RI and did not exceed regulatory levels (lower explosive limit of 50,000 parts per million-volume [ppmv]).

Soil. Shallow and deep soil sampling was conducted during the Phase I and II RIs.

- Of the 30 shallow soil samples, only arsenic and beryllium exceeded EPA Region 9 residential preliminary remediation goals (PRGs) in a few of the locations. However, these concentrations were lower than MCAS El Toro background concentrations (BNI 1996c) in shallow soils.
- Forty-six deep soil samples collected from the subsurface were analyzed for VOCs, total petroleum hydrocarbons (TPH), semivolatile organic compounds (SVOCs), pesticides, herbicides, metals, and radionuclides; however, of the metals detected, only arsenic, beryllium, and manganese exceeded EPA Region 9 residential PRGs in a few of the locations. Beryllium and manganese were determined to be within the range of the background or naturally occurring concentrations (BNI 1996c).

Groundwater. Twenty-one groundwater samples that were collected during both the Phase I RI and Phase II RI; VOCs, SVOCs, pesticides, metals, and gross alpha- and beta-emitting radionuclides were evidenced.

- The only VOC that exceeded its maximum contaminant level (MCL) was benzene; however, because the monitoring well in which it was detected is located downgradient of the Tank Farm No. 5 Area, it was reported that it was not clear whether the source was the landfill, the tank farm, and/or Agua Chinon Wash.
- Nickel was the only metal that exceeded its U.S. EPA primary MCL, but based on the levels and distribution of the metals detected in the upgradient and downgradient wells, it appeared that the elevated concentrations of nickel may be naturally occurring.
- Gross alpha activities reported for 4 of the 16 groundwater samples that were analyzed during the Phase I and Phase II RI exceeded the U.S. EPA MCL of 15 picoCuries per liter (pCi/L).

- Seven existing monitoring wells at Site 3 are sampled periodically as part of the CERCLA groundwater monitoring program (BNI 1999a).

Sediment. Seven sediment samples were collected during the Phase I RI and three samples were collected during the Phase II RI from locations in the Agua Chinon Wash that crosses Site 3. Pesticides, herbicides, VOCs, SVOCs, and metals detected in the samples did not exceed U.S. EPA residential PRGs, with the exception of arsenic and beryllium, but those concentrations were lower than background concentrations (BNI 1996c) in shallow soils. Thallium was the only metal whose reported concentration exceeded its background concentration, and that occurred in only one sediment sample. Therefore, thallium is a chemical of potential concern (COPC) for Unit 2 sediment.

Surface water runoff samples were collected at Site 3 and analyzed to assess whether the contents of Unit 1 are impacting the surface water in Agua Chinon Wash. A total of nine samples were collected from locations within the landfill boundaries during both the Phase I and Phase II RIs. In addition, three samples were collected at three locations: upstream, downstream, and within Agua Chinon Wash during the Phase II RI. There were no COPCs for surface water runoff identified during the RIs.

2.3.3.2 SITE 5

During the Phase I RI at Site 5, three subsurface soil samples collected from the boring of the monitoring well 05_DGMW68 (a downgradient well located at the center of APHO 46 area) were reported to contain acetone at concentrations hanging from of 7 micrograms per kilogram (µg/kg) to 10 µg/kg at depths ranging from 182 feet to 203 feet bgs. However, because acetone was also observed in the field blank at the same order of magnitude, the presence of acetone is suspect. The groundwater sample from the monitoring well was reported to contain tetrachloroethene (PCE), radionuclides, and a few total and dissolved metals. Previous sampling locations are shown on Figure 2-4.

Air. Fifteen air samples were collected during the Phase II RI, including three integrated surface samples, six ambient air samples, and six isolation flux chamber samples. In addition, instantaneous sampling for total organic carbon as methane was conducted over the entire landfill surface.

- Results indicate that low concentrations of methane and VOCs are being emitted from the surface of the landfill.
- Concentrations of VOCs were found to exceed the CARB median values, but were below the CARB maximum values.

Soil Vapor. Twenty-one shallow soil vapor samples were collected from depths of 8 feet to 15 feet bgs at 16 locations. Ten deep soil vapor samples were collected from the three lysimeter soil boreholes.

- VOCs were reported at concentrations above the CARB median values but below the maximum values.
- None of the VOCs reported at any of the Site 5 soil vapor sampling locations exceeded the hot-spot threshold of 300 µg/L.
- Methane concentrations migrating from the landfill were evaluated at three perimeter vapor sample locations and did not exceed regulatory levels (lower explosive limit of 50,000 ppmv).
- Subsurface soil vapor collected outside the landfill boundaries did not indicate any contamination, with the exception of one sample collected at the 05PG01 sampling location,

which was reported with a low concentration of CFC-113 (2 µg/L). Trichloroethene (TCE) was also detected in the same sample at a concentration of 25 µg/L.

Soil. One shallow soil sample collected from the boring drilled for monitoring well 05NEW1 during the Phase II RI was analyzed for VOCs and SVOCs; however, none of the analytes detected exceeded U.S. EPA Region 9 residential PRGs. Ten subsurface samples were collected during the Phase II RI from the boring drilled for monitoring well 05NEW1 and each of the borings drilled for lysimeters 05LYS1 through 05LYS3.

Groundwater. Groundwater samples collected from five monitoring wells during the Phase II RI were analyzed for VOCs, SVOCs, pesticides, metals, and gross alpha- and beta-emitting radionuclides. None of the compounds detected exceeded MCLs, with the exception of gross alpha concentrations, which exceeded MCLs in two wells located downgradient of the landfill. Five existing monitoring wells at Site 5 are sampled periodically as part of the CERCLA groundwater monitoring program.

Sediment. The overall ground surface at Site 5 is generally flat, with an approximate slope of 2.3 percent. Grasses and shrubs cover the surface, and no surface drainages occur at or adjacent to the site. No significant erosion is reported at the site.

2.3.3.3 Ecological Sampling

An ecological risk assessment was not performed for Site 3 because the site is covered with gravel or pavement and does not support wildlife habitat.

Site 5 is adjacent to a road and a golf course. The site is covered with grass, contains no shrub cover, and would therefore provide habitat for a limited range of animal species. In the Community Reuse Plan (County of Orange 1999), the proposed reuse for Site 5 is recreation (golf course).

The primary ecological exposure pathway was ingestion. Ground squirrels were assumed to ingest contaminants of potential ecological concern (COPEC) from plants, soil, and soil macro-invertebrates and invertebrates. The red-tailed hawk is assumed to ingest COPECs from soil and through ground squirrels. A bio-transfer factor was also used to estimate the amount of COPECs that could potentially be transferred from the ground squirrel's diet into its tissue. Field surveys and ecological sampling were performed at Site 5 to provide qualitative and quantitative data to assess the potential uptake of contaminants into the food chain. Information collected in the field includes data on plant communities, wildlife observations, small mammal tissue samples, plant samples, and soil samples.

2.3.4 Feasibility Study

The feasibility study for Sites 3 and 5 involved the development and analysis of remedial technologies and alternatives. Remedial action technologies/alternatives considered for the landfill soil are summarized below. Based on site characterization results, it was concluded that groundwater remedial action was not required at Sites 3 and 5 (BNI 1997a and 1997b).

2.3.4.1 Soil

Presumptive remedies for landfills were screened in the Phase II FSs for both Sites 3 and 5. This involved the development of remedial action objectives (RAOs), general response actions, and an estimation of areas requiring remedial action.

The following presumptive remedies were identified and screened:

1. Landfill capping.
2. Leachate collection and treatment.
3. Landfill vapor collection and treatment.
4. Land use institutional controls.

Technologies were identified and evaluated for the two presumptive remedies that were selected, namely, *landfill capping* and *institutional controls*. Capping designs considered were native soil or single-layer cap, single barrier cap, single barrier cap with additional vegetative cover, surface soil sealing, pavement barrier, and surface control technologies. Land use institutional controls evaluated were fencing and signs, deed restrictions, and monitoring.

Clean closure, involving the complete removal of all wastes and waste residuals, including contaminated soils, was also evaluated as a possible remedial action.

2.3.4.2 Development and Analysis of Alternatives

Presumptive remedy technologies were combined into action alternatives that were capable of meeting the RAOs for Sites 3 and 5. The following five alternatives were developed:

- Alternative 1: No Action
- Alternative 2: Institutional controls and monitoring
- Alternative 3: Single-layer soil cap with institutional controls and monitoring
- Alternative 4: Single-barrier cap with institutional controls and monitoring with four options:
  - Option a: Title 27 prescriptive cap with a clay barrier and a 2-foot-thick vegetative cover
  - Option b: Modified Title 27 prescriptive cap with a soil and bentonite mix barrier and a 2-foot-thick vegetative cover
  - Option c: Modified Title 27 prescriptive cap with a geosynthetic clay liner (GCL) barrier and a 2-foot-thick vegetative cover
  - Option d: Modified Title 27 prescriptive cap with a synthetic flexible membrane liner (FML) barrier and a 2-foot-thick vegetative cover
- Alternative 5: Pavement cap with institutional controls and monitoring with two options:
  - Option a: Concrete pavement cap
  - Option b: Asphalt pavement cap
- Alternative 6: Pavement cap with an FML barrier with institutional controls and monitoring with two options:
  - Option a: Concrete pavement cap with an FML barrier
  - Option b: Asphalt pavement cap with an FML barrier

The alternatives were evaluated relative to the following criteria in detail: (1) Overall protection of human health and the environment; (2) Compliance with applicable or relevant and appropriate requirements (ARARs); (3) Long-term effectiveness and permanence; (4) Reduction of toxicity, mobility, or volume; (5) Short-term effectiveness; (6) Implementability; (7) Cost; (8) State acceptance; and (9) Community acceptance.

2.3.5 Selected Remedy

The Proposed Plan for Sites 3 and 5 was released for public comments in June 1998. The Proposed Plan initially selected Alternative 3, i.e. single layer soil cap with institutional controls and monitoring, for both sites. However, based on the review of comments and discussion with the Local Redevelopment Authority (LRA) and regulatory members of the BCT, it was determined that Alternative 4d would better support the proposed reuse of Sites 3 and 5.

The selected alternative presented in the Draft ROD issued in March 1999, includes the following components:

- A single-barrier cap consisting of a 2-foot-thick foundation layer, a barrier layer made of FML, and a 2-foot-thick soil layer to support vegetation,
- Erosion control features to control surface water flow and protect the integrity of the cap,
- Land-use restrictions in the form of lease conditions (if the property is leased) or restrictive covenants (if the property is transferred by deed) to protect the landfill cover and assure that contact with landfill materials does not occur,
- Environmental monitoring, including monitoring of landfill vapor, leachate, and groundwater,
- Locks on monitoring wells to prevent tampering, and
- Maintenance of the cap, security measures, erosion-control features, monitoring equipment, and survey benchmarks

2.4 Well Replacement at Sites 3 and 5

Since the initial installation of monitoring wells at Sites 3 and 5, groundwater levels have risen, and some of the screened intervals are now submerged below the water table. Due to concerns that groundwater samples collected from these wells may not be representative of conditions at the groundwater interface, the Navy initiated a well replacement program. A total of eight replacement wells at or near Sites 3 and 5 were installed by The IT Group during August 2000. The new wells are identified by adding the suffix, "A," to the original well number, to indicate that it is a replacement well (e.g., replacement well 03_DGMW64A is associated with original well 03_DGMW64). Four wells, 03_DGMW64A, 03_DGMW65XA, 03_UGMW26A, and 04_DGMW66A, were installed at or near Site 3, and four wells, 05_DBMW41A, 05_DGMW67A, 05_DGMW68A, and 05_UGMW27A, were installed at Site 5.

Groundwater samples were collected from the existing wells (with submerged screens) and the new replacement wells for analysis for radionuclides and VOCs. Analytical results were compared to evaluate the effect of the submerged screens on the representativeness of the groundwater samples. The construction details, analytical results, and conclusions have been documented in the *Replacement Well Installation and Groundwater Evaluation Technical Memorandum* (Earth Tech 2001a). The report concluded that, in areas where groundwater may be impacted with gasoline-range hydrocarbons, monitoring wells should be screened across the water table. However, for areas impacted with the chlorinated hydrocarbons trichloroethene (TCE) and PCE (the major chemicals of concern at Former MCAS El Toro), the submerged screens did not have a significant effect on the reported concentrations of these compounds.

2.5 Lysimeter Evaluation at Sites 3 and 5

In order to evaluate the nature and extent of compounds detected in the pore water in the unsaturated zone, evaluate whether landfill leachate is migrating towards groundwater, and establish an

unsaturated zone monitoring network of landfill lysimeters for compliance with long-term monitoring requirements, six lysimeters (03LYS1, 03LYS2, and 03LYS3 at Site 3, and 05LYS1, 05LYS2, and 05LYS3 at Site 5) were installed in 1995:

- Lysimeters 03LYS1, 03LYS2, 05LYS1, and 05LYS2 were drilled at a 30-degree angle. This facilitated the placement of the lysimeters directly beneath the landfill for sampling of landfill leachate;
- Lysimeters 03LYS3 and 05LYS3 were installed vertically to facilitate collection of samples representative of background or ambient conditions.

Historical water level data from monitoring wells at Sites 3 and 5 indicate that groundwater is approximately 130 feet below the level of the lysimeters at Site 3 and approximately 60 feet below the level of the lysimeters at Site 5; however, during sampling, it was determined that water in excess of expected quantities was extracted from the lysimeters. Initially, it was suggested by BNI that the source of the water extracted from the lysimeters was the distilled water added to the boreholes when the lysimeters were installed. To evaluate this discrepancy, a lysimeter evaluation study was initiated.

On 17 December 2001, CPT boring 03CPT02 was advanced to a total depth of 103 feet bgs at Site 3. Boring 03CPT02 is located approximately 50 feet southeast of lysimeter 03LYS1. Pore water dissipation indicated that the soil was not saturated at 103 feet bgs and the CPT boring was terminated.

On 17 December 2001, three attempts were made to advance the CPT to the depth of the lysimeters at Site 5. Cone penetrometer test borings 05CPT03, 05CPT03A, and 05CPT03B were located approximately 25, 50, and 38 feet, respectively, northeast of lysimeter 052LYS3. The attempted borings met refusal at approximately 75 feet, 47 feet, and 59 feet bgs, respectively. Pore water dissipation indicated that the soil in 05CPT03A was not saturated at 58 feet bgs.

Based upon evaluation of the data collected during this investigation, it was concluded that the water extracted from the lysimeter cups represented moisture from the soil, the lysimeters are not installed in perched groundwater zones, and they are working properly as intended.

2.6 STATION-WIDE GROUNDWATER RADIONUCLIDE INVESTIGATION

Groundwater samples were collected from September 1992 through October 1998 (during remedial investigations and basewide groundwater monitoring events) and analyzed for radionuclides (gross alpha activity, gross beta activity, radon, cesium^{134}, radium^{226}, radium^{228}, strontium^{89}, strontium^{90} and total uranium. The sampling results from these investigations indicated that MCLs for gross alpha activity, gross beta activity, radon, and total uranium have been exceeded in a few of the samples analyzed (BNI 1998 and SWDIV 1999). Due to these exceedances and to evaluate if the source of these radionuclides was naturally occurring in groundwater at IRP Sites 1, 2, 3, 5, and 17, a groundwater radionuclide investigation was proposed.

2.6.1 Phase I

Groundwater samples were collected from seventeen wells including three wells from Site 3 and three wells from Site 5 and were analyzed for gross alpha emissions by U.S. EPA Method 900.0; isotopic uranium (uranium^{234}, uranium^{235}, and uranium^{238}) by American Society of Testing and Materials (ASTM) D3972; isotopic thorium: (thorium^{228}, thorium^{230}, and thorium^{232}) by ASTM D3972; radium^{226} by U.S. EPA Method 903.1; radium^{228} by U.S. EPA Method 904.1; lead^{210} by ASTM 5811; americium^{241} by ASTM 5811; and gross beta emissions by U.S. EPA Method 900.0.

The analysis rationale for this evaluation and the results are presented in *Draft Technical Memorandum, Evaluation of Radionuclides in Groundwater at Former Landfill Sites and the EOD Range* (Earth Tech 2000).

Groundwater samples were collected at wells 03DGMW64, 04DBMW40, and 04UGMW63 at Site 3 and wells 05UGMW27, 05NEW1, and 05DGMW41 at Site 5.

After data evaluation, it was concluded that: 1) the detected uranium is naturally occurring; 2) the gross alpha activity is primarily due to the presence of naturally occurring uranium; 3) No man-made radionuclides were detected at concentrations indicative of a release; and 4) the results for all samples satisfied the no further analysis criteria specified by the California Department of Health Services (DHS) analysis strategy for radionuclides (Earth Tech 2000).

2.6.2 Phase II

Due to uncertainties associated with low radionuclide concentrations and analytical uncertainty associated with laboratory method (ASTM Method D3972) used during Phase I evaluation, a more definitive evaluation (Phase II) was required by the BCT. The objective of Phase II evaluation was to unequivocally verify the previous conclusions that radionuclides detected in groundwater at MCAS El Toro are naturally occurring. Samples were collected from Sites 3 and 5 (from the same wells sampled during the Phase I evaluation) and submitted to GeoChron Laboratories in Cambridge, Massachusetts for the following analysis: uranium^{238} to uranium^{235} ratio and hydrogen, oxygen, and tritium isotopes. Samples collected for analysis of gross alpha, gross beta, radium^{226}, radium^{228}, strontium^{90}, americium^{241}, and general chemistry parameters were submitted to Paragon Analytical Laboratories in Fort Collins, Colorado. Split samples were collected from each well on behalf of the Orange County Water District (OCWD) for analysis of uranium^{235}, uranium^{236}, and uranium^{238} at the Lawrence Livermore National Library (LLNL) in Livermore, California.

The primary purpose of this investigation was to verify previous conclusions that radionuclides detected in groundwater at MCAS El Toro are naturally occurring. The natural ratio of uranium^{238} to uranium^{235} is consistent and well-documented in scientific literature. The presence of any man made uranium would have a significant effect on the isotopic ratio. The analytical methods that were used for evaluating the uranium isotope ratio were thermal ionization mass spectrometry (TIMS); uranium by inductively coupled plasma mass spectrometry (ICPMS).

The results from two independent laboratories known for their expertise in evaluating radiological data, using different analytical methods, yielded the following comparable results:

1. All of the isotopic mass ratios for Uranium^{238} to Uranium^{235} fell within the documented range for naturally occurring uranium (137.88 ± 0.34 (137.54 to 138.22)), except for one.
2. All Site 3 and Site 5 gross alpha samples were below the California drinking water standard of 15 pCi/L.
3. None of the Site 3 and Site 5 samples analyzed for gross beta exceeded the decision threshold of 50 pCi/L.

The results confirmed there is no evidence of anthropogenic radionuclides in the groundwater at MCAS El Toro. Therefore, it was concluded that no further evaluation of the origin of the radionuclides in groundwater was required, and the BCT concurred with this conclusion (Earth Tech 2001c).

2.7 STATION-WIDE RADIOLOGICAL SURVEY

A Historical Radiological Assessment (HRA) for the Former MCAS El Toro was issued in May 2000. Based on data collected during the HRA, locations requiring radiological characterization were identified. Sites 3 and 5 were included in the sites requiring characterization. The radiological characterization using mobile and hand-held survey equipment was completed in November 2001 and a release report will be issued by May 2002.

2.8 EVALUATION OF EXISTING DATA

Gaps have been identified in the existing data, requiring efforts to close those gaps prior to implementation of the remedial design.

2.8.1 Landfill Boundaries

It appears that the geophysical surveys that were conducted adequately covered the study areas for Sites 3 and 5, and APHO 46. Geophysical survey only partially covered MSCR2, and the remaining portion needs to be surveyed to verify whether waste placement occurred.

During the RI for Sites 3 and 5, limited trenching was conducted to assess the lateral extent of landfill waste. A closer spacing of trenches along the currently established boundary is required to confirm the landfill boundaries.

Since the geophysical survey did not reveal any anomalies indicative of waste placement activities at APHO 46 (with the exception of the surficial debris) and MSCR2, no intrusive investigations such as trenching are required.

2.8.2 Site Characterization

Site characterization involved sampling the following media: (1) air (instantaneous, integrated surface, ambient, and isolation flux); (2) soil vapor (shallow, subsurface, perimeter vapor migration, and deep soil); (3) soil (shallow and subsurface); (4) leachate; and (5) groundwater. Ecological sampling was also conducted to characterize the ecological risk. Sampling locations are shown on Figures 2-3 and 2-4.

2.8.2.1 MIGRATION OF LANDFILL VAPOR

Air emissions from both sites contain low concentrations of VOCs and methane. Concentrations did not exceed regulatory thresholds at Site 3 or Site 5. Further investigation by integrated surface air sampling, upwind and downwind ambient air sampling at the landfill perimeter, and isolation flux chamber sampling reported no concentrations in excess of regulatory thresholds. Methane was detected in samples collected during the Sites 3 and 5 Air SWAT (Strata 1991) and Phase II RI. However, none of the concentrations exceeded the regulatory threshold of 50,000 ppmv.

Evaluation of the data pertaining to landfill vapor migration, with respect to site characterization for the design of the selected remedy, appears to be comprehensive and adequate. Based on the RI, BNI concluded that installing a landfill vapor collection system was not necessary. Perimeter vapor migration monitoring probes were recommended in the *Draft ROD* (BNI 1999b) to monitor for possible offsite vapor migration in accordance with California Code of Regulations (CCR) Title 27 requirements for post-closure monitoring.

2.8.2.2 Soil Vapor Hot Spots

At Sites 3 and 5, no samples were found in excess of the regulatory threshold for hot spots (total VOC concentration of 300 µg/L).

2.8.2.3 Groundwater Contamination

Although benzene exceeded its MCL of 5 µg/L at a monitoring well located downgradient of Site 3, and nickel exceeded its primary MCL both upgradient and downgradient from Site 3, based on the evaluation of the nature and extent of groundwater contamination at Sites 3 and 5, it has been concluded that groundwater remediation is not required. Proposed long-term monitoring will be used to assess the impact of the site on groundwater quality.

2.8.2.4 Radionuclide Investigation

The results of the groundwater radionuclide evaluation prove that the radionuclides detected in groundwater at Former MCAS El Toro are naturally occurring and not caused by MCAS El Toro activities. Consequently, no additional investigation is required.

2.8.2.5 Impact to Sediments and Surface Water

Results of sediment sample analysis conducted during the Phase I and Phase II RI at Site 3 indicate only one COPC for sediment (thallium). Results of the analysis of surface water samples collected at Site 3 indicate that surface water and sediments are not being impacted by contaminants at the site. The overall ground surface at Site 5 is generally flat; therefore, this transport pathway will not significantly mobilize waste materials and contaminants. Consequently, surface water and sediment are not a potential medium of impact at Site 3 or Site 5.

2.8.2.6 Ecological Impact

The majority of Site 3 does not support native or non-native plant communities and does not provide habitat for wildlife. The Phase II RI report for Site 5 concluded that metals and organic compounds in soil are not likely to impact terrestrial receptors and that site chemicals are not bio-magnifying to higher-trophic-level organisms when realistic scenarios are considered.

2.8.3 Borrow Source Evaluation

The selected remedy requires the use of borrow soil for the construction of the foundation and vegetative cover of the cap. A potential borrow source located at Former MCAS El Toro, between Site 2 and Site 17, was identified during the feasibility study.

A geotechnical evaluation of the quality of borrow material from this on-station location was conducted during 1999 (FWEC 1999). The Former MCAS EL Toro source was compared to material that is readily available from an off-station source. The results of the geotechnical evaluation indicate that the MCAS source was capable of producing the required quantity and quality of material; however, it was determined that it would be more economical and cost-effective to obtain the borrow soil from an off-station source.

The following off-station borrow sources were recommended (FWEC 1999) and were evaluated to be suitable for use at Sites 3 and 5:

1. El Toro Materials, El Toro.
2. Robertson's, Anaheim Hills.
3. Frank R. Bowerman Landfill, Irvine.

3. DATA QUALITY OBJECTIVES SUMMARY

The study design was developed within the context of the Data Quality Objectives Process, as described in U.S. EPA guidance (EPA 2000). The following is a summary of the process and the outcome of the iterative planning approach.

3.1 PROBLEM STATEMENT

Additional investigation to confirm the boundaries and depth of waste that was established as part of the RI is required to facilitate the remedial design to meet landfill closure requirements for the sites.

3.1.1 Sites 3 and 5

Pre-design investigation data are required to design and implement the selected remedy and documented in the *ROD* (BNI 1999b) for Landfill Sites 3 and 5. Data is required to:

1. Confirm current landfill refuse boundaries.
2. Assess geotechnical/engineering design parameters for the landfill cover materials.
3. Evaluate the need for a landfill gas collection system.

3.1.2 APHO 46

An aerial photograph study identified an anomalous area (APHO 46) which was subsequently investigated by a geophysical survey. The survey revealed the presence of an area within APHO 46 (debris pile) containing scattered, small, shallow, buried metallic objects and debris. The potential impact or releases resulting from the disposal activities that created the debris pile needs to be assessed by collecting soil samples for chemical analyses.

3.1.3 MSCR2

A former refuse area was identified as a possible landfill area (MSCR2) during personnel interviews conducted as part of the station-wide *Environmental Baseline Survey* (JEG 1995). Based on these interviews, the MSCR2 area would extend to El Toro Blvd.

Review of aerial photographs from 1946 through 1991 do not indicate any activity that would suggest waste placement. The golf course was confined to the southwest of El Toro Blvd. in the 1952 photograph. The 1961 photograph shows the fifth tee hole to extend beyond El Toro Blvd. to the golf course trail. Based on this review, the extent of MSCR2 has been revised to encompass only the area between the southwestern boundary of Site 5 and the golf course trail (refer to Figures 2-2 and 2-4).

Portions of MSCR2 were evaluated by the geophysical survey that was conducted for APHO 46; no anomalies were evidenced. The remaining portions of MSCR2 need to be evaluated to verify that no anomalies indicative of waste placement are present.

3.2 PROJECT DECISIONS

3.2.1 Sites 3 and 5

1. Have the landfill refuse burial boundaries been adequately verified by trenching/potholing or is revision of currently established boundaries necessary?
2. Has adequate perimeter soil gas sampling data been collected to evaluate the potential need for a landfill gas collection system?

3. Has adequate geotechnical engineering data been collected to enable the design of a soil cover system to meet landfill closure requirements?

3.2.2 APHO 46

1. Has adequate soil sampling been conducted to verify whether releases occurred to the subsurface and to characterize the nature of the debris pile?
2. Can the debris pile be consolidated within Site 5 as part of housekeeping activities during the pre-design investigation, or will removal and consolidation during the remedial action for Site 5 be required?

3.2.3 MSCR2

1. Do the results of the geophysical survey support the extent of MSCR2 that was established based on aerial photograph review?
2. Do the results of the geophysical survey indicate the presence of anomalies requiring further investigation?
3. Do the anomalies, if any, upon investigation require removal and consolidation in Site 5 and associated confirmatory sampling?

3.3 DECISION INPUTS

The basis for the conceptual model of the sampling design is presented in prior documents and summarized in the background discussion in Section 2.

3.3.1 Sites 3 and 5

- To verify the landfill boundaries, field observations will serve as input to distinguish between native soil, fill material, and waste material encountered in trenches/potholes.
- To evaluate the need for a gas collection system, methane concentrations in the perimeter soil gas samples will be compared to the Title 27 CCR, Section 20925 stipulated threshold of 50,000 ppmv (5 percent in air by volume) of methane.
- To verify the remedial investigation findings, Total VOCs concentrations will be compared to the hot-spot threshold of 300 µg/L.
- To develop the design of the soil cover system, geotechnical engineering parameters of the existing soil will serve as input.

3.3.2 APHO 46

- EPA residential soil PRGs for all analytes except metals and background concentrations for metals (BNI 1996c) will serve as threshold levels to evaluate whether a release occurred.

3.3.3 MSCR2

- Results of the geophysical survey will serve as input to evaluate a further course of action.

3.4 STUDY BOUNDARIES

3.4.1 Sites 3 and 5

The approximate limits of existing waste at Sites 3 and 5 that were presented in the *ROD* (BNI 1999b) were evaluated by reviewing and comparing the pre-landfill, post-landfill, and current topographic maps. In addition, previous trenching and geophysical investigations were reviewed to provide additional information regarding the extent of waste within each location.

Trenches will be excavated around the perimeter of the landfills, with a maximum of 25 trenches in and around Site 3 and 6 trenches around Site 5. Backhoe exploration will be the primary method of trench excavation. Figures 3-1 and 3-2 present the locations of the proposed exploration trenches at Sites 3 and 5, respectively. The maximum vertical depth of trenching will be 15 feet bgs.

3.4.2 APHO 46

The extent of the debris pile and associated confirmatory sampling will be the study area boundary (Figure 2-4). The previous geophysical survey showed that the buried metallic debris is surficial; therefore, the vertical extent is not anticipated to be greater than 2 feet bgs.

3.4.3 MSCR2

The geophysical survey will encompass the western portion of MSCR2 as shown on Figure 2-4.

3.5 DECISION RULES

3.5.1 Sites 3 and 5

If the extent of the landfill boundaries have been adequately verified or revised by trenching/potholing, ***then*** the engineering design of the soil cover system will be developed (Decision 1). A trench excavation decision flow chart and narrative which addresses the decision rules for the excavation sequence is included in Appendix C.

If perimeter soil gas monitoring results indicate methane concentrations exceeding 50,000 ppmv, ***then*** the remedial design will incorporate a gas control system; else, continued monitoring will be recommended (Decision 2).

If perimeter soil gas monitoring results indicate that total VOCs concentration exceeds 300 µg/L (hot-spot threshold), ***then*** further investigation to assess the nature and extent of the hot-spot will be required. The hot spot threshold is the concentration that was identified by the BCT for designating soil gas contaminants as principal threat wastes (BNI 1995).

If adequate geotechnical engineering data have been collected to evaluate the existing and proposed conditions, ***then*** the design of the soil cover system will be developed (Decision 3).

3.5.2 APHO 46

If adequate sampling has been conducted to evaluate whether there are releases associated with the near surface debris pile, ***then*** the results will be evaluated to determine a further course of action (Decision 1).

If soil sampling results indicate that a release has occurred, ***then*** handling of (i.e. removal and consolidation) the debris pile and releases associated contamination will be proposed as part of the

remedial action for Site 5; else, the former debris pile will be consolidated within Site 5, as a housekeeping exercise and the area graded to match the surrounding (Decision 2).

3.5.3 MSCR2

If the results of the geophysical survey show that no anomalies are present, ***then*** no further action will be recommended for MSCR2.

If the results of the geophysical survey indicate that anomalies are present, ***then*** further investigation will be required to evaluate the anomalies (Decision 2).

If anomalies are present in the vicinity of the golf course trail (current MSCR2 boundary), ***then*** the geophysical survey will be extended to El Toro Blvd (Decision 1).

If the further evaluation of anomalies confirms the presence and extent of waste refuse material, ***then*** handling (i.e. removal and consolidation) of the waste/refuse as part of the remedial action for Site 5 will be proposed (Decision 3).

3.6 DECISION ERROR

The physical investigation and sampling for chemical analysis are based on a judgmental sampling design, using data and observations from previous investigations. The judgmental sampling design does not have a probability associated with the decision but is based on field observations and documentation, as well as previously collected data.

3.7 STUDY DESIGN

3.7.1 Confirmation of Landfill Boundaries

The proposed trenching locations along the currently estimated landfill boundary are shown on Figures 3-1 and 3-2. These trenches will be considered the primary test pits and are spaced approximately 200 feet apart. The maximum depth of excavation will be 15 feet bgs. Additional test pits will be advanced in accordance with the Trench Excavation Decision Flowchart and Narrative presented in Appendix C. The flowchart and narrative present the rationale to confirm the lateral and vertical extent of the landfill boundary.

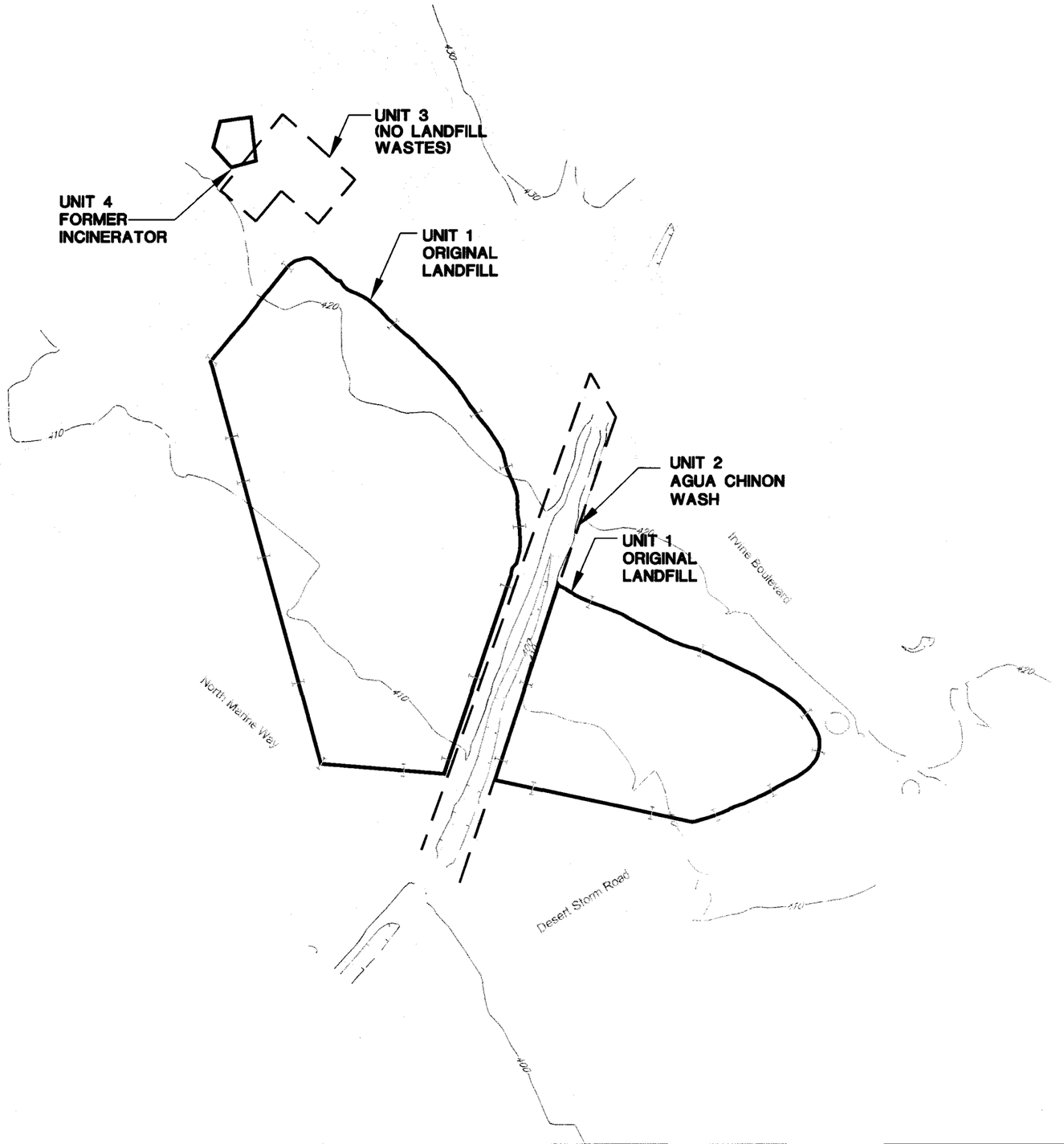
3.7.2 Foundation Layer

Geotechnical testing will be conducted to develop design criteria for final static and seismic stability of the final cover system and grading of the sites. Geotechnical laboratory testing will be performed to characterize in situ materials. Geotechnical testing will provide classification, index properties, and engineering properties (shear strength).

The existing soil cover will be evaluated for its suitability to serve as the foundation for the final cover. Soil samples will be collected at approximately every fourth trench during excavation for laboratory analysis of index properties, moisture/density evaluation, and possible permeability analysis and shear testing. Up to five samples each at Sites 3 and 5 will be collected for classification and index testing, with duplicates collected for each sample for possible shear testing.

Classification and index property testing for onsite soil materials will be performed to provide grain-size distribution ASTM D422 and D1140), Atterberg limits (ASTM D4318), moisture content (ASTM D2216), specific gravity (ASTM D854), and in situ dry density (ASTM 2937). Engineering property testing for foundation layer materials will include compaction characteristics of foundation layer soil materials (ASTM D1557).

SOURCE OF MAP INFORMATION
RI REPORT; BNI 1996a



LEGEND

- BUILDING
- IMPROVED ROADS
- FENCE
- 560 — ELEVATION CONTOURS (10' INTERVAL)
- ELEVATION CONTOURS (2' INTERVAL)
- STREETLIGHT
- LANDFILL BOUNDARY
- EXISTING WASH
- PROPOSED TRENCH LOCATIONS

NORTH

0 100 200 FEET

SCALE: 1" = 200'

Pre-Design Investigation — Final Work Plan

Site 3: Proposed Trench Locations

Remedial Design IRP Site 3 and Site 5

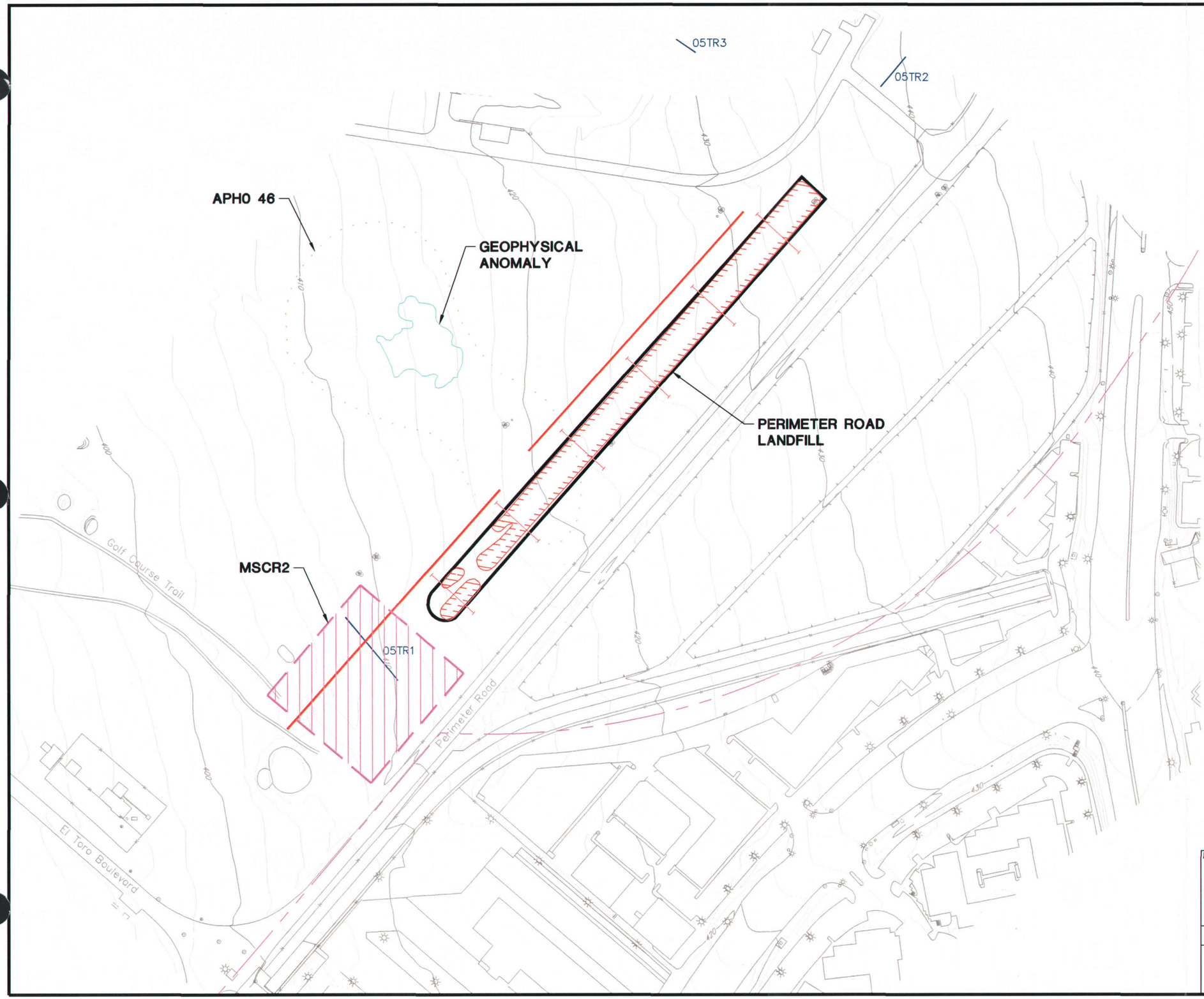
Date: 02-02	Former MCAS El Toro	Figure 3-1
Project No. 37380	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	

L:\NAVCLEAN\Sites 3 & 5 Pre-Design Investigation\Workplan\Draft Final\Figures\Site 3 Figures.dwg, 03/22/2002 03:35:34

PAGE NO. 3-6

THIS PAGE INTENTIONALLY LEFT BLANK

SOURCE OF MAP INFORMATION
RI REPORT; BNI 1996a



LEGEND

- BUILDING
- IMPROVED ROADS
- FENCE
- 440 — ELEVATION CONTOURS (10' INTERVAL)
- ELEVATION CONTOURS (2' INTERVAL)
- STREETLIGHT
- MCAS EL TORO BOUNDARY
- PREVIOUSLY IDENTIFIED DISPOSAL TRENCH
- PERIMETER ROAD LANDFILL BOUNDARY (1950's–1960's)
- 05TR1 — PREVIOUS TRENCH LOCATIONS (PHASE II RI; BNI 1996b)
- PROPOSED TRENCH LOCATION
- INFERRED UTILITY LINES (PHASE II RI; BNI 1996b)
- GEOPHYSICAL ANOMALY: APPROXIMATE AREA OF SCATTERED, SMALL, SHALLOW BURIED METALLIC DEBRIS (DEBRIS PILE) (GEOVISION 2000)
- APHO 46
- APPROX. LOCATION OF MSCR2. AREA BASED ON AERIAL PHOTOGRAPH REVIEW.

NORTH

0 100 200 FEET

SCALE: 1" = 200'

Pre-Design Investigation — Final Work Plan

Site 5: Proposed Trench Locations

Remedial Design IRP Site 3 and Site 5

Date: 02-02	Former MCAS El Toro	Figure
Project No. 37380	EARTH TECH — A tyco INTERNATIONAL LTD. COMPANY	3-2

L:\NAVCLEAN\Sites 3 & 5 Pre-Design Investigation\Workplan\Draft Final\Figures\Site 5 Figs.dwg, 03/22/2002 03:36:36 PM

PAGE NO. 3-8

THIS PAGE INTENTIONALLY LEFT BLANK

Shear strength testing will be performed to develop strength parameters of the in situ foundation materials. Triaxial compression (per ASTM D2850 and D4767) tests will be performed on materials obtained from existing slopes at or greater than a 33-percent grade. Each sample will be tested at densities representing in situ or anticipated densities, depending on whether these soils will be left in place or removed and re-compacted, respectively. Shear strength testing will also include direct shear tests (ASTM D3080).

Testing of soluble sulfates and soluble chlorides in soils, pH, and resistivity (California Department of Transportation [DOT] 417, 532, 643) will be performed to develop recommendations for protection against corrosion potential of buried metallic utilities and aggression of sulfate soils to concrete structures.

3.7.3 Perimeter Vapor Migration

To further evaluate the need for a landfill vapor collection system at Sites 3 and 5, soil vapor monitoring wells will be installed at the perimeter of the landfill boundary. The concentration of methane migrating from the landfill must not exceed 5 percent in air by volume (50,000 ppmv). The vapor monitoring wells will be spaced at a distance not greater than 1000 feet apart along the perimeter of the sites. The actual locations will be established based on the finalized landfill boundaries.

The location, number, design, and installation of the vapor monitoring wells will meet the requirements of Title 27 CCR, Section 20925. Accordingly, these vapor monitoring wells will serve to meet monitoring requirements during closure and post-closure operations. At each location, the vapor monitoring wells will be installed at depths to coincide with the shallow zone, intermediate zone, and the zone at or near the depth of the waste. The depth of the waste is estimated to be in the range of 25 feet to 40 feet bgs. At locations where groundwater is encountered at depths shallower than 30 feet, wells will be installed in the shallow zone and at a depth of approximately 5 feet above the groundwater table.

Four monitoring events are planned to evaluate perimeter vapor migration prior to implementation of the remedial design. Analytes will include the compounds required by regulation (fixed gases, including methane) in addition to compounds detected at the site during previous investigations (VOCs).

3.7.4 Confirmatory Sampling

Surface and subsurface soil samples will be collected in and around the debris pile in accordance with CLEAN standard operating procedures (SOPs) (BNI 1999c) to evaluate whether a release had occurred. Six soil samples will be collected in the area of the debris pile at evenly spaced locations. Samples will be analyzed for total volatile petroleum hydrocarbons (TVPH), total extractable petroleum hydrocarbons (TEPH), VOCs, SVOCs, metals, dioxins and furans, and pH by methods presented in Section A-2.2.2.2 of Appendix A.

4. DATA EVALUATION

4.1 TRENCHING

The revised limits, if any, of landfill waste will be mapped in plan view based upon visual observations during trenching. If applicable, results of field monitoring and/or sampling will also be plotted.

4.2 GEOPHYSICAL SURVEY

Waste/refuse placement at MSCR2 will be verified and the results of the geophysical survey reported. If the survey shows that wastes have been placed at that location, then feasibility of delineation of the waste placement boundary by additional trenching or potholing will be considered (since the golf course has been developed over MSCR2).

4.3 LABORATORY DATA EVALUATION

Analytical results of samples of soil underlying the debris pile will be evaluated against the decision thresholds. If results suggest that there is contamination, further investigation and evaluation may be warranted. Air samples will be evaluated for evidence of offsite vapor migration and to assess the need to install landfill gas controls.

4.4 PERIMETER SOIL VAPOR SAMPLES

The perimeter soil vapor sample analytical results for methane will be compared to the regulatory threshold of 50,000 ppmv for methane, to evaluate the need for a landfill vapor collection system.

4.5 GEOTECHNICAL EVALUATION

Geotechnical soil sample results will assist with meeting CCR Title 27 stability analysis requirements for landfill covers, and minimize the amount of fill material that will be required for construction of the monolithic soil covers, which will save both time and money. Data collected will help to provide further detailed design requirements for the preparation of construction drawings and specifications.

Following completion of the design and prior to construction, a report will be submitted to the DoN. The geotechnical report will consist of the purpose, field methodologies, interpretation of laboratory results, conclusions and recommendations regarding geotechnical properties and stability. The report will include trenching logs, chain-of-custody records, table of results, geotechnical laboratory reports, calculation sheets, site location maps and site plans, geologic cross sections, and other pertinent data and information. The final report will be signed by a State of California professional engineer or State of California certified engineering geologist.

5. REFERENCES

Bechtel National, Inc. (BNI). 1995. *Final Work Plan Phase II Remedial Investigation/Feasibility Study*. San Diego, CA.

———. 1996a. *Draft Phase II Remedial Investigation Report Operable Unit 2C-Site 3, Marine Corps Air Station El Toro, California*. San Diego, California. March.

———. 1996b. *Draft Phase II Remedial Investigation Report Operable Unit 2C-Site 5, Marine Corps Air Station El Toro, California*. San Diego, California. April.

_____. 1996c. *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations*. San Diego, CA.

———. 1997a. *Draft Final Phase II Feasibility Study Report-Site 3, Marine Corps Air Station El Toro, California*. San Diego, California. March.

———. 1997b. *Draft Final Phase II Feasibility Study Report-Site 5, Marine Corps Air Station El Toro, California*. San Diego, California. February.

———. 1998. *Draft Technical Memorandum, Site 2 Compliance Well Installation. Marine Corps Air Station El Toro, California*. San Diego, California. October.

———. 1999a. *Draft Final CERCLA Groundwater Monitoring Plan*. San Diego, California.

———. 1999b. *Draft Record of Decision*. San Diego, California. March.

———. 1999c. *CLEAN II Program Procedures Manual*. San Diego, California.

Brown and Caldwell. 1986. *Initial Assessment Study of Marine Corps Air Station El Toro, California*. CLE-C01-01F018-A2-016.

California Regional Water Quality Control Board, Santa Ana Region (CRWQCB). 1995. *Water Quality Control Plan, Santa Ana River Basin*. Riverside, California.

County of Orange. 1999. *The Preferred Land Use Plan, Concept B*. August.

Earth Tech 2000. *Technical Memorandum, Evaluation of Radionuclides in Groundwater, Marine Corps Air Station, El Toro, California*. Draft. Honolulu. March.

———. 2001a. *Technical Memorandum, Replacement Well Installation and Groundwater Evaluation, Marine Corps Air Station, El Toro, California*. Honolulu, Hawaii. December.

———. 2001b. *Work Plan, Phase II Evaluation of Radionuclides in Groundwater at Former Landfill Sites and the EOD Range, Marine Corps Air Station, El Toro, California*. Honolulu. January.

Environmental Protection Agency (EPA). 2000. *Guidance for the Data Quality Objectives Process*. EPA QA/G-4. Washington, D.C. September.

Foster Wheeler Environmental Corporation (FWEC). 1999. *Draft Technical Memorandum, Report of Findings from Geotechnical Evaluation of Borrow Source for Landfill Covers.* San Diego, California. August.

———. 2000 *Draft Project Work Plan, Pre-Design Activities at IRP Sites 3 and 5 and Debris Disposal from Site 1, MCAS El Toro.* San Diego, CA. August.

Geovision. 2000. *Geophysical Investigation, Aerial Photographic Anomaly Area 46, MCAS El Toro, California.* Corona, California. June.

Jacobs Engineering Group, Inc (JEG). 1995. *Installation Restoration Program, Final Environmental Baseline Report.* Irvine, CA.

James M. Montgomery Engineers, Inc. 1988. *MCAS El Toro and Tustin Site Inspection Plan of Action.*

Naval Facilities Engineering Command, Southwest Division (SWDIV). 1995. *Final Environmental Baseline Report.*

———. 1999. *Preliminary Data, Quarterly Sampling Results, August.* San Diego, California.

———. 2000. *Summary Report, Aerial Photograph Anomaly 46, Aerial Photograph Anomaly Program, MCAS El Toro.* San Diego, California. September.

Science Applications International Corporation (SAIC). 1993. *Final Report Aerial Photograph Assessment, MCAS El Toro.* San Diego, CA. October.

Strata Technologies. 1991. *Solid Waste Air Quality Assessment Test Reports for MCAS El Toro.*

Appendix A
Sampling and Analysis Plan

Appendix A
Sampling and Analysis Plan
Final Work Plan
Pre-Design Investigation
Operable Unit 2C, Landfill Sites 3 and 5
Former MCAS El Toro, California

Contract No. N62742-94-D-0048
Contract Task Order No. 0078

Reviews and Approvals:

V. Saravanan

Date: March 4, 2002

Eli Vedagiri
Project Engineer
Earth Tech, Inc.

Date: March 4, 2002

Crispin Wanyoike, P.E.
CTO Manager
Earth Tech, Inc.

Date: March 4, 2002

Ken Vinson, P.E.
Program Quality Manager
Earth Tech, Inc.

Date: 3/5/02

Narciso Ancog
Quality Assurance Officer (QAO)
U.S. Naval Facilities Engineering Service Command
Southwest Division

PAGE NO. A-ii

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENTS

FIGURES

TABLES

PAGE NO. A-iv

THIS PAGE INTENTIONALLY LEFT BLANK

µg/kg	microgram per kilogram
µg/L	Micrograms per liter
APHO	aerial photograph anomaly
ASTM	American Society for Testing and Materials
BCT	BRAC Cleanup Team
bgs	below ground surface
BNI	Bechtel National, Inc.
BRAC	Base Realignment and Closure
CIWMB	California Integrated Waste Management Board
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	contract laboratory program
COC	chain of custody
COPC	chemical of potential concern
CTO	contract task order
DoN	Department of the Navy
DOT	Department of Transportation
DQO	Data Quality Objective
Earth Tech	Earth Tech, Inc.
EDD	electronic data deliverable
ELAP	Environmental Laboratory Correction Program
EPA	Environmental Protection Agency
EWI	Environmental Work Instructions
FID	flame ionization detector
FSP	Field Sampling Plan
GM	Geiger-Mueller (detector)
GPS	global positioning system
HSP	health and safety plan
ICP	inductively coupled plasma
ID	identification
IDW	investigation-derived waste
IRCDQM	Installation Restoration Chemical Data Quality Manual
IRP	Installation Restoration Program
LCS	laboratory control sample
LEL	low explosive limit
MCAS	Marine Corps Air Station
mdl	method detection limit
mg/kg	milligram per kilogram
ml/min	milliliters per minute
MS	matrix spike
MSCR	miscellaneous refuse
MSA	master services agreement
MSD	matrix spike duplicate
MSL	mean sea level
n.a.	not applicable
NAD	North American Datum
NFESC	Naval Facilities Engineering Service Center
NPL	National Priorities List
OU	operable unit
PACNAVFACENGCOM	Pacific Division, Naval Facilities Engineering Command

PCAS	post-construction award services
pg/kg	picograms per kilogram
pH	negative log of the hydrogen ion concentration
PID	photoionization detector
PPE	personal protective equipment
ppmv	parts per million – volume
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QA	quality assurance
QAO	quality assurance officer
QAPP	quality assurance project plan
QC	quality control
%R	percent recovery
RCRA	Resource Conservation and Recovery Act
RPD	relative percentage of difference
RPM	remedial project manager
SAP	Sampling and Analysis Plan
SCAQMD	South Coast Air Quality Management District
SOP	standard operating procedure
SOW	statement of work
SVOC	semivolatile organic compound
SW	solid waste
SWDIV	Southwest Division, Naval Facilities Engineering Command
TEF	toxicity equivalency factor
TEQ	toxicity equivalency quotient
U.S.	United States
VOA	volatile organic analysis
VOC	volatile organic compound
WHO	World Health Organization
WW	water and waste

A.1 INTRODUCTION

This Sampling and Analysis Plan (SAP), which consists of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP), was prepared for sampling and analysis associated with the remedial design for Installation Restoration Program (IRP) Site 3 – Original Landfill and IRP Site 5 – Perimeter Road Landfill at the Former Marine Corps Air Station (MCAS), El Toro, California. These two landfill sites are contained in Operable Unit (OU)-2C. The Work Plan addresses the data collection requirements for the Aerial Photograph Anomaly (APHO) 46 and possible landfill area designated as miscellaneous refuse area (MSCR) 2.

This work plan was prepared by Earth Tech, Inc. (Earth Tech) on behalf of the United States (U.S.) Department of the Navy (DoN), Southwest Division, Naval Facilities Engineering Command (SWDIV), as authorized by the U.S. Navy, Pacific Division, Naval Facilities Engineering Command (PACNAVFACENGCOM) under Contract Task Order (CTO) number 0078 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) II program, contract number N62742-94-D-0048.

A.2 FIELD SAMPLING PLAN

Methodologies and procedures will conform to the standard operating procedures (SOPs) for the CLEAN II projects (BNI 1999a). Copies of the applicable SOPs will be made available upon written request to the remedial project manager (RPM). Field teams will maintain copies of the current and applicable SOPs on site during all fieldwork. Any necessary significant modifications/deviations (e.g., changes in equipment, materials, or deletion of a procedural step) will first be discussed with the CTO manager, the CLEAN program quality manager, and the RPM. Upon approval, significant modifications and corresponding justification will be documented in project files.

Data collection will be performed in accordance with SOPs for the SWDIV CLEAN program and will include applicable documentation, data review, validation methods, and technical oversight.

Although some tasks may be performed concurrently, field sampling tasks will be performed in the general order presented below.

A.2.1 SUBSURFACE CLEARANCE

Project personnel will perform an evaluation of records prior to the establishment of preliminary locations of trenches. The evaluation will include review of available site plans, utility layouts, as-built construction drawings, and results of previous subsurface investigations. This survey will be conducted prior to excavation or sampling. No geophysical survey is anticipated at Sites 3 and 5 and APHO 46, but one is anticipated at MSCR 2.

A.2.2 TRENCHING

Prior to trenching, a global positioning system (GPS) will be used to mark the location of the primary test pit along the currently estimated landfill boundary. Primary test pits will be excavated along the estimated waste limit at a spacing of 200 feet and to a depth of up to 15 feet. These primary test pits will be logged to determine the interface between the waste and adjacent native or fill soils. If waste is encountered, then a decision must be made as to whether or not the lateral extent of the landfill has been identified. If waste is not encountered and native soils have been identified or the excavation has continued up to 15 feet vertically through fill soils, then another test pit will be advanced approximately 50 feet inward toward the center of the landfill. This procedure will continue until waste is encountered and the lateral extent of the landfill has been determined, similar to the procedure stated above.

After confirmation of the lateral extent of the landfill (interface of the waste and adjacent soils), the vertical extent of the waste will be verified by confirming whether native or fill soil has been encountered below the waste or whether the maximum reach of the excavator has been met. If the vertical extent of the waste has not been identified but the maximum reach of the excavator has been met, then excavation will stop.

If the lateral extent of the landfill (interface of the waste and adjacent soils) has not been confirmed during the initial excavation, another test pit will be advanced approximately 50 feet outward from the center of the previously excavated trench. This procedure will continue until the interface between the waste and adjacent soils has been confirmed. If the test pits show the presence of the waste but the interface of the waste and the adjacent soil cannot be identified, then a trench will be excavated between the pit that does not contain waste and the adjacent pit containing waste to identify the transition from the waste to soil.

If both the lateral and the vertical extent of waste have been identified within the test pit, then excavation will cease at that location. These primary test pits will be excavated every 200 feet along the currently estimated landfill boundary. If the last primary test pit location has been excavated and the landfill boundaries have been established, then excavation at the site will be continued. If, after the last primary test pit has been advanced, the landfill boundaries have not been identified, then contingency test pits will be excavated at the midpoint or at a selected location between the two primary test pit locations (where uncertainty of lateral extent exists). The procedure will be performed in accordance with the procedure developed for the primary test pits detailed above. If the first contingency test pit does not adequately establish the lateral extent of waste, then another contingency pit will be excavated between the initial contingency pit and the adjacent primary test pit. This activity will continue until the landfill boundaries have been clearly identified. Additionally, the trench will be extended 40 feet from the waste/native soil interface to confirm that no disposal trenches lay beyond the first encountered waste/native soil interface. A trench excavation decision flowchart and decision narrative are presented in Appendix C.

Trenching with a backhoe allows for relatively large excavation faces to be exposed, thereby enabling the geologist/engineer to confirm waste placement boundaries. Trench walls will be visually observed. Trench excavation spoils may be used to supplement these observations. In such an event, care will be exercised by the backhoe operator to ensure that the evaluated spoils are excavated by removing discrete volumes rather than scraping materials from a range of depths, and that the excavated material is placed over a 20-millimeter polyethylene liner for logging purposes. The field geologist will log each test pit to identify the limits of waste/fill (including visual identification of any ash-like or charred materials) and native material and will also record makeup and approximate percentages of various wastes. To assess whether localized lenses, if encountered, are part of the main waste body, the field geologist or engineer will estimate the amount (by volume) of the refuse material mixed with the soil. If 20 percent (or greater) of refuse material is present, then it will be considered to be part of the main waste body. A field geologist or engineer will identify and describe the types of soil encountered in the trenches in accordance with the D2487 (Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System) and D2488 (Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]). The description will also include the percentage of waste material.

A.2.2.1 Field Monitoring

Upon excavation of the trenches/test pits, a field geologist will log the orientation of the test pits using a compass. The trench bearings and the angle of the trench will be provided in the field, with $\pm 5^{\circ}$ accuracy. A minimum of two stakes (one on either end) will be driven for each linear segment of the trench/test pit. Once observation, visual inspection, and logging of each trench are completed, the excavated material will be returned back to the trench. Material excavated from the lower portion of the trench will be returned first, followed by soil excavated from the upper portion. The trenches will be backfilled in 1-foot-thick layers. A backhoe will compact each layer of material placed inside the trench. A measuring tape will be lowered inside the trench to measure the depth and thickness of each layer placed. Following the backfill and compaction of the material inside the trenches, the top of the backfilled trenches will be graded to match the surrounding grade.

A photoionization detector (PID) or flame ionization detector (FID) will be used during trench excavation to screen the material excavated from the trenches for the presence of volatile organic compounds (VOCs) and petroleum hydrocarbons. Both an Eberline SPA-3 NaI gamma scintillation detector and an Eberline HP-260 pancake Geiger-Mueller (GM) detector capable of detecting alpha, beta, and gamma emissions will be used at Sites 3 and 5 to screen for radiological material. During

trenching, field personnel will use various monitoring devices, including a GA-90 Oxygen meter, and lower explosive limit (LEL) meter.

The PID/FID will be lowered inside the trench to monitor and detect any vapors. If high levels of vapors are detected in any part of the trench or in the spoils, the section of the trench from which the spoils were excavated or vapor was detected will be marked and identified. The excavated spoils will also be inspected for any discoloration, characteristic odors, or other unusual physical characteristics.

Surface soil background radiological levels will be established at the beginning of each day by taking measurements with the SPA-3, with the detector facing the soil at a height of 1 inch to 2 inches at a location upgradient (minimum of 500 feet), and with soils similar to those found at each landfill. For the GM detector, the background level will be established by taking measurements at a height of 2 inches to 3 inches above the surface, with the detector facing the soil. The daily background levels will be documented on a radiological survey sheet for each survey instrument. Upon discovery of radiation levels in soil excavated from the trenches above the investigation level (i.e., the mean + three times the standard deviation [Weston 2000]), the area will be flagged for further evaluation. The boundaries of the area will be confirmed, and appropriate personnel will be notified. Further evaluation to characterize the radiological source will be coordinated by the Navy and performed as detailed in the *Radiological Survey Plan* (Weston 2000).

A.2.3 SOIL SAMPLING FOR GEOTECHNICAL TESTING

Samples will be collected and transported in accordance with CLEAN II SOP 4, *Soil Sampling* (BNI 1999a) and American Society of Testing and Materials (ASTM) D4220. Up to seven samples at Site 3 and four samples at Site 5 will be selected for index testing and moisture/density evaluation based on field observations. Additional bulk samples will be collected at each location for engineering properties such as permeability and shear testing. Up to five samples each from Sites 3 and 5 will be selected for these analyses. Multiple tests (for different conditions such as variable densities, confining pressures, and drainages) will be conducted on the same sample tested for engineering properties.

A.2.4 PERIMETER VAPOR WELL INSTALLATION

The perimeter vapor wells will be constructed in accordance with California Integrated Waste Management Board (CIWMB) requirements set forth in Title 27, Division 2, Section 20925 and the South Coast Air Quality Management District (SCAQMD) Rule 1150 compliance plan.

- Six boreholes at Site 3 and four boreholes at Site 5 will be drilled using hollow-stem auger to a total depth of at least 5 feet above the seasonal groundwater table. The boreholes will be converted to either double- or triple-completion (depending on the depth to groundwater), 2-inch diameter vapor monitoring wells, (Table A-2-1).
- Soil samples will be collected every 5 feet during drilling solely for field screening and lithologic description. Samples will be collected in accordance with CLEAN SOP 4, *Soil Sampling* (BNI 1999b). The lithology will be described, including all soil classification information, as listed in CLEAN II SOP 3, *Borehole Logging* (BNI 1999c).
- Polyvinyl chloride (PVC) Schedule 40 casing will be used. The screen slot size will be 0.02 inch and the filter pack will be # 3 Monterey sand. The filter pack will extend to 1 foot above each screened interval. A layer of bentonite will seal off each screened interval. Concrete grout will be placed above the uppermost bentonite seal and will continue to

ground surface. The anticipated screened interval ranges and lengths are listed in Table A-1-1. Actual screened intervals will be selected based upon lithologies encountered during drilling. Screens will be designed to discreetly segregate varied lithologies wherever possible, allowing for representative sample collection through diverse permeability ranges.

- Monitoring wells will be completed above ground using an 8-inch diameter lockable anodized aluminum well monument, with a concrete pad around the monument. Additional crash protection, if required, will be provided by installing four concrete-filled, 4-inch diameter steel crash posts around the wells.
- All equipment will be decontaminated before each use in accordance with CLEAN II SOP 11, *Decontamination of Equipment* (BNI 1999d), and Section A.2.4 of this document.

Table A.2-1 Proposed Perimeter Vapor Well Specifications

Well ID	Diameter	Estimated Screen Depth (feet)
03PGW01	2-inch; Dual casing	9–10 22–23
03PGW02	2-inch; Dual casing	9–10 24–25
03PGW03	2-inch; Dual casing	9–10 27–28
03PGW04	2-inch; Triple casing	5–6 15–16 29–30
03PGW05	2-inch; Triple casing	9–10 24–25 39–40
03PGW06	2-inch; Triple casing	9–10 24–25 34–35
05PGW01	2-inch; Triple casing	9–10 24–25 34–35
05PGW02	2-inch; Triple casing	9–10 24–25 34–35
05PGW03	2-inch; Triple casing	9–10 24–25 34–35
05PGW04	2-inch; Triple casing	9–10 24–25 34–35

A.2.5 PERIMETER VAPOR WELL SAMPLING

Four rounds of sampling are planned, prior to the implementation of the remedial design, for fixed gases (including methane) and total VOCs. The sampling procedures will be as follows:

- Samples will be collected using a vacuum pump and Tedlar bags, in a sampling chamber, for total VOC analysis, using FID/PID in the field.
- Samples will be collected using a vacuum pump and Tedlar bags in a sampling chamber for measurement of fixed gases (including methane). A site-specific purge volume versus sample concentration test (using a multi-gas meter [GA 90]) will be initially performed to

evaluate the appropriate volume of vapor to be purged from each casing prior to sample collection.

- The initial two rounds will also be analyzed at a subcontract laboratory for target VOC analytes by modified TO-14 and fixed gases by ASTM D1945.

Well casings will be purged of the requisite volume, at a flowrate of 100 milliliters per minute (ml/min). The vacuum pump will be removed and the Tedlar bags filled using an evacuated sampling chamber.

A.2.6 SURVEYING

The landfill boundary will be located with a survey stake placed adjacent to the trench. The stake will be placed at the location of the observed lateral limit of waste delineated within the trench. The depth of the trench and refuse limit will be referenced to a point on the survey stake. Following this, a land surveyor will locate and map the test pits based on the stakes. A plan view of the horizontal limits will be prepared for use on design drawings.

A survey will be conducted using Third-order, Class I accuracy. Horizontal control to the nearest 0.1 foot (northings and eastings) will be tied to the State Plane Coordinate System, based on the North American Datum of 1983 (NAD 83). Vertical control to the nearest 0.01 foot (elevation) will be tied to NAD 1988, mean sea level (MSL). The vertical elevation will be surveyed at a notch cut in the top of the well casing, typically on the north side of the well.

A.2.7 SAMPLING AND ANALYSIS SUMMARY

Samples of soil and soil vapor will be collected during this investigation. Methods selected are based on the data quality requirements of the project and the current technology available.

A.2.7.1 Geotechnical Analysis

Geotechnical testing of the soil samples for evaluating the in situ foundation material will be conducted for the parameters listed in Table A-2-2.

Table A.2-2: Sampling and Analysis Summary for Geotechnical Analysis

Parameter/Test	Method	Number of Samples [a]		
		Onsite Location		
		Site 3	Site 5	Total
Classification/Index Properties				
Grain-size Distribution	ASTM[b] D422/D1140	7	4	11
Atterberg limits	ASTM D4318	7	4	11
Moisture Content	ASTM D2216	7	4	11
Specific Gravity	ASTM D854	3	2	5
Engineering Properties				
Compaction	ASTM D1557	5	4	9
Triaxial Compression	ASTM D2850/D4767	3	2	5
Direct Chear[c]	ASTM D3080	3	2	5
Hydraulic Conductivity	ASTM D5084	3	2	5

Notes:

[a] Testing for engineering properties will require multiple tests (for different properties such as density, confining pressure, and drainage) on the same sample.
[b] ASTM=American Society for Testing and Materials
[c] This test method may be performed in lieu of triaxial compression testing.

A.2.7.2 Contaminant Evaluation at APHO 46

Three samples will be analyzed as presented in Table A.2-3. Samples will be collected from the surface using pre-cleaned disposable trowels and placed into 16-ounce glass jars (except for samples to be analyzed for volatile analytes, which will be collected using Encore sampling devices). Samples will be refrigerated upon collection and transported to the laboratory under chain-of-custody.

Table A.2-3: Planned Sampling and Analysis Summary for Confirmation Soil Samples

Parameter/Test	Method	Number of Samples	Field Duplicates	Total	Container	Preservative
Total Volatile Petroleum Hydrocarbons	SW5035/SW8015B	6	1	7	3 Encore	Cool 4°C
Volatile Organic Cmpds	SW5035/SW8260B	6	1	7	3 Encore	Cool 4°C
Total Extractable Petroleum Hydrocarbons	SW8270C	6	1	7	16-oz. glass	Cool 4°C
Semivolatile Organic Cmpds	SW3550B/SW8270C	6	1	7		
Metals	SW6010/7000	6	1	7	16-oz. glass	none
Dioxins/furans	SW8290C	6	1	7	16-oz. glass	Cool 4°C

Notes:
Cmpds = Compounds

A.2.7.3 Soil Vapor

Soil vapor samples will be collected from the landfill gas wells in four events at 3-month intervals. During the initial two sampling events, samples will be collected in Tedlar bags or Summa canisters and submitted for analysis of fixed gases by ASTM D1945 and VOCs by a modified TO-14 method at a subcontractor laboratory. At sample collection time, field measurements will also be collected. If the field measurements and laboratory measurements correlate and the laboratory does not identify significant concentrations, subsequent monitoring will be conducted with field instruments only. Landfill gas samples will be analyzed for total VOCs, using field PID/FID instruments, and fixed gases. Measurements will be conducted on samples collected in Tedlar bags.

Table A.2-4: Sampling and Analysis Summary for Landfill Gas Analysis

Parameter/Test	Method	Number of Samples					
		By Site				Per event	Total
		Site 3	Field Dups	Site 5	Field Dups		
VOC	Modified TO-14	15	2	12	1	30	60
Fixed Gases	ASTM[a] D-1946	15	2	12	1	30	60

Notes:
[a] ASTM=American Society for Testing and Materials
Dups=Duplicates

A.2.8 SAMPLE HANDLING

A.2.8.1 Sample Containers

The soil samples for geotechnical testing will be collected in 5-gallon buckets. Leachate samples will be collected from the existing lysimeters in 40-ml volatile organic analysis (VOA) bottles with Teflon-lined caps. Soil vapor samples will be collected in Tedlar bags.

A.2.8.2 Sample Designation

Sample containers will be labeled as follows:

1. Labels will be written in indelible ink with the following information:
   - Project name
   - Environmental Protection Agency (EPA) sample Identification (ID) number
   - Date and time of collection
   - Initials of the person collecting the sample
   - Method number or name of analysis to be performed
2. A label with adhesive backing will be affixed to each sample container.
3. The label will be covered with clear tape to secure it to the container and to prevent the ink from smearing.

EPA Sample ID Number. To facilitate data tracking and storage, all samples will be labeled with a five-character sample ID number, referred to as an EPA ID, in accordance with recordkeeping, sample labeling, and chain-of-custody procedures. The ID number for CTO 0078 is determined as follows:

LIzzz

Where,

L	The Earth Tech Long Beach Office
I	CTO 78, Remedial Design Sites 3 and 5
zzz	Chronological number, starting with 001

For example, the EPA ID number "LI030" would represent the 30th sample collected for the MCAS El Toro investigation, a project managed by Earth Tech's Long Beach office. Quality control (QC) samples will be included in the chronological sequence. If a sample is lost during shipping, a replacement sample will be assigned a new EPA ID number. If different containers for the same sample are shipped to the laboratory on different days, a new EPA ID number must be assigned. All sample identification numbers will be recorded in field logs, records, and a database to ensure traceability of the sample to the designated location or site.

Samples will also be assigned an Earth Tech sample ID, which will be recorded in field logs and databases. A descriptive sample ID number will specify the location, sequence, matrix, and depth, as follows:

#-bbcc-dde-Dfff

Where,

Site number
bb Location ID (e.g., 01, 02, 03)
cc Sample type and matrix (see Table A.2-5)
dd Chronological sample number from a particular sampling location (e.g., MW01, SB02, DP03)
e Sample or QC identifier (see Table A.2-6)
D The letter "D" denotes depth.
fff Depth of sample in feet below ground surface (bgs). For field blanks and equipment rinsates, the depth field will contain the month and date of collection.

Table A.2-5: Character Identifiers

Identifier	Sample Type	Matrix
SS	Surface soil	Soil
TS	Trench soil	Soil
LL	Landfill leachate	Water
LG	Landfill gas	Vapor
QS	Field QC	Soil
QW	Field QC	Water
QG	Field QC	Vapor

Table A.2-6: QC Identifiers

Identifier	QC Sample Type	Description
S	Normal sample	All non-field QC samples
D	Duplicate	Co-locate (adjacent liners or locations)
E	Equipment rinsate	Water
F	Field blank	Water
X	Blind spike	Performance evaluation sample

A.2.8.3 Sample Custody

Sample lids and caps will be covered with custody seals. All samples will be recorded on the chain-of-custody (COC) forms in accordance with CLEAN II SOP 10, *Sample Custody, Transfer and Shipment* (BNI 1999e). Samples will be shipped or delivered within 24 hours to allow the laboratory to meet holding times for analysis.

Two copies of the COC forms will be placed in an adhesive plastic pouch and taped on the inside of each sample cooler. The coolers will then be sealed with waterproof tape and labeled "Fragile," "This End Up," (or with directional arrows pointing up) and with other appropriate notices. Coolers will also have custody seals placed on them to prevent tampering.

Upon receipt, the laboratory will sign and retain copies of the air bill. A list of analyses to be performed and a space to record sample condition upon receipt are located on the COC record. The laboratory representative will sign the COC form and record the temperature of the samples or

cooler on the COC form and on the Sample Condition Upon Receipt form. All samples requiring preservative will be checked for proper preservation by measuring pH upon receipt (except for VOC samples). In the event of breakage or discrepancies between the COC form, sample labels, and requested analysis, the sample custodian will notify the laboratory project manager. A nonconformance report will be completed, and the project chemist will be notified within 24 hours. At the time of notification, corrective action will be chosen. The sample custodian will enter the information into the laboratory system, and a log-in confirmation sheet will be sent to the project chemist within 48 hours. The laboratory will send the project chemist a written declaration of the samples in each sample delivery group.

Hazardous Materials Shipment. Hazardous materials, as defined by the Department of Transportation (DOT), are not expected in the course of this project. Shipment of soil samples is not expected to exceed the minimum quantities for hazardous materials handling. The field team leader has been trained to recognize hazardous or dangerous goods and will notify the CTO manager of such issues prior to shipping.

A.2.9 EQUIPMENT DECONTAMINATION

All non-consumable equipment that comes into contact with potentially contaminated soil will be decontaminated in accordance with CLEAN SOP 11, *Decontamination of Equipment* (BNI 1999d). Equipment will be decontaminated by steam cleaning or by a non-phosphate detergent scrub, followed by freshwater and distilled or deionized water rinses. Decontamination will take place on pallets or on plastic sheeting. Clean equipment will be stored on plastic sheeting in an uncontaminated area. Equipment stored for an extended period will also be covered by plastic sheeting.

All consumable equipment (e.g., gloves, disposable bailers) and liquid and solid wastes (e.g., purged water, decontamination water, and soil cuttings) will be treated as potentially hazardous and discarded in accordance with the procedures prescribed in Section A.2.10.

The field team and backhoe operator will perform personnel decontamination prior to leaving the work site at the conclusion of each workday, following procedures described in the *Health and Safety Plan (HSP)* (Earth Tech 2001).

A.2.10 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) consists of all materials generated during this investigation that may be contaminated with landfill constituents of concern. It is anticipated that field investigation will generate nonhazardous wastes, including but not limited to the following:

- Soil and refuse
- Decontamination water
- Disposable personnel protection and sampling equipment

Investigation-derived waste will be properly classified, labeled, managed, and disposed of in accordance with U.S. EPA Guidance and CLEAN II SOP 22, *IDW Management* (BNI 1999f) will be followed. If the IDW generated during sampling is determined to be regulated by the Resource Conservation and Recovery Act (RCRA), then RCRA storage, transportation, and disposal requirements may apply. In general, proper implementation of IDW procedures requires CTO managers, field managers, and their designates to perform the following tasks:

- Minimize IDW as it is generated.
- Segregate IDW by matrix and source location.
- Follow proper procedures for IDW drum handling and labeling.
- Prepare an IDW drum inventory.
- Update and report changes to the IDW drum inventory.

Soil. Soil excavated during trenching will be stockpiled on site. Surface and subsurface soil stockpiles will be segregated. Once sampling in each trench is completed, excavated soil will be returned to the trench. Soil from the lower part of the trench will be returned first, followed by soil from the upper 2 feet.

Disposable Sampling and Personal Protective Equipment (PPE). If, based on the best professional judgment of the field manager, the PPE and disposable sampling equipment can be rendered nonhazardous after decontamination procedures, then this equipment will be collected in double plastic bags and disposed of off site as municipal waste. Equipment that is potentially contaminated will be stored in drums, labeled, inventoried, and disposed of as hazardous waste. All waste materials generated in the support zone are considered non-IDW trash and will be properly disposed of as municipal waste.

A.3 QUALITY ASSURANCE PROJECT PLAN

The QAPP has been prepared in accordance with the requirements and specifications of the following:

- U.S. Naval Facilities Engineering Command, Southwest Division, *Environmental Work Instructions* (EWI) EWI #1 "Chemical Data Validation" (SWDIV 2001)
- EWI #2 "Review, Approval, Revision, and Amendment of Field Sampling Plan and Quality Assurance Project Plan" (SWDIV 2001)
- EWI #3 "Laboratory Quality Assurance Program" (SWDIV 2001)
- Navy Installation Restoration Chemical Data Quality Manual, (NFESC 1999)

Project data quality will be assured through internal (field and laboratory) and external (second-party review and validation) processes designed to meet measurement quality objectives.

A.3.1 PROJECT MANAGEMENT

A.3.1.1 Tasks

All tasks associated with CTO-0078, including the remedial design, are summarized in Table A-2-1. Tasks that are related to project planning, field investigation, meetings, and data evaluation are applicable to this pre-design investigation.

Table A.3-1: CTO-0078 Task Summary

Project Planning (SOW Task 1)	Field Investigation (SOW Task 4)	Meetings (SOW Task 9)
Task 20- Project Planning Task 21- Planning Documents Task 23- Sampling and Analysis Plan (SOW Task 2) Task 24- Heath and Safety Plan (SOW Task 3)	Task 30- Field Investigation Task 25-Investigation-Derived Waste (IDW) Management Task 46- Offsite Chemical Analysis and Oversight Sampling and Analysis (SOW Task 5)	Task 11- Meetings
Data Evaluation (SOW Task 7)	**Remedial Design**	**Post Construction Award Services**
Task 50- Data Evaluation Task 51- Data Validation (SOW Task 6)	Task 81- Remedial Design	Task 84- PCAS Task 85- Submittal Review Task 88- Operation and Maintenance Manual
Report Preparation (SOW Task 8)	**Project Management (SOW Task 12)**	**Purchasing Support (SOW Task 11)**
Task 67- Remedial Action Report	Task 10- Project Management	Task 12- Purchasing Support

Notes:
SOW = statement of work
PCAS = post-construction award services

A.3.1.2 Project Organization

Figure A-2-1 identifies project team members. The following is a brief description of each team member's duties:

Remedial Project Manager (RPM). Provides governmental oversight of technical issues. Interfaces with the Base Realignment and Closure (BRAC) Cleanup Team (BCT), community representatives, and the contractor to meet project objectives.

Quality Assurance Officer (QAO). Provides governmental oversight of contractor's quality assurance (QA) program. Provides quality-related directives through the RPM. Has authority to suspend project execution if quality assurance (QA) requirements are not adequately met.

BCT. Representatives from local, state, and federal regulatory agencies who provide input to the Navy.

CTO Manager. Responsible for day-to-day management of project budgets, staffing, deliverables, and schedule. Communicates with the RPM on technical issues.

CLEAN II Program Manager. Provides management oversight of execution of the task order in compliance with the program contract.

Pacific Division Contracting Officer. Represents the government in all contractual, cost, and scheduling issues. Interfaces with RPM on performance and execution of the task order.

Program Quality Manager. Responsible for executing the contractor's QA program. Responsible for ensuring that technical standards and specifications are met for each deliverable to the client. Coordinates the peer and technical review of project deliverables and ensures that standards and QA requirements are met.

Health and Safety Manager. Ensures that all field operations are conducted in accordance with safe operating practices and in compliance with federal and state requirements.

Project Chemist. Manages analytical laboratory services. Prepares planning documents, technical specifications, and quality assurance plans for collection of data. Oversees technical performance of laboratory subcontractors.

Project Engineer. Responsible for overseeing field operations and evaluating technical data. Prepares planning documents and technical specifications for collection of data. Oversees technical performance of subcontractors.

Project Geologist. Responsible for overseeing field operations that relate to groundwater, soil vapor and soil sampling, and evaluation of technical data. Oversees technical performance of subcontractors.

Special Training Requirements. Training requirements applicable to this project are as follows:

All field personnel will have current health and safety training in accordance with the Health and Safety Plan (HSP) (Earth Tech 2001). This includes the initial 40-hour training and current 8-hour refresher training. The onsite health and safety manager will also have an additional 8 hours of supervisor training.

A.3.1.3 Schedule

The investigation will span approximately 6 months. The schedule shown on Figure A.3-2 is for planning purposes only and will be revised as needed.

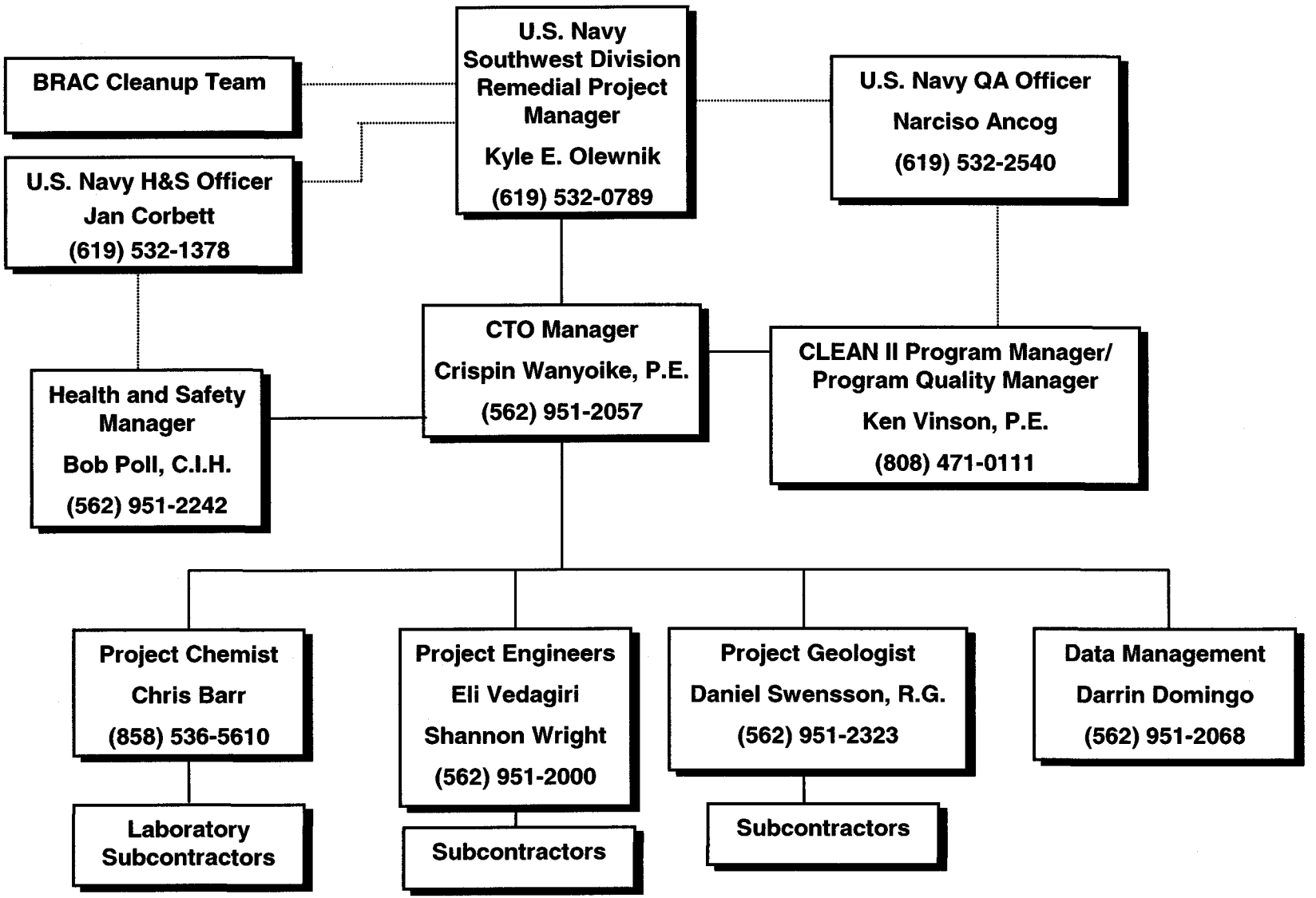


Figure A.3-1 Organization Chart

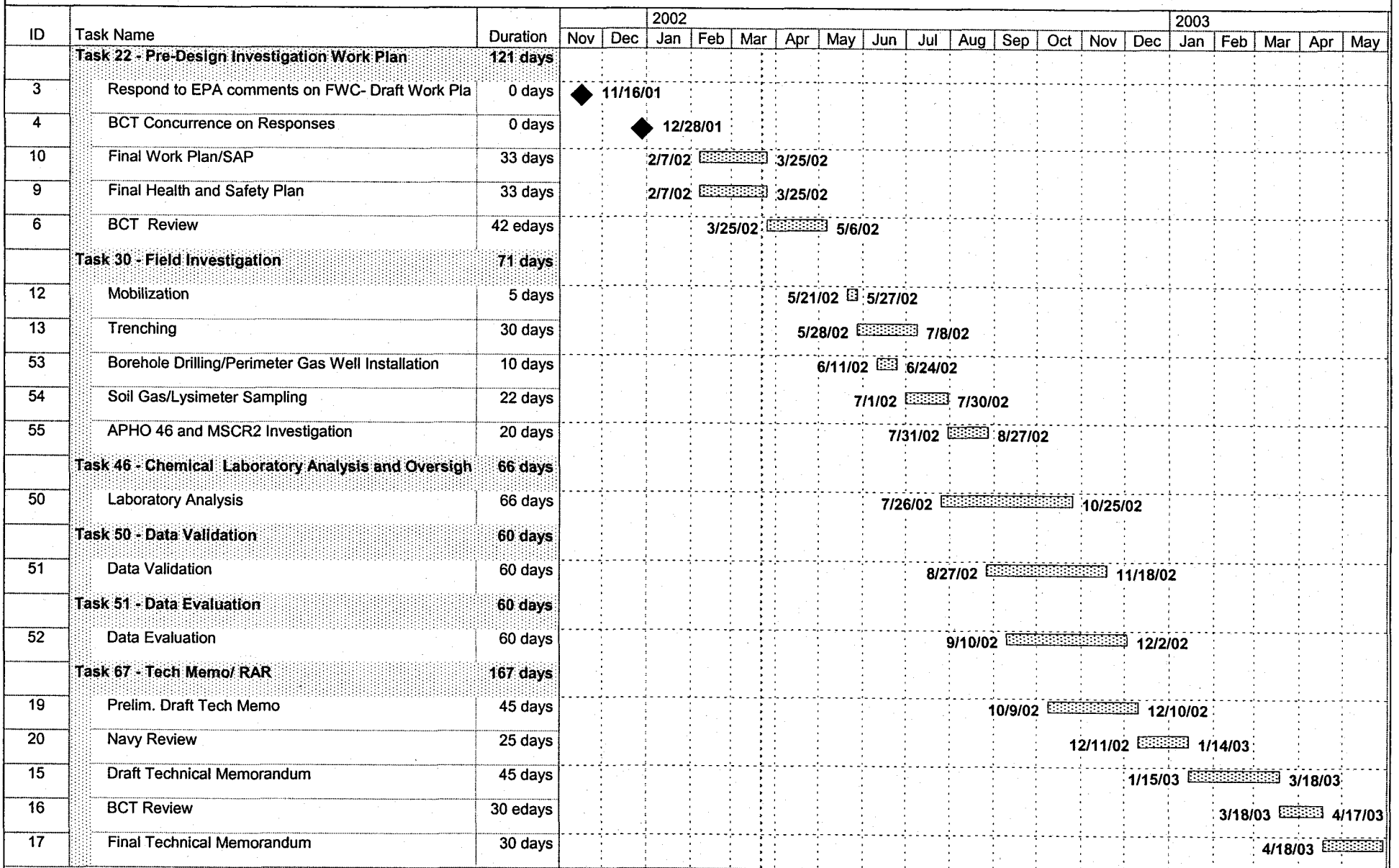
PAGE NO. A-16

THIS PAGE INTENTIONALLY LEFT BLANK

cRpt

78P2_cw

Figure A-2
Project Schedule
Pre-Design Investigation
Sites 3 and 5, Former MCAS El Toro



THIS PAGE INTENTIONALLY LEFT BLANK

A.3.2 MEASUREMENT AND DATA ACQUISITION

All samples will be collected in accordance with Navy CLEAN II Program Procedures (BNI 1999a), except as modified to meet project specific requirements and as presented in this QAPP.

A.3.2.1 Field Quality Control

To ensure sample quality, only personnel trained in sampling techniques will collect samples. Standard sample collection procedures will be followed. Field logs and notes will be reviewed by a second party in accordance with CLEAN II SOP 17, *Logbook Protocols* (BNI 1999g).

A.3.2.1.1 TRIP BLANKS

Trip blanks will be shipped with each package of samples submitted for analysis of volatile organic compounds. The trip blank will be assigned unique EPA ID and submitted for analysis. The results of the measurements will be used to assess the potential contribution of the shipping process to analytes found in the samples. Trip blanks with detectable concentrations of target analytes may be used to qualify the findings and results of associated samples.

A.3.2.1.2 TEMPERATURE BLANKS

A temperature blank will be submitted with each package in which samples are cooled and measured upon receipt at the laboratory. The acceptance criteria (4°C $\pm$ 2) will be used to qualify the results of associated samples in accordance with applicable guidance.

A.3.2.1.3 FIELD DUPLICATES

Due to the limited scope of the sampling program, field duplicates for soil samples are not warranted. Soil vapor samples will include one duplicate per ten samples.

A.3.2.1.4 EQUIPMENT RINSATE BLANKS

Equipment rinsates will be collected from reusable sampling equipment after decontamination to assess the potential contribution of cross contamination between sample locations to the results reported. Target analytes detected in equipment rinsates will be compared to analytes detected in samples and the conclusions qualified as necessary.

A.3.2.1.5 FIELD BLANKS

Field blank samples will be used to characterize any contribution from the water used for decontamination of equipment and may qualify the assessment of the results based on the equipment rinsates. Since the soil vapor samples are collected using dedicated equipment, no field blanks are required.

A.3.2.2 Laboratory Analytical Methods and Requirements

Laboratory services will be contracted under the Navy CLEAN II subcontracting system, which has master services agreements (MSAs) with Naval Facilities Engineering Service Center (NFESC)-evaluated (and approved) laboratories qualified to perform work for this project. The MSAs specify the work to be performed, which shall be done in accordance with the referenced method and the Navy Installation Restoration Chemical Data Quality Manual *(IRCDQM)* (NFESC 1999).

A.3.2.2.1 VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds will be analyzed in accordance with EPA Method 8260B, using sample collection and preparation in accordance with EPA 5035 for soil and 5030B for water. The analytes will be compounds on the contract laboratory program (CLP) target list.

A.3.2.2.2 VOLATILE PETROLEUM HYDROCARBONS

Volatile hydrocarbons will be evaluated for the approximate carbon range C6 through C12, using purge and trap followed by gas chromatography. Samples will be analyzed in accordance with EPA Method 8015B for soil and water, prepared in accordance with EPA 5035.

A.3.2.2.3 EXTRACTABLE PETROLEUM HYDROCARBONS

Extractable hydrocarbons will be evaluated for the approximate carbon range C10 through C36, using extraction and gas chromatography. Samples will be analyzed in accordance with EPA Method 8015B for soil.

A.3.2.2.4 SEMIVOLATILE ORGANIC COMPOUNDS (SVOCS)

Samples will be analyzed for SVOCs in accordance with EPA Method 8270C. The analytes will be compounds on the CLP target list.

A.3.2.2.5 METALS

Samples will be analyzed for metals by trace inductively coupled plasma (ICP) EPA Method 6010, except where an alternative method will be needed to achieve the target reporting limits in the sample matrix. Samples will be analyzed for CLP target list metals by SW6010 or 7000 series methods. Soils will be prepared in accordance with 3050.

A.3.2.2.6 DIOXINS AND FURANS

Samples will be analyzed for dioxins and furans in accordance with EPA Method 8290C. Target compounds will be analytes found in the World Health Organization (WHO) list of compounds (WHO 1997).

A.3.2.2.7 VOCS IN LANDFILL GAS

Analysis of soil gas samples will be performed (at a subcontract laboratory) in accordance with modified EPA Method TO-14 (EPA 1996). EPA Method TO-14 offers use of either nonspecific detectors (electron capture detectors) or a mass spectrometer. The detector selection will be based on laboratory capabilities and costs.

A.3.2.2.8 FIXED GASES

Analysis of the initial two rounds of soil gas samples for fixed gases are shown in Table A-2-3 in accordance with ASTM D1945.

A.3.2.3 Quality Control Requirements

All laboratory measurements will be performed in accordance with the Navy's *IRCDQM* (NFESC 1999) and the Earth Tech MSA. The laboratory is required to have an approved QA program with current SOPs for each method performed.

The laboratory will perform the following quality control analyses in accordance with the cited methods:

- Method or reagent blanks
- Matrix spikes
- Duplicates or matrix spike duplicates
- Surrogates
- Blank spikes or laboratory control samples

The values shown in Table A-3-2 will be used to validate the data and assess the acceptability for the project goals. Laboratory-derived acceptance criteria will be used if the criteria are narrower than those presented in Table A-3-2, or if not, they will be developed in accordance with the published method to represent realistic operational criteria.

Table A.3-2: Project Quality Control Criteria for Soil Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Total Volatile Petroleum Hydrocarbons (Extraction: SW5035; Analysis: SW8015B) (mg/kg)					
Volatile Petroleum Hydrocarbons	10	10	28	71–127	72–124
Total Extractable Petroleum Hydrocarbons (Extraction: SW3550B; Analysis: SW8015B) (mg/kg)					
Extractable Petroleum Hydrocarbons	10	10	50	50–149	51–134
Volatile Organic Compounds (Extraction: SW5035; Analysis: SW8260B) (µg/kg)					
1,1,1-Trichloroethane	630,000	5	30	65–135	65–135
1,1,2,2-Tetrachloroethane	380	5	30	64–135	64–135
1,1,2-Trichloroethane	840	5	30	65–135	65–135
1,1-Dichloroethane	59,000	5	30	62–135	62–135
1,1-Dichloroethene	54	5	29	69–127	71–125
1,2-Dichloroethane	350	5	30	58–137	58–137
cis-1,2-Dichloroethene	43,000	5	30	65–135	65–135
trans-1,2-Dichloroethene	63,000	5	30	65–135	65–135
1,2-Dichloropropane	350	5	30	60–135	60–135
2-Butanone	7,300,000	100	50	50–150	50–150
2-Hexanone	--	50	50	50–150	50–150
4-Methyl-2-pentanone	790,000	50	50	50–150	50–150
Acetone	1,600,000	100	50	35–165	35–165
Benzene	650	5	22	75–119	76–118
Bromodichloromethane	1,000	5	30	65–135	65–135
Bromoform	62,000	5	30	65–135	65–135
Bromomethane	3,900	5	30	62–135	62–135
Carbon disulfide	360,000	5	30	65–135	65–135
Carbon tetrachloride	240	5	30	52–135	52–135
Chlorobenzene	150,000	5	21	75–125	76–116

Table A.3-2: Project Quality Control Criteria for Soil Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Chloroethane	3,000	5	30	55–135	55–135
Chloroform	240	5	30	64–135	64–135
Chloromethane	1,200	5	30	65–135	65–135
cis-1,3-Dichloropropene	700	5	30	64–135	64–135
Dibromochloromethane	1,100	5	30	63–135	63–135
Ethylbenzene	1,500,000	5	30	65–135	65–135
Methylene chloride	8,900	5	30	65–135	65–135
Styrene	4,600,000	5	30	65–135	65–135
Tetrachloroethene	5,700	5	29	66–125	69–121
Toluene	590,000	5	21	72–126	72–126
trans-1,3-Dichloropropene	700	5	30	56–135	56–135
Trichloroethene	2,800	5	30	61–135	61–135
Vinyl chloride	150	5	30	36–144	36–144
Xylenes (total)	1,400,000	15	30	65–135	65–135
Semivolatile Organic Compounds (Extraction: SW3550B; Analysis: SW8270C) (µg/kg)					
1,2,4-Trichlorobenzene	650,000	500	61	10–132	40–116
1,2-Dichlorobenzene	900,000	500	30	32–135	32–135
1,3-Dichlorobenzene	13,000	500	30	26–135	26–135
1,4-Dichlorobenzene	3,400	500	57	15–128	38–116
2,2'-oxybis(1-Chloropropane)	2,900	500	30	36–135	36–135
2,4,5-Trichlorophenol	6,100,000	500	30	25–175	25–175
2,4,6-Trichlorophenol	44,000	500	30	29–138	29–138
2,4-Dichlorophenol	180,000	500	30	36–135	36–135
2,4-Dimethylphenol	1,200,000	500	30	35–149	35–149
2,4-Dinitrophenol	120,000	2,500	30	25–161	25–161
2,4-Dinitrotoluene	120,000	500	61	12–134	38–118
2,6-Dinitrotoluene	61,000	500	30	41–135	41–135
2-Chloronaphthalene	3,900,000	500	30	50–135	50–135
2-Chlorophenol	63,000	500	54	12–120	35–113
2-Methylnaphthalene	--	500	30	31–135	31–135
2-Methylphenol	3,100,000	500	30	25–135	25–135
2-Nitroaniline	3,500	2,500	30	40–135	40–135
2-Nitrophenol	--	500	30	34–135	34–135
3,3'-Dichlorobenzidine	1,100	500	30	25–175	25–175
3-Nitroaniline	--	2,500	30	41–135	41–135
4,6-Dinitro-2-methylphenol	--	2,500	30	25–144	25–144
4-Bromophenyl-phenylether	--	500	30	43–137	43–137
4-Chloro-3-methylphenol	--	500	58	10–126	37–113

Table A.3-2: Project Quality Control Criteria for Soil Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
4-Chloroaniline	240,000	1,000	30	35–146	35–146
4-Chlorophenyl-phenyl ether	--	500	30	41–142	41–142
4-Methylphenol	310,000	500	30	25–135	25–135
4-Nitroaniline	--	2,500	30	30–153	30–153
4-Nitrophenol	490,000	2,500	60	12–132	15–128
Acenaphthene	3,700,000	500	59	16–134	41–118
Acenaphthylene	--	500	30	37–135	37–135
Anthracene	22,000,000	500	30	35–175	35–175
Benzo(a)anthracene	620	500	30	41–143	41–143
Benzo(a)pyrene	62	25[d]	30	31–135	31–135
Benzo(b)fluoranthene	620	500	30	27–135	27–135
Benzo(g,h,i)perylene	--	500	30	25–159	25–159
Benzo(k)fluoranthene	6,200	500	30	31–135	31–135
bis(2-Chloroethoxy)methane	--	500	30	39–135	39–135
bis(2-Ethylhexyl)phthalate	35,000	500	30	34–135	34–135
bis-(2-Chloroethyl)ether	210	163 (mdl)	30	25–139	25–139
Butylbenzylphthalate	12,000,000	500	30	25–135	25–135
Carbazole	24,000	500	30	25–159	25–159
Chrysene	62,000	500	30	45–143	45–143
Di-n-butylphthalate	6,100,000	500	30	40–135	40–135
Di-n-octylphthalate	1,200,000	500	30	42–135	42–135
Dibenz(a,h)anthracene	62	25[d]	30	27–135	27–135
Dibenzofuran	290,000	500	30	25–175	25–175
Diethylphthalate	49,000,000	500	30	25–136	25–136
Dimethylphthalate	610,000,000	500	30	28–137	28–137
Fluoranthene	2,300,000	500	30	37–135	37–135
Fluorene	2,600,000	500	30	38–149	38–149
Hexachlorobenzene	200	500	30	36–143	36–143
Hexachlorobutadiene	6,200	500	30	25–135	25–135
Hexachlorocyclopentadiene	420,000	2,500	30	31–135	31–135
Hexachloroethane	35,000	500	30	25–163	25–163
Indeno(1,2,3-cd)-pyrene	620	500	30	25–170	25–170
Isophorone	510,000	500	30	25–175	25–175
N-Nitroso-di-n-propylamine	69	25[d]	30	40–135	40–135
N-Nitroso-diphenylamine	99,000	2,500	30	36–143	36–143
Naphthalene	56,000	500	30	27–135	27–135
Nitrobenzene	20,000	500	62	10–134	32–122
Pentachlorophenol	3,000	1,700	62	10–134	15–128

Table A.3-2: Project Quality Control Criteria for Soil Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Phenanthrene	--	500	30	44–135	44–135
Phenol	3,700,000	500	53	10–116	30–111
Pyrene	2,300,000	500	56	22–134	38–130
Metals (Preparation: SW 3050B; Analysis: Mercury SW 7471, all other metals SW 6010) (mg/kg)					
Aluminum	14,800	5	20	75–125	80–120
Antimony	3.06	3	20	75–125	80–120
Arsenic	6.86	0.3	20	75–125	80–120
Barium	173	1	20	75–125	80–120
Beryllium	0.669	0.2	20	75–125	80–120
Cadmium	2.35	0.2	20	75–125	80–120
Calcium	46,000	10	20	75–125	80–120
Chromium	26.9	0.5	20	75–125	80–120
Cobalt	6.98	0.5	20	75–125	80–120
Copper	10.5	0.5	20	75–125	80–120
Iron	18,400	3	20	75–125	80–120
Lead	15.1	0.3	20	75–125	80–120
Magnesium	8,370	0.5	20	75–125	80–120
Manganese	291	10	20	75–125	80–120
Mercury	0.22	0.2	20	75–125	80–120
Nickel	15.3	0.2	20	75–125	80–120
Potassium	4,890	20	20	75–125	80–120
Selenium	0.32	0.3	20	75–125	80–120
Silver	0.539	0.5	20	75–125	80–120
Sodium	405	100	20	75–125	80–120
Thallium	0.42	0.4	20	75–125	80–120
Vanadium	71.8	0.5	20	75–125	80–120
Zinc	77.9	1	20	75–125	80–120
Dioxins and Furans (Extraction: SW3550B. Analysis: SW8290C) (pg/kg)					
2,3,7,8-TCDD	3,900	500[c]	25	40–135	40–135
1,2,3,7,8-PCDD	TEFsum	2,500	25	40–135	40–135
1,2,3,4,7,8-HxCDD	TEFsum	2,500	25	40–135	40–135
1,2,3,6,7,8-HxCDD	TEFsum	2,500	25	40–135	40–135
1,2,3,7,8,9-HxCDD	TEFsum	2,500	25	40–135	40–135
1,2,3,4,6,7,8-HpCDD	TEFsum	2,500	25	40–135	40–135
OCDD	TEFsum	5,000	25	40–135	40–135
2,3,7,8-TCDF	TEFsum	500	25	40–135	40–135
1,2,3,7,8-PCDF	TEFsum	2,500	25	40–135	40–135
2,3,4,7,8-PCDF	TEFsum	2,500	25	40–135	40–135

Table A.3-2: Project Quality Control Criteria for Soil Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
1,2,3,4,7,8-HxCDF	TEFsum	2,500	25	40–135	40–135
1,2,3,6,7,8-HxCDF	TEFsum	2,500	25	40–135	40–135
1,2,3,7,8,9-HxCDF	TEFsum	2,500	25	40–135	40–135
2,3,4,6,7,8-HxCDF	TEFsum	2,500	25	40–135	40–135
1,2,3,4,6,7,8-HpCDF	TEFsum	2,500	25	40–135	40–135
1,2,3,4,7,8,9-HpCDF	TEFsum	2,500	25	40–135	40–135
OCDF	TEFsum	5,000	25	40–135	40–135
Miscellaneous analytes					
pH (units) (Method: SW9045C)	--	n.a.	n.a.	0.5 units	0.10 units

Notes:
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
pg/kg = picograms per kilogram
LCS = laboratory control sample
EPA = U.S. Environmental Protection Agency
-- = none established
MS = matrix spike
MSD = matrix spike duplicate
n.a. = not applicable
RPD = relative percentage of difference
%R = percent recovery
SW = Test Method Solid Waste (EPA 1997)
TEFsum = calculated from TEF values as TEQ
TEF = toxicity equivalency factor
TEQ = toxicity equivalency quotient
WW = Water and Waste (EPA 1983)
(mdl) = Laboratory will report to the method detection limit.
* Laboratory reporting limits are greater than the project decision thresholds; see discussion in the subsection 'Reporting Limits' below for evaluation of these analytes.
[a] For VOCs, SVOCs, explosives, dioxins, and perchlorate, the lower of California Modified preliminary remediation goals (PRGs) and EPA Region IX PRGs residential (November 2000 Update) has been used; for metals, established background threshold levels (95th quantile) have been used (BNI 1996).
[b] Laboratory-specific performance criteria.
[c] Actual dioxin reporting limits are calculated based on sample-specific internal standard recovery data.
[d] Analysis by low-level Selective Ion Monitoring.

Table A.3-3: Project Quality Control Criteria for Soil Vapor Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
Fixed Gases (ASTM D-1946) (% by volume)					
Oxygen	0.1	0.1	20	n.a	75–125
Nitrogen	0.1	0.1	20	n.a	75–125
Carbon Monoxide	0.001	0.001	20	n.a	75–125
Methane	0.001	0.001	20	n.a	75–125
Carbon Dioxide	0.001	0.001	20	n.a	75–125
Soil Vapor Analysis (modified TO-14) (µg/L)					
Dichlorodifluoromethane	1	1	20	n.a	75–125
Chloromethane	1	1	20	n.a	75–125
1,2-Dichlorotetrafluoroethane	1	1	20	n.a	75–125
Bromomethane	1	1	20	n.a	75–125
Chloroethane	1	1	20	n.a	75–125
Trichlorofluoromethane	1	1	20	n.a	75–125

Table A.3-3: Project Quality Control Criteria for Soil Vapor Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS
1,1-Dichloroethene	1	1	20	n.a	75–125
Methylene Chloride	1	1	20	n.a	75–125
1,1-Dichloroethane	1	1	20	n.a	75–125
cis-1,2-Dichloroethlene	1	1	40	n.a	60–140
Chloroform	1	1	40	n.a	60–140
1,2-Dichloroethane	1	1	40	n.a	60–140
1,1,1-Trichloroethane	1	1	40	n.a	60–140
Benzene	1	1	20	n.a	75–125
Carbon Tetrachloride	1	1	20	n.a	75–125
1,2-Dichloropropane	1	1	20	n.a	75–125
Trichloroethene	1	1	20	n.a	75–125
cis-1,3-Dichloropropene	1	1	20	n.a	75–125
trans-1,3-Dichloropropene	1	1	20	n.a	75–125
1,1,2-Trichloroethane	1	1	20	n.a	75–125
Toluene	1	1	20	n.a	75–125
1,2-Dibromoethane	1	1	20	n.a	75–125
Tetrachloroethylene	1	1	20	n.a	75–125
Chlorobenzene	1	1	20	n.a	75–125
Ethylbenzene	1	1	20	n.a	75–125
p-Xylene	1	1	20	n.a	75–125
Styrene	1	1	20	n.a	75–125
1,1,2,2-Tetrachloroethane	1	1	20	n.a	75–125
o-Xylene	1	1	20	n.a	75–125
1,3,5-Trimethylbenzene	1	1	20	n.a	75–125
1,2,4-Trimethylbenzene	1	1	20	n.a	75–125
1,2-Dichlorobenzene	1	1	20	n.a	75–125
1,3-Dichlorobenzene	1	1	20	n.a	75–125
1,4-Dichlorobenzene	1	1	20	n.a	75–125
1,2,4-Trichlorobenzene	1	1	20	n.a	75–125
Hexachlorobutadiene	1	1	20	n.a	75–125
m-Xylene	1	1	20	n.a	75–125
Benzyl chloride	1	1	20	n.a	75–125

Notes:

µg/L = micrograms per liter
LCS = laboratory control sample
EPA = U.S. Environmental Protection Agency
MS = matrix spike
n.a. = not applicable
RPD = relative percentage of difference
% R = percent recovery
MSD = matrix spike duplicate

[a] Project Decision Threshold is equal to the Reporting Limit. Decision Threshold for the hot spot determination is 300 µg/L total VOC concentration.

Table A.3-3: Project Quality Control Criteria for Soil Vapor Air Samples

Analyte	Project Decision Threshold[a]	Reporting Limit Required	Precision (RPD)	Accuracy (%R)[b]	
				MS/MSD	LCS

[b] Laboratory-specific performance criteria.

Reporting Limits. The laboratory will have current and documented reporting limits consistent with the values presented in Table A-3-2 and Table A-3-3. Reporting limits that exceed the selected decision criteria will be evaluated on an individual basis. Analytes not detected in any sample at the site or that have no reasonable expectation to be the result of site activities will not be included in further evaluation. Analytes that are identified as site chemicals of potential concern (COPCs) will be incorporated into the site evaluation and recommendations; the detection limit will be addressed as a factor in the uncertainty associated with the decision-making process.

Method Blanks. A method blank will be analyzed with every batch of 20 or fewer samples to measure laboratory contamination. The method blank will be an analyte-free matrix (water, soil vapor, or soil) that will be carried through the entire preparation and analysis procedure. If any analytes are found above reporting limits, the results of samples in the batch will be examined. Those analytes with results less than the reporting limit or greater than 10 times the concentration in the method blank will be accepted. Other samples will be reanalyzed in another batch. Consistent presence of contamination will require investigation and correction.

Laboratory Control Samples. A LCS will be analyzed with every batch of 20 samples or fewer for accuracy. The LCS will consist of a method blank spiked with a known amount of analyte that will be carried through the entire preparation and analysis procedure. The LCS source will be different from that used to prepare calibration standards. Analytes used for the LCS will comply with the method requirements. Control charts may be used, and control limits will be calculated based upon historical data. When control limits are exceeded, the analysis will be stopped, and the problem corrected. Samples associated with the out-of-control LCS will be reanalyzed in another batch, unless documented evidence is presented to show that associated samples were not affected. Guidance limits for the LCS listed in Table A.3-2 and Table A.3-3 will be used unless more restrictive laboratory-specific limits are established or statistically based limits are developed.

Matrix Spikes. A MS will be analyzed for at least one out of every 20 soil samples to measure matrix effects on accuracy. The MS will consist of additional aliquots of sample spiked with a known amount of analyte. Compounds to be spiked will be in accordance with the laboratory SOP or the published method. Guidance limits for the MS listed in Table A-3-2 and Table A-3-3 will be used unless more restrictive laboratory-specific limits are established. If the analyte concentration in the sample is greater than twice the amount of spike added, the spike will be considered invalid and the recovery will not be calculated. If a valid spike recovery exceeds acceptance limits but the LCS is in control, matrix interference is indicated.

Duplicates or Matrix Spike Duplicates. A duplicate or a matrix spike duplicate (MSD) will be analyzed for at least one out of every 20 samples to measure precision. For any batch of samples that does not contain a duplicate or MSD (i.e., when insufficient sample is available), two LCSs may be used. However, every effort will be made to provide a sufficient amount of sample for laboratory QC. If the RPD does not meet the established acceptance limits, the problem will be investigated and corrected. Any affected samples will be reanalyzed in a separate batch. Acceptance limits for duplicates and MSDs listed in Table A-3-2 and Table A-3-3 will be used unless more restrictive laboratory-specific limits are established or statistically derived limits are developed.

Surrogates. Surrogate spikes will be added to soil samples for organic analyses to measure sample-specific accuracy. Surrogate spike acceptance criteria are developed by the laboratory and will be provided with the data package.

A.3.2.4 Calibration and Preventive Maintenance

The laboratory is required to document calibration procedures in accordance with Appendix C, Section 5.9.4 of the Navy *IRCDQM* (NFESC 1999). Calibration procedures will be consistent with specified method requirements.

The laboratory will perform preventive maintenance on instruments used to analyze project samples and will keep records of all such maintenance in accordance with Section 5.8 of Appendix C of the *IRCDQM*. Preventive maintenance documentation is incorporated into laboratory certification requirements and is an element of the subcontractor laboratory quality assurance plan, which will be reviewed and approved prior to selection of a CLEAN II subcontractor laboratory.

A.3.2.5 Acceptance Requirements for Supplies and Consumables

Supplies and consumables that have the potential to effect data quality will include sample containers and preservatives. All sample containers and preservatives will be provided by the laboratory. The laboratory will track sample container and preservative sources and ensure that the containers are free from contamination. Field blanks will serve as an independent verification of consumable integrity.

Consumables used in sample collection include the tubing installed in each well. New materials in original packaging from the supplier will be used and selected on the basis of being appropriate for the application.

A.3.2.6 Data Management

The laboratory will verify, reduce, and report data as specified in their laboratory QA plan and in accordance with the laboratory SOW. Both hard copy and electronic data deliverables (EDDs) will be required within 30 days of sample receipt. The format for both hard copies and EDDs is specified in the subcontract. Hard copy data will be delivered on CLP-like forms, along with a case narrative, table of contents, and raw data for Level IV QC deliverables.

Printed laboratory reports will be received and reviewed for completeness and compliance with the laboratory SOW. The project chemist will immediately review the case narrative and report to project management any issues that may effect the project conclusions or schedule. The project chemist will also ensure that appropriate copies are provided to technical staff, data validation personnel, and the CTO manager.

Electronic data deliverables will be received on diskettes or through electronic mail in the format specified in the analytical laboratory technical specifications. Electronic data deliverables will be loaded into a database management system and checked for completeness and errors. Part of this check involves verifying that all requested analyses for each sample are performed and reported. This may be accomplished by comparing the delivered results to those recorded electronically. If errors are encountered or data are not complete, the laboratory will be notified and data will be resubmitted. If only minor errors or omissions are encountered, data management personnel will manually correct the data, but the laboratory will be notified so that it can correct the problems for future projects. Once in the database, the records will be made accessible to project personnel.

The electronic data versus hard copy data will be manually verified for the entire project. Final data tables will be compared to the database to verify the output.

Computer files will be backed up daily to avoid loss of information. Hard copy data will be stored in secure areas, while electronic data will be stored in password-protected files, with read-only access to users who do not have authorization to edit the data. The data will be stored for 10 years after the close of the contract, in accordance with SWDIV Procedures.

A.3.3 PROJECT QUALITY ASSURANCE OVERSIGHT

Samples will be submitted to an NFESC-evaluated and approved laboratory for analysis by methods cited in Table A-2-2 and Table A-2-3. The laboratory will also be certified by the California State Environmental Laboratory Accreditation Program (ELAP). Laboratory data quality strategies and criteria were developed in accordance with the project data quality objectives (DQOs) and the following references:

- *Navy Installation Restoration Chemical Data Quality Manual* (NFESC 1999)
- *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods* (SW846) (EPA 1997)
- *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis* (EPA 1999a)
- *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis* (EPA 1999b)

System and performance audits are a fundamental element of the QA process and are the tool used to demonstrate compliance with data quality requirements.

Overall responsibility for implementation and monitoring of the Earth Tech QA program resides with the CLEAN II project quality manager. The CLEAN II project quality manager and the CTO manager will be responsible for reviewing the technical contents of all submittals required under this project. The QA activities applicable to this CTO are described in SOPs (BNI 1999a). The Earth Tech peer review program will be followed during this project.

A.3.3.1 Field Audits

The project chemist is anticipated to visit the site during fieldwork to assess field practices for compliance with procedures and requirements. Documentation of the review shall be included in the project files.

A.3.3.2 Laboratory System Audits

Laboratories solicited for this project are required to have successfully completed evaluation by the NFESC. Further evaluation of laboratory performance will be through data package reviews and oversight by the project chemist.

A.3.3.3 Laboratory Performance Review

Continual laboratory performance reviews will be conducted for the project. These will consist of the following tasks:

- Internal laboratory oversight by laboratory QA manager

- Frequent progress reports and discussions between the project chemist and the laboratory project manager
- Project chemist oversight of deliverables and reports
- Desktop evaluation of reports and data packages
- Data validation, as discussed in Section A.3.4.2.

A.3.3.4 Corrective Actions

Corrective action requests will be issued and tracked by the project chemist when deficiencies or instances of noncompliance are noted, whether in field audits or laboratory evaluations. These findings will be resolved in a timely manner, typically within 30 days, by the project manager and documented in the project file. Findings that affect the collection or interpretation of project data will be noted in the laboratory case narrative and, as necessary, the pilot test report.

A.3.3.5 Reports to Management

Documentation of audits, copies of audit checklists, and copies of corrective action reports will be included in project files to be reviewed during management evaluation of project progress. Significant corrective actions, which are identified as having a direct effect on data quality or project completion, will be addressed by the CTO manager in writing to the program manager.

A.3.4 DATA VALIDATION AND USABILITY

All data developed in the course of the project will be evaluated for usability and compliance with measurement quality objectives. Field data will be tabulated and presented in the context of the data gathering activity. Laboratory data will be validated as specified below in accordance with the project DQO's and SWDIV's environmental work instructions.

A.3.4.1 Desktop Data Review

Upon receipt, all field data will be reviewed by the field manager and project manager for internal consistency and completeness. Laboratory data will be reviewed by the project chemist and the project geologist for applicability to the assessment of the site.

A.3.4.2 Data Validation

The data validation strategies presented in the SWDIV EWI #1 specify that investigations at National Priorities List (NPL) sites will be subject to a minimum of 20 percent Level IV validation, with the remainder of the data subject to Level III validation.

Due to the nature of the validation process, Level III and IV data validation will be performed on complete sample delivery groups, i.e. all samples in a package will be validated at Level III or IV as assigned. This may result in a higher percentage of Level IV validated data than planned, but the approach will save in management and tracking resources.

A.3.4.2.1 LEVEL III VALIDATION

A minimum of Level III validation, as described in SWDIV EWI #1, will be performed on all samples collected during the investigation. Systematic concerns identified in Level III may be cause for additional Level IV review. Such review will be conducted until a return to compliance is verified.

A.3.4.2.2 LEVEL IV VALIDATION

Level IV validation will be performed on at least 20 percent of the samples, typically the first data packages submitted by the laboratory. The Level IV validation is intended to identify whether any significant, systematic errors are present in the laboratory procedures or processes. If the Level IV validation identifies systematic errors, the laboratory will be required to initiate corrective action and ensure that such errors are corrected.

A.3.4.3 Data Usability

The final report will summarize the data validation findings, indicating the processes and findings of the review process. Data reported in the project report will be flagged with appropriate qualifiers to indicate the usability.

Data may be assigned the following qualifiers:

- J estimated concentration
- N presumptive evidence of the identification of an analyte
- R rejected data (unusable)
- U not detected (e.g., not present because of blank contamination)

Combinations of qualifiers such as UJ and NJ are possible. Where the validation qualifiers affect the project decision recommendations, the report will discuss the issue and the necessary corrective action.

A.4 REFERENCES

Bechtel National, Inc. (BNI). 1996. *Final Technical Memorandum, Background and Reference Levels, Remedial Investigations*. San Diego, CA.

———. 1999a. *CLEAN II Program Procedures Manual*. San Diego, California.

———. 1999b. CLEAN II SOP 4, *Soil Sampling*. San Diego, California.

———. 1999c. CLEAN II SOP 3, *Borehole Logging*. San Diego, California.

———. 1999d. CLEAN II SOP 11, *Decontamination of Equipment*. San Diego, California.

———. 1999e. CLEAN II SOP 10, *Sampling Custody, Transfer, and Shipment*. San Diego, California.

———. 1999f. CLEAN II SOP 22, *IDW Management*. San Diego, California.

———. 1999g. CLEAN II SOP 17, *Logbook Protocols*. San Diego, California.

Earth Tech. 2001. *Health and Safety Plan, Pre-Design Investigation, Remedial Design, IRP Sites 3 and 5, Marine Corps Air Station, El Toro, California*. Honolulu, Hawaii. February.

Environmental Protection Agency (EPA). 1983. (Water and waste; refernced in Table A-2-2)

———. 1996. *Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air*. EPA/625/R-96/010b. Cincinnati, OH. January.

———. 1997. Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (SW846). Washington D.C.

———. 1999a. Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis. Washington D.C. October.

———. 1999b. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics*

———. 2000. *Environmental Protection Agency Region IX, Preliminary Remediation Goals*. November.

Naval Facilities Engineering Command, Southwest Division (SWDIV). 1999. *Preliminary Data, Quarterly Sampling Results, August*. San Diego, California.

———. 2001. *Environmental Work Instructions (EWI)*. San Diego, California. November.

Naval Facilities Engineering Service Center (NFESC). 1999. *Navy Installation Restoration Chemical Data Quality Manual (IR CDQM)*. NFESC Special Report SP-2056-ENV. Port Hueneme, CA. September.

Roy F. Weston (Weston). 2000. *Draft Radiological Survey Plan, MCAS El Toro*. Vallejo, CA. July.

World Health Organization (WHO). 1997. *Toxicity Equivalent Factors* (TEF). Geneva.

Appendix B
Response to Comments
For Draft Project Work Plan Pre-Design Activities
At Installation Restoration Sites 3 and 5. OU 2C
MCAS El Toro, California
(FWEC 1999)

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
This set of response to comments only addresses comments pertaining to the Pre-Design Investigation for IR Sites 3 and 5. These responses have been prepared by the new Remedial Design Contractor (Earth Tech). Following resolution of these comments, Earth Tech will prepare a Final Pre-Design Work Plan for Sites 3 and 5.			
GENERAL COMMENTS			
1.		The overall process as described on Section 4.6 ....UXO...	The document that was reviewed included debris disposal at Site 1. The Final Work Plan will only address the pre-design investigation for Sites 3 and 5. Responses to comments pertaining to Sites 3 and 5 are provided here.
2.		The proposed trench spacing does not adequately evaluate the potential location and perimeter of the landfills for Site 3 and Site 5. Investigation locations spaced 250 feet apart at Site 3 are potentially too far apart. Six trenches for investigation of approximately 2500 feet of landfill perimeter at Site 5 seem to be inadequate. Experience with other landfill perimeter evaluations has shown that waste limits must be investigated on a maximum 50-spacing, particularly around landfill corners or curves and nearby structures or physical features, to observe waste placed in any "fingers" or similar small features. A 50-foot spacing is recommended for most landfills where records are not available specifying the locations where waste was placed. This spacing is related to the approximate dimension of four truck widths, observed as a minimum operational effort in a typical landfill when waste is placed with mechanized equipment. Efficiencies may be gained by phasing the investigations for 200-foot spaced initial trenches, which may be elongated to chase the waste edge as necessary, then secondary trenches at the 50-foot final spacing. This phased method allows for much more exact location of the secondary trenches, limiting length and disturbed waste, while being definitive in the evaluation. Please revise the work plan to provide an adequate waste delineation plan that includes trenching at no more than 50-foot intervals or show reason why the proposed approach will be adequate to delineate the waste at the site.	An initial test pit spacing of 200 feet, as recommended by the EPA, has been implemented. For more details, see the attached Trench Excavation Decision Narrative and Flowchart in Appendix C.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
3.		No criterion for waste identification is provided in the work plan. While some generalized description about suspect material is included in the trenching description, no criterion is given about composition, thickness, frequency, or consistency. The landfills contain wastes, which are reported to have been burned; therefore, identification methods for ash within soil materials should be described. Experience with landfill investigations has shown that significant interpretation is required to assess whether localized "lenses" are thin, discontinuous layers of the main waste body or simply windblown litter or other small waste volume that was covered separately from the main landfill.	Trenching with a backhoe allows for relatively large excavation faces to be exposed and be waste boundaries better observed by the geologist or engineer. The field geologist will log each test pit to identify the limits of waste/fill (including visual identification of any ash-like or charred materials) and native material and will also record the makeup and approximate percentages of various wastes. To assess whether localized lenses, if encountered, are part of the main waste body, the field geologist/engineer will estimate the amount (by volume) of the refuse material mixed with the soil. If 20% (or greater) of refuse material is present, then it will be considered to be part of the main waste body. It should be noted in this context, that the remedial design would have a provision for the cover to extend approximately 10 feet beyond the confirmed waste placement limits. This response is presented in the Trench Excavation Decision Flowchart and Narrative located in Appendix C.
4.		Please revise the work plan to provide an indication of what the waste delineation data will be used for. If the Navy intends to excavate all of the waste at some point in the future, a detailed understanding of the extent of waste is probably not required at this time. If the Navy intends to cover the waste, then a detailed understanding of the extent of the waste is required and it should be obtained during the activities to be conducted under this work plan.	The waste delineation data will be used to confirm the approximate limits of the landfill delineated in the RI and for the design of the landfill cap. This data will enable a detailed understanding of the extent of waste.
SPECIFIC COMMENTS			
5.	3.1.1.1	Section 3.1.1.1 describes anomalies determined by the geophysical investigations for Site 3. No anomalies are shown on Figure 4. Please revise Figure 4 to show all anomalies found.	Anomalies identified during the RI that may intersect the landfill boundary at Site 3 has been added to Figure 2-3 (of the Final Work Plan) and evaluated, where possible, to confirm the lateral and vertical extent of waste/fill material.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
6.	3.1.1.1	Section 3.1.1.1 contains a description of a feature interpreted in the geophysical investigations for Site 5 as a buried utility. However, this feature is not shown on Figure 5, the Site 5 site plan. Please revise Figure 5 to include the feature interpreted as a buried utility.	Figures 2-2, 2-4, and 3-2 (of the Final Work Plan) have been revised to include the buried utility (interpreted). In addition, utility plans have been reviewed and used to confirm the presence of the buried utility.
7.	3.1.2.1 & 3.1.2.2	Section 3.1.2.1 and Section 3.1.2.2 describe air sampling and soil gas surveys performed at Site 3 and Site 5, respectively, that reported several different VOCs. Many of these VOCs are not addressed in the health and safety plan, nor are they described as potential chemical hazards for the trenching operation. Please revise the Work plan and the health and safety plan to address all of the reported VOCs.	Many of the VOCs identified during the RI were not included in the Health and Safety Plan because they were found in soil gases at levels well below those, which would have presented occupational exposure risks, especially in an outdoor environment. The revised Site-Specific Health and Safety Plan has a monitoring program, using a PID/FID with specific action levels for upgrades of PPE and speciation of selected high occupational hazard VOCs, using draeger tubes.
8.	3.2	Section 3.2 describes the project approach, including the proposed trench spacing. As described, the trench explorations are too far apart. See General Comment 2. Please revise text and approach for trench exploration spacing of 50 feet or less.	Please refer to the responses to General Comment #2, and the attached Trench Excavation Decision Narrative and Flowchart in Appendix C.
9.	3.2	Section 3.2, Paragraph 7 contains description of the trench explorations as having a maximum length of 20 feet. This description does not match what is shown on the site plans, Figure 4 and Figure 6. Also, 20 feet is both too short and too restrictive for trench lengths in a landfill waste investigation. Experience has shown that a 20-foot length may significantly misinterpret the waste occurrence at a landfill, judging many wastes to be either wholly continuous or completely absent, depending on the observation. Please revise the text to accommodate whatever trench length is necessary to determine an accurate assessment of waste occurrence. It is recommended that the trenches be continued until at least 40 feet of undisturbed soil outboard of the waste footprint have been uncovered. This length of undisturbed soil is recommended, as the Navy cannot be sure of the distance between disposal trenches at the landfill. Additionally, please revise Figures 4 and 6 to accurately match the text description.	Please refer to the responses to General Comment #2, and the attached Trench Excavation Decision narrative. Test pits in lieu of long trenches will be used to confirm existing waste. Once the lateral extent is established, (i.e., test pit/trench with native soils) the trenches will be advanced to connect the two test pits to establish the transition from landfill waste to native soils. Additionally, the trench will be extended 40 feet from the waste/native soil interface to confirm that no disposal trenches lay beyond the first encountered waste/native soil interface.
10.	4.5	Section 4.5 does not address the buried utility interpreted from the geophysical investigation of Site 5. Please revise the text to include a description of the anomaly and its location.	The buried utility interpreted from the geophysical investigation of Site 5 has been described and addressed in Section 2.2.2 of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
11.	4.6	Section 4.6, page 4-3, second sub-paragraph, fourth sentence: Large scrap metal items should be ...	The document that was reviewed included debris disposal at Site 1. The Final Work Plan will only address the pre-design investigation activities for Site 3 and 5. Responses to comments pertaining to Sites3 and 5 are provided here and will be incorporated upon concurrence.
12.	4.6	Section 4.6, page 4-3, second sub-paragraph, and fifth sentence: UXO material encountered should not be	The document that was reviewed included debris disposal at Site 1. The Final Work Plan will only address the pre-design investigation for Sites 3 and 5. Responses to comments pertaining to Sites 3 and 5 are provided here.
13.	4.6	Section 4.6, page 4-3, second sub-paragraph, ninth and twelfth sentences: Any UXO items that remain ...	The document that was reviewed included debris disposal at Site 1. The Final Work Plan will only address the pre-design investigation for Site 3 and 5. Responses to comments pertaining to Sites 3 and 5 are provided here.
14.	4.6	Section 4.6, page 4-4, seventh sub-paragraph, ninth and twelfth sentences: There is a potential for ...	The document that was reviewed included debris disposal at Site 1. The Final Work Plan will only address the pre-design investigation activities for Site 3 and 5. Responses to comments pertaining to Sites 3 and 5 are provided here.
15.	4.6	Section 4.6 omits description of the edge definition for the Site 1 debris stockpile. As the activities include ...	The document that was reviewed included debris disposal at Site 1. The Final Work Plan will only address the pre-design investigation activities for Site 3 and 5. Responses to comments pertaining to Sites 3 and 5 are provided.
16.	4.9	Section 4.9 describes the waste limit exploration trenches as being 20 feet long. This length is too short to assure that the Navy has located the edge of waste. See specific comment #5. Please revise the text to accommodate whatever trench length is necessary to determine an accurate assessment of waste occurrence. Coordinate revisions with revisions made in response to specific comment #5.	Refer to response to comment #9. It appears that the reviewer is cross-referencing comment #5 instead of #9.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
17.	4.9	Section 4.9 includes a description of the measurement of trench alignment and orientation, but does not include a figure for the resolution of the orientation, only the length. Please revise the text to include the required angular resolution, to be read from the compass. The Navy should revise the approach and the text to also include Global Positioning Satellite location procedures, using differential measurements for sub-meter accuracy, for the location of each trench end and any angle points.	The text has been revised to reflect the following: GPS will initially be used to locate the test pits. Prior to the start of trenching, a Global Positioning System (GPS) will be used to mark the location of the primary test pit along the currently estimated landfill boundary. Upon the excavation of the trenches/test pits, a field geologist will log the orientation of the test pits using a compass. The trench bearings and the angle of the trench will be provided in the field with $\pm 5^{o}$ accuracy. A minimum of two stakes (one on either end) will be driven for each linear segment of the trench/test pit. Following this, a land surveyor will locate and map the test pits based on the stakes. A survey will be conducted using Third-order, Class I accuracy. Horizontal control (northings and eastings) will be tied to the State Plane Coordinate System, based on the North American Datum of 1983 (NAD 83). Vertical control (elevation) will be tied to NAD 1988, mean sea level (MSL). This response is presented in Section A.2.6 in Appendix A of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
18.	4.9	Section 4.9 describes mapping of trenches to determine the limit of landfill debris, but provides no description of waste identification or criteria. For landfills composed of burned wastes, distinguishing ash from soil materials can be difficult. Also, wastes may not occur in large, uniform units. Please revise the text and the approach to assess the trench excavation spoils for waste materials using physical observation. For the benefit of field personnel, please include procedures in the work plan for waste identification. These procedures should include examples of waste likely to be encountered, description of each likely waste, and a description of waste placement and soil covering methodologies used at the landfill and the likely waste profiles and sections that are likely to have been created. It is suggested that the procedures include having field personnel place material specimens on pieces of white paper for better ash identification.	Earth Tech's experience in verifying landfill limits (including work performed at IRP Sites 2 and 17 at MCAS El Toro) indicates that visual observations are adequate to distinguish waste materials from native soils. A field geologist or engineer will identify and describe the types of soil encountered in the trenches in accordance with the American Society of Testing Materials D2487 (Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System) and D2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)." The description will also include the percentage of waste material. Waste placement and covering methodologies are not well documented in the archive; in addition the wastes placed would be typical of household and construction debris. It must be noted that every attempt will be made to describe the kinds of waste by visual observations. However, the primary objective is to assess if the encountered material originates from the landfill or native soils to enable delineation of the waste placement boundaries. Again, identification of ash may be accomplished with a fair amount of certainty based on its texture and color as compared to soil. Placing of specimens on pieces of white paper will be done at the discretion of the field geologist. This response is presented in Section A.2.2 in Appendix A of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
19.	4.9	Section 4.9 describes mapping of the waste limit exploration trenches, which are proposed to be up to 20 feet deep. However, no methodology is described to observe the trench walls and measure the depth and location of the observations within the trench. Based on the statement in the text that entry into the trench by project personnel will not be done, it is assumed that the trench excavation spoil will be evaluated and logged for location and depth. Please revise the text to describe the method of trench observation. If the investigation relies upon observations of materials removed from the trench, include a methodology for describing the location from which the materials where excavated. Note that the methodology must address the characteristic of backhoes to scrape materials from a range of depths, rather than pluck chunks of soil from a single location.	Refer to response to General Comment #2, comment #18 and the attached Trench Excavation Decision Narrative and Flowchart in Appendix C. A backhoe capable of excavating to a depth of 17-20 feet will be used; however, the excavation will not be continued beyond 15' if waste is not encountered. Test pits as described in the Trench Excavation Decision Narrative and Flow Chart describe the methodology to establish the waste/native soil interface. Trenches will only be excavated in accordance with response to comment #9 (for confirming the absence of disposal trenches). The methodology to observe trench walls will be visual. Trench excavation spoils may be used to supplement these observations. In such an event, care will be exercised by the backhoe operator to ensure that the evaluated spoils are excavated by removing discrete volumes rather than scraping materials from a range of depths. It must be noted that this kind of an operation is routinely performed in environmental sampling projects related to UST removal and removal action verification sampling, quite often under the direction of regulatory personnel.
20.	4.9	Section 4.9 describes placement of soil and debris excavated from the trenches on 20-millimeter (mil) polyethylene liner. It should be noted that a mil is not a millimeter, but a unit of length equal to one-one thousandth of an inch. A 20-mil liner is about $1/64^{th}$ of an inch thick, not over $3/4^{th}$ of an inch thick. Please revise the text – and the abbreviations and acronyms list – accordingly.	The acronym has been deleted to avoid confusion. Millimeter will be spelled out as shown in Section A.2.2 of Appendix A in the Final Work Plan.
21.	4.9	Section 4.9 includes procedures for returning the excavation spoil to the trench. However, no information is included about the repair of the ground surface after backfilling, to limit settlement or erosion. Please revise the text to include a description of the proposed surface treatment and repair.	The following have been added to Section A.2.2.1 of Appendix A: "The trenches will be backfilled in 1-foot-thick layers. A backhoe will compact each layer of material placed inside the trench. A measuring tape will be lowered inside the trench to measure the depth and thickness of each layer placed. Following the backfill and compaction of the material inside the trenches the top of the backfilled trenches will be graded to match the surrounding grade".

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
22.	4.10	Section 4.10 omits description of any dust control procedures and criteria for response that will done during the concrete and pavement demolition. The proposed activities of pavement breaking, loading and hauling typically generate significant amounts of dust. Please revise the text to address dust control procedures and the criteria for their use.	Demolition of concrete and pavement has already been performed.
23.	4.12	Section 4.12 describes the surveying of observed waste limits, with the statement that straight-line interpolation will be done between refuse limits in trenches. Straight-line interpolation is not an appropriate technique for mapping waste, especially at corners. Please revise the text and the mapping methodology to address how the waste will be delineated, especially at corners and other discontinuities in the waste boundary.	Surveying to record the waste delineation established by trenching will be as described in the response to comment #17. The objective of the trenching is to determine the boundary of the landfill/waste placement. Excavating a 50-foot trench outward from the waste/native soil interface at 200-foot intervals will provide high confidence in the boundary of the landfill. The current lateral extent and topography of Sites 3 and 5 do not indicate undue variations or corners. The intent of the waste delineation mapping is not to closely identify every crevice and discontinuity in the landfill, but to obtain an upper-bound estimate of the landfill perimeter that will be covered with an adequate factor of safety.
24.	6.2.2.1	Section 6.2.2.1, Page 6-3, Soil Stockpiles: The Navy is intending to build waste storage facilities at El Toro ...	The Final Work Plan will only address the pre-design investigation for Sites 3 and 5. Responses to comments pertaining to Sites 3 and 5 are provided here.
25.	7.2	Section 7.2 describes project responsibilities of many project personnel, but left out is anyone tasked with the responsibility of observing the trench explorations and evaluating the soil and wastes encountered. Please revise the project organization and the text to include specific workers for the fieldwork proposed, not just the management of activities. Include a list of the minimum qualifications to do the work, and the available personnel who meet or exceed these qualifications.	A engineer or geologist working under the supervision of a registered geologist or professional engineer will direct all trenching, conduct trench logging in the field, and prepare the logs. Similar text will be added to the Final Work Plan. In addition, HAZWOPER 40-hour training will be mentioned. An updated project organization chart will be included in Appendix A of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Glenn Kistner, U.S. Environmental Protection Agency, Region IX, Comments dated 23 August 2000

Comment No.	Section/ Page No.	Comment	Response
26.	7.4	Section 7.4 describes the data management for this project; however, no mention is made of the management proposed for the geographic or topographic data generated on this project. Please revise the text to include development of a geographic and topographic survey database, either graphically by surveyed mapping or mathematically by geographic information system.	A State of California licensed and Registered Land Surveyor will perform the surveying. The data for the surveyed trenches will be tabulated in a text file, and plotted using AutoCAD (version 14 or the latest version). The survey information will be presented graphically on a surveyed topographic map of the site. In addition, data from the land survey will be incorporated into the final cover design.
27.		On Figure 4, the trench locations proposed for Site 3 are shown. Absent are any evaluations of either the banks of Aqua Chinon Wash (both east and west banks) or the area around Building 796 (reported in Section 3.2 as the building for which waste was observed in the foundation excavation). Note that the Aqua Chinon Wash banks could be composed of edge Berms used for waste perimeter control, similar to situations found at many other solid waste landfills of the mid-1900s. Please revise the project approach and the figure to accommodate investigation of both banks and the building perimeter.	Trenches have been proposed to be excavated at both banks of the Aqua Chinon Wash, and adjacent to Building 796. Trenches will be advanced in the vicinity of the building(s) where possible, with consideration for foundations, utilities, or other limiting factors. In addition, if the building(s) are within the limits of the landfill boundary these data will be taken into consideration during the preparation of the remedial design.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Robert L. Richardson, MCAS Local Redevelopment Authority; Bertrand S. Palmer, Ph.D., P.E., GeoSyntec Consultants. Comments dated 28 August 2000

Comment No.	Section/ Page No.	Comment	Response
This set of response to comments only addresses comments pertaining to the Pre-Design Investigation for IR Sites 3 and 5. These responses have been prepared by the new Remedial Design Contractor (Earth Tech). Following resolution of these comments, Earth Tech will prepare a Final Pre-Design Work Plan for Sites 3 and 5.			
1.		One of the work tasks described in the draft work plan is the dismantling and disposal of PVC pipe from the Site 24 Soil Vapor Extraction (SVE) System (see draft work plan at Page 4-4). Does this dismantling indicate that remediation of Site 24 by SVE is now complete or expected to be complete in the near future? Could DON/USMC provide additional information regarding the Site 24 SVE system closure?	Page 4-4 pertains to Site 24. The Final Work Plan will only address the pre-design investigation for Sites 3 and 5.
2.	3.0	The draft work plan provides background information regarding previous waste limit delineation efforts performed by DON/USMC (see Section 3 of draft work plan). Based on this information, estimated landfill boundaries were plotted for Sites 3 and 5 on Figures 4 and 5 by DON/USMC. However, based on a review of Figure 4, it appears that some borings drilled within the estimated landfill boundaries (Borings 03SB14 and 03SB18) did not encounter refuse (see draft work plan at Page 3-3). Given this, could DON/USMC further explain the rationale used to plot the estimated landfill boundary shown in Figures 4 and 5 of the draft work plan?	The landfill boundaries for Sites 3 and 5 that are shown on Figures 4 and 5, respectively, are the estimated limits of exposed and buried waste established in the Remedial Investigation (RI) Reports for Sites 3 and 5. The RI reports were prepared by Bechtel National, Inc. (BNI) and were reviewed and approved by all pertinent regulatory agencies; the rationale used to delineate the landfill boundaries was also presented. Borings 03SB14 and 03SB18 did not encounter refuse, but the trenching activity proposed in the Final Work Plan will confirm landfill boundaries shown in the RI Report. Figures 4 and 5 in the Draft Project Work Plan are now presented as Figures 2-3 and 2-4 in the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Robert L. Richardson, MCAS Local Redevelopment Authority; Bertrand S. Palmer, Ph.D., P.E., GeoSyntec Consultants. Comments dated 28 August 2000

Comment No.	Section/ Page No.	Comment	Response
3.	3.2	DON/USMC states in the draft work plan that the number and location of the trenches that will be used to delineate the boundaries of each landfill are based on previous "historical information" (see draft work plan at Page 3-6). Could DON/USMC further expand on the rationale for selecting the location, number, and size of trenches?	The RI has been reviewed and approved by all pertinent regulatory agencies. An initial trench spacing of 200 feet has been proposed as summarized on the attached Trench Excavation Decision narrative.
4.	3.2	DON/USMC indicates that a trench will have a maximum length of 20 ft and if a trench does not show presence of waste material, it will be backfilled with the excavated soil (see draft work plan at Page 3-7). Will DON/USMC consider trenching beyond the specified 20-ft length until the soil/waste limit is found? If not, why not?	A primary test pit will be advanced at 200-feet spacing along the landfill boundary. If this primary test pit does not show the presence of waste material, then another test pit will be advanced 50-feet inward, towards the center of the landfill. This test pit advancement will be done until the soil/waste interface has been identified. See the attached Trench Excavation Decision narrative in Appendix C for more details.
5.	3.2	DON/USMC states on Page 3-7 of the draft work plan that the depth of the trenches will be a minimum of 6 ft and a maximum of 20 ft. what rationale will be used to select the depth of the trenches? Will the trench be excavated until waste is found or to a depth of 20 feet, whichever is less?	The purpose of trenching is to delineate the waste/fill and native material interface and not the vertical extent. A backhoe capable of excavating to a depth of 17-20 feet will be utilized; however, the excavation will not be continued beyond 15 feet if waste is not encountered. See the attached Trench Excavation Decision narrative in Appendix C for more details.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Robert L. Richardson, MCAS Local Redevelopment Authority; Bertrand S. Palmer, Ph.D., P.E., GeoSyntec Consultants. Comments dated 28 August 2000

Comment No.	Section/ Page No.	Comment	Response
6.		The waste material present in Sites 3 and 5 includes chemical-impacted soil, which may be difficult to visually differentiate from non-impacted soil. Could DON/USMC provide additional information regarding the method that will be used to differentiate impacted soil/waste material from non-impacted soil or material?	A photoionization detector (PID) or flame ionization detector (FID) will be used during trench excavation to screen the material excavated from the trenches for presence of volatile organic compounds, and petroleum hydrocarbons. The PID/FID will also be lowered inside the trench to monitor and detect any vapors. If high levels of vapors are detected in any part of the trench or in the spoils, the section of the trench from which the spoils were excavated or vapor detected will be marked and identified. The excavated spoils will also be inspected for any discoloration, characteristic odors, or other unusual physical characteristics. This response is presented in Section A.2.2.1 in Appendix A of the Final Work Plan.
7.		DON/USMC is planning to use an Eberline SPA-3 sodium iodide (NaI) detector or approved equivalent to screen for radiological material (Gamma radiation emitters) from Site 1 and from trenches excavated at Sites 3 and 5. Does DON/USMC also intend to screen such material for Beta radiation emitters, volatile organic compounds, and/or other chemicals? If not, why not?	In addition to the Eberline SPA-3 NaI gamma scintillation detector, an Eberline HP-260 pancake Geiger-Mueller (GM) detector capable of detecting alpha, beta, and gamma emissions will be used at Sites 3 and 5. VOCs will be screened using a PID. This response is presented in Section A.2.2.1 in Appendix A of the Final Work Plan.
8.		Site 3 includes Unit 1 and Unit 4 (see Phase II Remedial Investigation Report (RI) at Page 4-9). Does this draft work plan address waste delineation only at Unit 1, or will Unit 4 also be evaluated by DON/USMC as part of this draft work plan?	The Work Plan will only address Unit 1 (the landfill) and the boundaries of Unit 1 where they intersect Unit 2 (Agua Chinon Wash). The remedial action calls for the consolidation of wastes in Unit 4 (former incinerator site) within Unit 1. Due to the relatively small volume of wastes (approximately 1,000 cubic yards), no additional delineation/confirmation of the waste volume will be performed at Unit 4. This response is presented in Section 2.2.1 of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Robert L. Richardson, MCAS Local Redevelopment Authority; Bertrand S. Palmer, Ph.D., P.E., GeoSyntec Consultants. Comments dated 28 August 2000

Comment No.	Section/ Page No.	Comment	Response
9.		DON/USMC reported that waste material was present in soil excavated for the construction of Building 746 (see Phase II RI at Page 4-9). Depending on the size of the excavation made for Building 746, it is possible that waste-containing soil may still be present below the pavement around Buildings 746 and 796. Does DON/USMC intend to evaluate the presence of waste material around Buildings 746 and 796 and between Building 746 and the proposed exploratory Trench 037P07 (see draft work plan at Figure 4)?	A trench has been proposed to be excavated adjacent to Buildings 746 and 796 in order to confirm the estimated landfill limits described in the RI. This response is presented in Section 2.2.1 of the Final Work Plan.
10.		Will the pavement located northeast of Building 746 and the decontamination and equipment storage pads located on Site 3 be removed as part of the draft work plan implementation?	All but two of the decontamination and equipment storage pads have been removed from Site 3. This comment pertains to the removal of the treatment pad and asphalt at Site 3. Please see responses prepared by Foster and Wheeler Corporation.
11.	2.1.2	In Page 2-2 of the draft work plan, Perimeter Road is described to be the southern boundary of Site 3. However, Figure 4 shows North Marine Way and Desert Storm Road as being southwest and southeast of Site 3, respectively.	The description of the location of Site 3 has been corrected to read: "The site is located at MCAS El Toro, between Irvine Boulevard and North Marine Way. Irvine Boulevard forms the approximate northern boundary of the site. Desert Storm Road forms the approximate eastern boundary, and North Marine Way forms the southern boundary of the site." This response is presented in Section 2.2.1 of the Final Work Plan.
12.		The wastes potentially present in landfill Sites 3 and 5 are listed in Pages 2-2 and 2-3 of the draft work plan. These lists could be expanded to include "radiological material" based on the results of the historical radiological assessment.	Reference to the potential for encountering radiological material has been added to the Final Work Plan. This response is presented in Section 2.2.1 of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Robert L. Richardson, MCAS Local Redevelopment Authority; Bertrand S. Palmer, Ph.D., P.E., GeoSyntec Consultants. Comments dated 28 August 2000

Comment No.	Section/ Page No.	Comment	Response
13.		Soil potentially containing unexploded ordnance (UXO) is to be screened in a mechanically operated shaker (see draft work plan at Page 4-3). Are there any issues or concern associated with this screening method considering the potential presence of UXO in the material to be screened?	Page 4-3, Section 4.6 pertains to Site 1. The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
14.		In the draft work plan, DON/USMC states that if radiation measurements of any portion of excavated material exceeds 1½ times the background levels, that portion of the material will be segregated from other material and the DON/USMC will be notified for proper course of action. Could DON/USMC specify how will background levels be established? Will DON/USMC map the areas of Site 1, 3, and 5 where radiological material has been found? Could DON/USMC describe the specific course of action that will be taken upon discovery of radioactive material (if any) at Sites 1, 3, and 5?	During trenching at Sites 3 and 5, an Eberline SPA-3 sodium iodide (NaI) scintillation detector and an Eberline HP-260 pancake Geiger-Mueller (GM) detector or an approved equivalent will be used for radiological screening. Surface soil background levels will be established at the beginning of the day by taking measurements with the SPA-3, with a detector facing the soil, at a height of 1 to 2 inches at a location upgradient (minimum of 500 feet) with soils similar to those found at each landfill. For the GM detector, the background level will be established by taking measurements at a height of 2 to 3 inches above the surface, with the detector facing the soil. The daily background levels will be documented on a radiological survey sheet for each survey instrument. Upon discovery of radiation levels in soil excavated from the trenches above the investigation level (i.e., mean + three times the standard deviation [Roy F. Weston, January 2002]), the area will be flagged for further evaluation. The boundaries of the area will be confirmed, and appropriate authority and personnel will be notified. Further evaluation to characterize the radiological source will be coordinated by the Navy and performed as detailed in the Radiological Survey Plan (Roy F. Weston, January 2002). This response is presented in Section A.2.2.1 in Appendix A of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Robert L. Richardson, MCAS Local Redevelopment Authority; Bertrand S. Palmer, Ph.D., P.E., GeoSyntec Consultants. Comments dated 28 August 2000

Comment No.	Section/ Page No.	Comment	Response
15.		DON/USMC indicates that non-UXO and non-radioactive soil will be analyzed for characterization and hazard classification (see draft work plan on Page 4-4). Per Section 4.13 of the draft work plan, samples collected during the removal activities for characterization purposes and hazard classification will be analyzed for metals, polychlorinated biphenyls (PCB), pesticides, total recoverable petroleum hydrocarbon (TRPH), volatile organic compounds (VOC) and semi-VOCs. Additional hazard classification analyses will be performed using the Toxicity Characteristic Leaching Procedure (TCLP), as required. Will DON/USMC use other testing methods such as fish toxicity to characterize the waste material? What threshold concentrations for metals, PCB, pesticides, TRPH, VOC, and semi-VOC will be used by DON/USMC to categorize the tested material, waste, or soil? How many categories of material will be defined and what will be the fate of each category of material?	Page 4-4, Section 4.13 pertains to Site 1. The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
16.		DON/USMC will use American Society for Testing and Materials (ASTM) methods D2487 and D2688 for soil classification (see draft work plan at Page 4.5). Which method does DON/USMC intend to use to classify waste material in terms of physical content (paper, plastic, metal, etc.) and chemical content or characteristics?	Wastes will not be classified during the pre-design activities; however they will be described. The purpose of field activities is to delineate the waste/fill and native material interface. This response is presented in Section A.2.2 in Appendix A of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Michael B. Wochnick, P.E., Manager, Closure and Technical Services Section, California Integrated Waste Management Board. Comments dated 7 September 2000.

Comment No.	Section/ Page No.	Comment	Response
This set of response to comments only addresses comments pertaining to the Pre-Design Investigation for IR Sites 3 and 5. These responses have been prepared by the new Remedial Design Contractor (Earth Tech). Following resolution of these comments, Earth Tech will prepare a Final Pre-Design Work Plan for Sites 3 and 5.			
1.		During trenching all excavated waste should be characterized to determine the potential for biodegradation that could result in the production of landfill decomposition gas. Please provide a methodology for detailed logging of exposed waste during implementation of the work plan.	An RI has been reviewed and approved by the BCT. Therefore, a formal characterization will not be performed as a part of this pre-design investigation. The objective of the trenching at Sites 3 and 5 is not to characterize the waste and conduct a detailed logging of the exposed waste, but to confirm the limits of the landfills that have been developed and presented in the RI. Site 3 was operated from 1945 to 1955, and Site 5 operated from about 1955 to the late1960s. All pitrucable waste is assumed to have been for the most part decomposed and biodegraded since then. A landfill gas generation study based on the EPA Model indicated that LFG generation at this landfill is minimal and insignificant (BNI 1997a).
2.		Monitoring for methane gas should occur during the trenching operations. Please provide a methane gas protocol to be followed during implementation of the work plan.	During trenching, field personnel will use various monitoring devices, including a GA-90, oxygen meter, and an LEL meter. Monitoring for methane will also be performed. This response is presented in Section A.2.2.1 in Appendix A of the Final Work Plan.
3.		When waste is encountered during the trenching operation, how will it be handled? Will it be characterized, classified, and sent to an appropriate landfill?	Waste encountered during trenching will be field screened using a PID/FID and radiological instruments in accordance with the work plan and the health and safety plan. Once visual inspection, and logging of each trench are completed, the excavated material will be returned to the trench. Material excavated from the lower parts of the trench will be returned first, followed by soil excavated from the upper parts. This response is presented in Section A.2.2 in Appendix A of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Michael B. Wochnick, P.E., Manager, Closure and Technical Services Section, California Integrated Waste Management Board. Comments dated 7 September 2000.

Comment No.	Section/ Page No.	Comment	Response
4.		The rationale for selecting the number, size and location of the trenches is not clear. Please submit an additional explanation for this rationale.	The rationale for trenching has been revised following discussion with the USEPA. The rationale is presented in the attached Trench Excavation Decision Narrative and Flowchart in Appendix C.
5.		On page 3-7, first paragraph, it states that excavation will cease when no waste is found in the initial trenching location. When waste is not present in the initial trench, additional trenching locations may be necessary in order to delineate the landfill boundary. Please adapt the work plan to allow for engineering judgment in the field.	The rationale for trenching has been revised following discussion with the USEPA. The rationale for trenching is presented in the attached Trench Excavation Decision Narrative and Flowchart in Appendix C.
6.		On page 4-5, section 4.9, first paragraph, it states that all trenching will conform to South Coast Air Quality management District (SCAQMD) Rule 1150. CIWMB and LEA Staff recommend that the Navy contact SCAQMD in order to determine if an excavation permit is required for this trenching operation.	Since this investigation activity is part of the CERCLA process, only the substantive requirements of Rule 1150 apply. Therefore, permit will not required; however monitoring will be conducted in accordance with Rule 1150 as indicated. This response is presented in Section A.2.4 in Appendix A of the Final Work Plan.
7.		The routing slip does not indicate whether this work plan was sent to the California Department of Health Services (DHS). Please ensure that this work plan is reviewed and approved by the DHS Radiological Health Branch for the radiological waste issues identified in the Work Plan.	The scope of this pre-design investigation work plan is restricted to only radiological monitoring during trenching. The Radiological Branch has received the Radiological Survey Work Plan that was separately issued by the Navy to address radiological waste issues at MCAS El Toro, including Sites 3 and 5. The results of this survey will be incorporated into the final remedial design. This response is presented in Section A.2.2 in Appendix A of the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Department of Toxic Substances Control. Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
This set of response to comments only addresses comments pertaining to the Pre-Design Investigation for IR Sites 3 and 5. These responses have been prepared by the new Remedial Design Contractor (Earth Tech). Following resolution of these comments, Earth Tech will prepare a Final Pre-Design Work Plan for Sites 3 and 5.			
1.		Title: Please include Site 24 in the title since this work plan includes dismantling and disposal of piping associated with the Site 24 soil vapor extraction system.	Site 24 has been dropped from the Statement of Work and, therefore, is not pertinent to the current Pre-Design Investigation activity. The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5.
2.	3.1.1.3	Section 3.1.1.3 – Soil Borings: In the second paragraph, 03-DGMW65 and 04-DGMW66 are listed but their locations are not shown on Figure 4, Site Plan and Proposed Trench Locations. Also, 03-DGMW65 is not included in the notes that show "depth" and "waste encountered." Please show the locations of 03-DGMW65 and 04-DGMW66 on Figure 4 and include notes (depth and waste encountered) for 03-DGMW65.	Figure 4 in the Draft Project Work Plan is now presented as Figure 2-3 in the Final Work Plan The location of borings 03_DGMW65 and 03_DGMW66 are shown and identified. Well 03_DGMW65 was abandoned and identified as such on Figure 4. The Table on Figure 4 has also been revised to show the depth of the borehole 03_DGMW65, which was approximately 255 feet. No waste was encountered in this borehole.
3.	3.1.1.3	Section 3.1.1.3 – Soil Borings: In the third paragraph, eighteen soil borings (03SB1 through 03SB15 and 03SB17 through 03SB19) are listed; however only borings 03SB11 through 03SB15 and 03SB17 through 03SB19 shown on Figure 4, Site Plan and Proposed Trench Locations. Please show the locations of borings 03SB1 through 03SB11 on Figure 4.	Borings 03SB01 through 03SB10 were drilled outside Unit 1 (landfill) and in and around Units 4 (former incinerator) and Unit 3 (solvent spill area). The 4th sentence, 4th paragraph of Section 2.2.1 has been revised to read: "Eight soil borings (03SB11 through 03SB15 and 03SB17 through 03SB19) and three lysimeter borings (03LYS1 through 03LYS3) were drilled during the Phase II RI in and around Site 3-Unit."

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Department of Toxic Substances Control. Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
4.	4.6	Section 4.6 – Site 1 [EOD (Explosive Ordnance Disposal) Range] Debris Segregation and Disposal Activities: The sixth paragraph states, "Samples of the non-UXO (unexploded ordnance) or non-radioactive soil remains from screening operations will be collected and analyzed for characterization and hazard classification. One sample will be collected and analyzed for every 20 tons of screened and stockpiled soil material. Following hazard classification, the material will be hauled off-site to a CERCLA-approved facility for disposal. It is estimated that approximately 100 tons of debris including scrap metal and soil may be generated from the segregation activities at this site." Please refer to Chapter 9 of SW-846 to verify that the number of samples proposed is adequate for waste classification. If preliminary data is not available, please state as such and describe that the number of samples will be verified after the analytical results are reviewed and additional samples will be collected, if necessary.	Section 4.6 pertains to Site 1. The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
5.	4.7	Section 4.7 – Site 24 [Potential VOC (volatile organic compound) Source Area] SVE (Soil Vapor Extraction) Pipe Dismantling and Disposal: Please clarify that the work at this site (dismantling, removal, and disposal of approximately 8,000 linear feet of polyvinyl chloride piping associated with the SVE system) will only occur following regulatory approval.	Section 4.7 pertains to Site 24. The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
6.	4.7	Section 4.7 – Site 24 (Potential VOC Source Area) SVE Pipe Dismantling and Disposal: Please clarify waste classification sampling to be conducted for the waste piping prior to disposal.	Section 4.7 pertains to Site 24. The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Department of Toxic Substances Control. Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
7.	4.10	Section 4.10 – Demolition of Concrete and Pavement: This section states that concrete and asphalt demolition material will be hauled off-site for recycling. The section does not mention classification of the waste prior to disposal/recycling. The concrete pad and asphalt pavement overlies a landfill (Site 3) where VOCs, semivolatile organic compounds (SVOCs), pesticides, petroleum hydrocarbons, radionuclides, dioxins, furans and metals were detected in shallow soils from 0 to 10 feet below ground surface (bgs) (refer to Section 3.1.2.1 – Site 3 Chemical Analyses Results). As a result, following demolition, the concrete waste must be sampled and classified according to Federal and State hazardous waste criteria. Please include the type and number of samples to be collected and the analyses to be performed. Following waste classification, the demolition waste can be transported to an appropriate facility. Due to the chemical composition of asphalt, the associated compounds may interfere with detection of contaminants. As a result, please include a strategy for classification of the waste asphalt.	The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
8.	6.2.3	Section 6.2.3 – Waste Disposal: Their third paragraph states, "The Chemical Waste Management facility in Kettleman City, California, and the Safety-Kleen facility in Westmoreland, California, are two Class I hazardous waste facilities that will be considered for hazardous waste disposal." Please specify each waste stream and the anticipated disposal facility. Additionally, please be advised that Safety-Kleen Corporation has notified DTSC that they are experiencing financial difficulties. It may be appropriate to have an alternative disposal site available.	The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
9.	7.1	Section 7.1 – Project Schedule, Stage 5 – Closeout Report: it is possible that the completion of proposed activities for Sites 1, 3, 5 and 24 will not coincide. Please clarify if only one Closeout Report will be prepared or if information for each site will be reported as activities for each site are completed.	A separate Pre-Design Investigation Report will be prepared for Sites 3 and 5 combined. The project schedule has been revised to reflect this.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Department of Toxic Substances Control. Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
10.	4.10	Section 4.10 – Demolition of Concrete and Pavement and Table 1 – Waste Management Summary Requirements: In Section 4.10, it is proposed that concrete and asphalt demolition material will be hauled off site for recycling. The characterization requirements for construction debris identified in Table 1 are not referenced in Section 4.10.	The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
11.	6.2.2.1	Section 6.2.2.1 – Soil Stockpiles: In general, the work plan appears to provide justification for storage of waste piles that have not been sampled or classified and have been on site for approximately 10 months. DTSC is concerned that the stockpiled debris (metallic material and associated soil) was generated in October and November 1999 and after 10 months; the waste has not been sampled or classified. Since the waste has not been classified and the specific regulations applicable to the waste cannot be determined, it may be found after sampling and classification that the waste was not managed properly. DTSC is also concerned regarding failure of the Department of the Navy to provide timely notification regarding these waste generation activities. The stockpiled debris was generated in October and November 1999 and the members of the Base Realignment and Closure Clean Team (BCT) were first informed about the stockpiles during the July 26, 2000 BCT meeting, approximately nine months after generation of the waste. Subsequently, DTSC received the Project Work Plan on August 7, 2000 that proposed classifying this waste for off-site disposal. Please notify DTSC at least two weeks prior to the collection of waste classification samples from the stockpiled waste at Site 1 so that DTSC personnel can be present to observe sampling activities.	The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Department of Toxic Substances Control. Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
12.	6.2.2.1	Section 6.2.2.1 – Soil Stockpiles: The second paragraph in this section states, "If excavated soil from Site 1 activities are determined to be RCRA (Resource Conservation and Recovery Act) hazardous waste, then the new (effective June 1, 1999) RCRA Staging Pile regulations of 40 CFR (Code of Federal Regulations), Section 264.554, may apply." The State of California (State) is authorized to implement RCRA. To date, the State has not adopted the Federal Staging Pile regulations and as a result these do not satisfy State requirements.	The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
13.	Table 1	Table 1 – Waste Management Summary Requirements: The "Storage Requirements: for Excavated Soil and/or Reuse state, "If hazardous, the stockpiles will be managed in accordance with the Staging Pile requirements of 40 CFR Section 264.554." As stated in comment number 12 above, the State is authorized to implement RCRA. To date, the State has not adopted the Federal Staging Pile regulations and as a result these do not satisfy State requirements.	The Final Work Plan will only address the pre-design investigation activities for Sites 3 and 5. Please see responses prepared by Foster Wheeler Corporation.
14.	Table 1	Table 1 – Waste Management Summary Requirements: The "Storage Requirements" for Soil from Exploratory Trenching state, "The soil from exploratory trenching has been predetermined to be non-hazardous..." Please provide an explanation for this determination.	This sentence has been revised to delete the reference to the soil being predetermined as nonhazardous and presented in the text, not as a table. The soil will be filled back into the trench.
15.	Figure 4	Figure 4 – Site Plan and Proposed Trench Locations: The location of an abandoned monitoring well is shown approximate 100 feet west of Unit 1 of the Original Landfill. Please include the original designation for this monitoring well.	Figure 4 has been revised and the abandoned well is identified as 03_DGMW65. Figure 4 in the Draft Project Work Plan is now Figure 2-3 in the Final Work Plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Triss M. Chesney, P.E., Remedial Project Manager, Department of Toxic Substances Control. Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
16.	Attachment 1, Section 1.3	Attachment 1 – Site-Specific Health and Safety Plan, Section 1.3 – Summary of Major Risks: "There is potential exposure to contaminants associated with gasoline, jet fuel, and volatile organic compounds (VOCs)." Although this section only provides a summary, all of the major chemical categories should be listed and should be consistent with the information provided in the previous investigation studies and as presented in the Work Plan for Site 3 (Section 3.1.2.1), Site 5 (Section 3.1.2.2), Site 1 (Section 2.1.1), and Site 24 (Section 2.1.4). For example, according to Section 3.1.2.1, VOCs, SVOCs, pesticides, petroleum hydrocarbons, radionuclides, dioxins, furans and metals were detected in shallow soils from 0 to 10 feet bgs.	The Site-specific Health and Safety Plan has included a section discussing the summary of major risks at the site and the suggestion will be incorporated into the plan.
17.	Attachment 1, Section 4.1	Attachment 1 – Site-Specific Health and Safety Plan, Section 4.1 – Chemical Hazards: The information in this section should list the specific chemical hazards associated with each of the chemical categories identified in Section 1.3 of the Site-Specific Health and Safety Plan by. Please refer to Comment Number 12. Additionally, it would be helpful to identify the chemical hazards for each site.	The Site-specific Health and Safety Plan has included a section discussing the chemical hazards at the site and the suggestion will be incorporated into the plan.
18.	Attachment 1, Table 1	Attachment 1 – Site-Specific Health and Safety Plan, Table 1 – Chemical Hazard Assessment: The information in this table should be consistent with Section 4.1 of the Site-Specific Health and Safety Plan.	The Site-specific Health and Safety Plan has included a section discussing the chemical hazard assessment at the site and the suggestion will be incorporated into the plan.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Julie Kim, M.S., Department of Toxic Substances Control, Industrial Hygiene and Field Safety Section (IHFSS). Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
This set of response to comments only addresses comments pertaining to the Pre-Design Investigation for IR Sites 3 and 5. These responses have been prepared by the new Remedial Design Contractor (Earth Tech). Following resolution of these comments, Earth Tech will prepare a Final Pre-Design Work Plan for Sites 3 and 5.			
GENERAL COMMENTS			
1.		Federal Occupational Safety and Health Administration is the overall governing body for occupational safety and health, when a state approved program does not exist. In the State of California, there is a state approved OSHA plan. Therefore, Cal-OSHA should be referenced and followed.	The site-specific Health and Safety Plan now references and follows the Cal-OSHA codes.
2.		Please note that all sub-contractors must submit their own health and safety plans to the DTSC for review. The document was reviewed for scientific content. Minor grammatical or typographical errors that do not affect interpretation have not been noted; however, these should be corrected in future versions of the document.	A new site-specific Health and Safety Plan has been prepared by Earth Tech and will be submitted to the pertinent agencies for review and approval. Subcontractors will not prepare their own Health and Safety Plans; however, they will comply with the new Health and Safety Plan. All subcontractor tasks are addressed in the HSP.
SPECIFIC COMMENTS			
3.		General. The state of California administers its own OSHA program; please note that California Code of Regulations (CCR) should be cited and applied over the Code of Federal Regulations (CFR) where applicable.	The Site-specific Health and Safety Plan cites Title 8 CCR and that regulation is applied over the CFR, where applicable.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Julie Kim, M.S., Department of Toxic Substances Control, Industrial Hygiene and Field Safety Section (IHFSS). Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
4.	Attachment 1 Section 4.1	Section 4.1, Chemical Hazards. What were the maximum concentrations of contaminants found in the previous investigations and in what media were the contaminants contained (i.e., soil, water, etc.)?	A review of existing site evaluations data shows: Site 3 – Soil, groundwater and surface water/sediments show moderate concentrations (up to several hundred parts per million) of petroleum hydrocarbon contaminants (primarily diesel range), while soil gas samples show slight concentrations of solvent-type volatile organic compounds and moderate concentrations (less than 100 parts per million) of petroleum hydrocarbons. No occupationally significant concentrations of metals or pesticides were noted on site. Site 5 – Ambient air and soil gas samples showed potentially significant concentrations (up to several hundred parts per million) of solvent-type volatile organic compounds. However, soil and groundwater concentrations of these materials were not found at levels that might be occupationally significant. No occupationally significant concentrations of metals or pesticides were noted onsite. This data has been used in determining HSP requirements for initial PPE use, upgrade criteria, and real-time monitoring procedures for further site investigation activities.
5.	Attachment 1 Section 4.3	Section 4.3, Physical Hazards. Please include Lockout/Tagout procedures as a part of this plan or as an attachment to the plan.	Activities that would require lockout/tagout procedures are not anticipated at Sites 3 and 5.
6.	Attachment 1 Section 5.0	Section 5.0, Activity Hazard Analysis. Are confined space entry activities anticipated? If so, will personnel potentially working under these conditions be trained in confined space entry?	No confined space entry is anticipated at Sites 3 and 5.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Julie Kim, M.S., Department of Toxic Substances Control, Industrial Hygiene and Field Safety Section (IHFSS). Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
7.	Attachment 1 Section 6.0	Section 6.0, Personal Protective Equipment. What is the initial level of protection as work commences? How will this PPE level be determined? How will upgrade or downgrade of PPE level be determined throughout the project? Will action levels be utilized as determinants? If so, what action levels will be set with what instrumentation? How will these action levels be established; based upon what rationale? Since there is a potential for respirator use (level C), what type of cartridges will be utilized? What is the cartridge change-out schedule? Are all employees with the potential to utilize respirators trained in respiratory protection and fit tested?	Initial PPE requirements will be specified based on a hazard analysis of each specific work activity being performed versus the known/suspected contaminant types/distribution. Based on an initial assessment, it appears that protective clothing will be required to provide workers with skin protection during most work activities (Modified Level D ensemble), however respiratory protection will likely not be initially required. Onsite real-time monitoring will be conducted for airborne VOC and fuels concentrations in worker breathing zones, with upgrade criteria established at conditions well below those that could represent occupationally significant concentrations. For protection against airborne VOCs/fuels, workers would be required to upgrade to full-face air-purifying respirators with organic vapor cartridges. Cartridge change-out frequency will be established by assessment of cartridge performance against maximum potential contaminant concentrations (upper range acceptable for Level C PPE), with a change-out frequency of no less than each day. All employees assigned to work at the site will be required to participate in a respiratory protection program meeting the requirements of 8 CCR §5144, and will be properly fit tested for the air purifying respirators used on the site.
8.	Attachment 1 Section 7.0	Section 7.0, Air and Radiation Monitoring. What is the frequency of monitoring for each instrumentation? Please provide rationales for the action levels set for each instrumentation.	Monitoring requirements are thoroughly presented in the Final HSP Section 6.6.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Julie Kim, M.S., Department of Toxic Substances Control, Industrial Hygiene and Field Safety Section (IHFSS). Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
9.	Attachment 1 Section 7.1.1	Section 7.1.1, Photoionization detector (PID) or flame ionization detector. Which lamp strength will specifically be used for the PID? The PEL for benzene is 1 ppm; is the action level set at 10 ppm health protective?	A minimum PID bulb rating of 10.2 eV has bene specified. With respect to benzene: Earth Tech has had considerable experience with fuels-contaminated sites, and we have found that in such environments benzene constitutes just one of many VOC compounds collectively detected by PID/FID instruments (consistently observed to be less than 10 percent of the total VOC contribution). Thus, while a benzene-specific real-time monitoring protocol (using colorimetric detector tubes) is established together with a corresponding response action level, benzene-specific monitoring is not initiated unless total VOC concentrations exceed 10 ppm to account for the fractional component of benzene in the VOC environment.
10.	Attachment 1 Section 7.2	Section 7.2, Monitoring Strategy. Please note that relying on olfactory senses to detect exposure is not a health protective practice. Please rely on instrumentation readings for objective determination of exposure. It states in paragraph one, "The PID/FID will also be used wherever odors are detected and will continue to be used until odors can no longer be detected and organic vapor levels are below 5 ppm." What is the rationale for 5 ppm? It states in paragraph one, "If organic vapors are detected in the work zone, the SHSS will also monitor the perimeter of the work area to ascertain that the levels of organic vapors will not impact personnel outside of the work area. If these levels exceed 1 ppm, the SHSS will consult with the PESM and the NTR for proper course of action." What is the rationale for the action limit of 1 ppm? Is the action limit the result of monitoring in both upwind and downwind locations? What type of radiation (i.e., alpha, beta, gamma) is suspected to be potentially present at the site and what type will the instrumentation detect? How do the measurement values from the instrumentation compare to the exposure limits?	There will be no reliance on odor as an onsite exposure indicator. The stated 5-ppm criteria has been eliminated. The stated perimeter action level has been revised, and an appropriate rationale for its selection has been provided. Based on previous site investigations, no specific radiological impacts have been noted. However, onsite radiological screening will be conducted for some investigations, using a thin-window halogen-quenched Geiger-Mueller detector capable of resolving alpha, beta and gamma radiations. Significance criteria will be based on significant departures from established "normal" background levels for the various material types.

Document Title:

(1) Draft Project Work Plan Pre-Design Activities at Installation Restoration Sites 3 And 5, Operable Unit 2C, Marine Corps Air Station, El Toro, California

Reviewer: Julie Kim, M.S., Department of Toxic Substances Control, Industrial Hygiene and Field Safety Section (IHFSS). Comments dated 11 September 2000

Comment No.	Section/ Page No.	Comment	Response
11.	Attachment 1, Table 1	Table 1, Chemical Hazards Assessment. According to T8 CCR 5155, many of the exposure limits in the table are incorrectly stated. The corrected information is as follows: Gasoline: PEL = 300 ppm Perchloroethylene: PEL = 25 ppm Trichloroethene: PEL = 25 ppm 1,1-dichloroethene: Ceiling = 0.025 mg/m^3 Hydrogen Sulfide: PEL = 10 ppm; Ceiling = 50 ppm Please indicate the arsenic form (i.e., inorganic). Please correct the information in the table accordingly.	The stated values have been correctly stated in the revised HSP.

Appendix C
Decision Narrative and
Trench Excavation Decision Flowchart

Trench Excavation Decision Narrative for Sites 3 and 5
Former MCAS El Toro, California

Primary test pits will be excavated along the estimated waste limit at a spacing of 200-feet and to a depth of up to 15 feet. These primary test pits will be logged to determine the interface between the waste and adjacent native or fill soils. The primary list and associated succession of pits will progress as follows:

1. If waste is encountered, then a decision must be made as to whether or not the lateral extent of the landfill has been identified.

2. If waste is not encountered and native soils have been identified or the excavation has continued up to 15 feet vertically through fill soils, then another test pit will be advanced approximately 50 feet inward toward the center of the landfill. This procedure will continue until waste is encountered and the lateral extent of the landfill has been determined, similar to the procedure stated above.

3. After confirmation of the lateral extent of the landfill (interface of the waste with adjacent soils), the vertical extent of the waste will be verified by confirming whether native or fill soil has been encountered below the waste or if the maximum reach of the excavator has been exceeded. If the vertical extent of the waste has not been identified but the maximum reach of the excavator has been exceeded, then excavation will stop.

4. If the lateral extent of the landfill (interface of the waste and adjacent soils) has not been confirmed during the primary test pit excavation, another test pit will be advanced approximately 50 feet outward from the center of the landfill. This procedure will continue until the interface between the waste and adjacent soils has been confirmed. If the test pits show the presence of the waste but the interface of the waste and the adjacent soil cannot be identified, then a trench will be excavated between the pit that does not contain waste to the adjacent pit containing waste to identify the transition from the waste to soil.

5. If both the lateral and the vertical extent of waste have been identified within the test pit, then excavation will cease at that location.

The primary test pits will be excavated every 200 feet along the currently estimated landfill boundaries. If the last primary test pit location has been advanced and the landfill boundaries have been established, then excavation at the site will be discontinued.

Upon completion of the last primary test pit, the need for any additional (contingency) test pits will be evaluated as follows:

1. If the revised boundary varies from the current boundary by greater than 50 feet, then contingency test pits will be excavated at the midpoint or at a selected location between the two primary test pit locations (where uncertainty of lateral extent exists). The procedure will be performed in accordance with the procedure developed for the primary tests pits detailed above.

2. If the first contingency test pit does not adequately establish the lateral extent of waste, then another contingency pit will be excavated between the initial contingency pit and the

adjacent primary test pit. This activity will continue until the landfill boundaries have been clearly identified.

Trench Excavation Decision Flowchart for Sites 3 and 5
Former MCAS El Toro

ADVANCE PRIMARY TEST PIT AT 200-FOOT SPACING (MINIMUM DEPTH OF 15 FEET), ALONG THE ESTIMATED LANDFILL BOUNDARY (Note #1)

Note 3

WASTE/FILL ENCOUNTERED?

Yes

No

ADVANCE TEST PIT APPROXIMATELY 50 FEET INWARD, TOWARDS THE CENTER OF THE LANDFILL

HAS THE LATERAL EXTENT OF WASTE/FILL BEEN CONFIRMED?

Yes

No

ADVANCE A TEST PIT APPROXIMATELY 50 FEET OUTWARD FROM THE CENTER OF THE LANDFILL.

HAS THE VERTICAL EXTENT OF WASTE/FILL BEEN CONFIRMED OR REACH OF EXCAVATOR BEEN EXCEEDED?

No

CONTINUE TO EXCAVATE VERTICALLY UNTIL EXTENT OF WASTE/FILL IS ESTABLISHED OR REACH OF EXCAVATOR IS EXCEEDED

Yes

CEASE EXCAVATION AT CURRENT TEST PIT LOCATION.

IS THIS THE LAST PRIMARY TEST PIT LOCATION?

No

Yes

LANDFILL BOUNDARIES ADEQUATELY CONFIRMED/ESTABLISHED BY THE PRIMARY TEST PITS? (Note #2)

No

Yes

ADVANCE A CONTINGENCY TEST PIT AT THE MIDPOINT BETWEEN (OR OTHER SELECTED POINT) PRIMARY TEST PITS.

DOES THE CONTINGENCY TEST PIT CONFIRM/ESTABLISH LANDFILL BOUNDARY IN THIS AREA?

No

Yes

OTHER AREAS OF LANDFILL BOUNDARY UNCERTAIN?

Yes

No

DISCONTINUE EXCAVATION ACTIVITIES.

NOTES:

Note #1 - Primary Test Pit locations will be marked at approximately every 200 feet along the currently estimated landfill boundaries. The Primary Test Pit will be followed by additional exploratory pits in accordance with this flowchart.

Note #2 - "Adequately Confirmed/Established" refers to whether the Primary Test Pits confirm that landfill boundaries are within 50 feet of what was Originally estimated. If the Primary Test Pits do not identify the landfill boundaries within 50 feet as originally estimated, then additional test pits will be required in between (or other selected point) the Primary Test Pits.This would result in a higher resolution (spacing less than 200 feet) at these areas. Engineering judgement may require additional test pits.

Note #3 - The protocol shown within the dashed box will be used when advancing test pits between the primary test pits.