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MCAS EL TORO
SSIC NO. 5090.3.A

Final

Work Plan

Groundwater Monitoring at Anomaly Area 3 and IRP Sites 1 and 2

Former Marine Corps Air Station El Toro Irvine, California

05 October 2007

Prepared for:

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
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Under Subcontract with:



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Prepared under:

Naval Facilities Engineering Command
Contract Number N68711-04-D-1110
Contract Task Order 0006
DCN: JNS.1110.0006.0119

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Sites 1 and 2**

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Program Management Office West
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05 October 2007



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Mr. Louie Cardinale
Base Realignment and Closure
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Subject: Navy Contract No. N68711-04-D-1110, Delivery Order 0006,
Groundwater Monitoring Program (GMP) at Anomaly Area 3 (AA3) and Installation
Restoration Program (IRP) Sites 1, 2, 3, 5, and 17 at former Marine Corps Air Station
(MCAS) El Toro, Irvine, California
Final Work Plan for Groundwater Monitoring at Anomaly Area 3 and IRP Sites 1
and 2, Former Marine Corps Air Station El Toro Irvine, California

Dear Mr. Cardinale:

Enclosed for your distribution are four hard copies and two electronic copies of the Final Work Plan for Groundwater Monitoring at Anomaly Area 3 and IRP Sites 1 and 2, Former Marine Corps Air Station El Toro, Irvine, California. Six hard copies and three electronic copies have been distributed to the Base Closure Team and other interested parties under the Navy's cover letter dated 04 October 2007. Two bound copies and one unbound copy will be sent directly to Ms. Diane Silva for the Administrative Record and one additional copy will be delivered to Ms. Marge Flesch at former MCAS El Toro.

If you have any questions or require additional information, please call me at (925) 374-0020 or Jacob Dunk with CDM at (858) 268-3383.

Sincerely,

JONAS AND ASSOCIATES INC.

A handwritten signature in black ink that reads "Romena Jonas". The signature is written in a cursive style with a large, looping initial "R".

Romena Jonas
Program Manager

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D. Silva (NAVFAC Southwest)
M. Flesch (Former MCAS El Toro)

J. Dunk (CDM)
File

Final

Work Plan

**Groundwater Monitoring at Anomaly Area 3 and IRP
Sites 1 and 2**

Former Marine Corps Air Station El Toro

Irvine, California

Contract Number N68711-04-D-1110

Delivery Order Number 0006

DCN: JNS-1110-0006-0119

Prepared by:



Jake Dunk
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10/5/07
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Approved by:



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Executive Summary

CDM Federal Programs Corporation (CDM) has prepared this Work Plan for a groundwater monitoring program (GMP) at Anomaly Area 3 (AA3) and Installation Restoration Program (IRP) Sites 1 and 2 at the Former Marine Corps Air Station (MCAS) El Toro. The groundwater monitoring will be performed for Naval Facilities Engineering Command (NAVFAC) Southwest under Contract Number N68711-04-D-1110, Delivery Order Number 0006.

IRP Site 1 was formerly used for explosives ordnance disposal (EOD) training. IRP Site 2 was formerly a landfill and AA3 was formerly a refuse disposal area. As part of an ongoing GMP in place since 1992, 24 rounds of groundwater monitoring have been conducted at Former MCAS El Toro to evaluate different aspects of groundwater quality at the base. Rounds 1 and 2 (1992-1993) were conducted under the Comprehensive Long-Term Environmental Action Navy (CLEAN) I program and Rounds 3 through 7 (1995-1997) were conducted under the CLEAN II program. In 1999, the GMP was evaluated and revised for Rounds 8 through 11. Modifications to the number of wells sampled, and the analyses conducted at each well were implemented during Round 12. Wells were added and removed from the GMP during Rounds 13 through 24 based on discussions with the Base Realignment and Closure (BRAC) Cleanup Team (BCT). Following Round 24, sampling at IRP Sites 3, 5, and 17 will be discontinued under the current basewide GMP and monitored under site-specific remedial actions.

This Work Plan has been prepared to further characterize groundwater at AA3, and to update the current GMP activities at IRP Sites 1 and 2. Due to historic uses, AA3 and IRP Site 2 will be monitored as part of routine monitoring constituents to support the remedy selection process. Groundwater sampled from IRP Site 1 has reported measurable concentrations of perchlorate, and will be monitored until a preferred remedial action is selected. The Department of the Navy (Navy) evaluated each site individually to assess historical groundwater trends and site activities in order to recommend the updated GMP described in this Work Plan.

Groundwater samples will be collected semi-annually from a total of 37 monitoring wells. Table ES-1 provides a list of the monitoring wells and analyses to be included in the GMP. All samples will be submitted to and analyzed at a Naval Facilities Engineering Service Center (NFESC)-approved and California-certified laboratory. Analytical results will be validated by a third party data validator. Details of groundwater monitoring activities and analytical results from the first half of the year will be presented in Data Summary Reports. Details from groundwater monitoring activities and analytical results completed during the second half of the year will be presented in Annual Reports. Appendices attached to this Work Plan include the Sampling and Analysis Plan (Appendix A), the Site Health and Safety Plan (Appendix B), Standard Operating Procedures (Appendix C), and Field Monitoring Forms (Appendix D).

**Table ES-1
GMP Monitoring Wells and Analyses**

Monitoring Well ID	Sampling Rationale	VOCs	TPH-g	TPH-d	Dissolved Metals	Perchlorate	General Chemistry
Site AA3							
AA3MW01	Monitor water quality changes.	x			x		x
AA3MW02	Monitor water quality changes.	x			x		x
AA3MW06	Upgradient (background).	x			x		x
AA3MW08	Monitor water quality changes.	x			x		x
AA3MW11	First evidence of release.	x			x		x
AA3MW12	First evidence of release.	x			x		x
IRP Site 1							
01MW102	Monitor low perchlorate concentrations in northern portion of Site 1.				x	x	x
01MW201	Monitor elevated perchlorate concentrations in the north-central portion of Site 1. Within area of potential hydrocarbon contamination.	x	x	x	x	x	x
01-MW202	Monitor elevated perchlorate concentrations in the north-central portion of Site 1.					x	
01-MW203	Monitor elevated perchlorate concentrations in the north-central portion of Site 1.				x	x	x
01-MW204	Delineate perchlorate source area to 6 µg/L. Within area of potential hydrocarbon contamination.	x	x	x	x	x	x
01-MW209	Monitor elevated concentrations in perchlorate source area. Within area of potential hydrocarbon contamination.	x	x	x	x	x	x
01-MW211	Monitor elevated concentrations in perchlorate plume between Sites 1 and 2.				x	x	x
01-MW215	Monitor elevated perchlorate concentrations between IRP Sites 1 and 2.				x	x	x
01-MW218	Delineate perchlorate source area to 6 µg/L.					x	
01-MW219	Monitor elevated perchlorate concentrations in source area and to delineate perchlorate source area to 6 µg/L.					x	
01-MW223	Monitor elevated perchlorate concentrations in perchlorate plume between Sites 1 and 2.				x	x	x
01-PZ01	Monitor marginal perchlorate concentrations in the north portion of Site 1.					x	
01-PZ06	Delineate perchlorate source area to 6 µg/L.					x	

Table ES-1 (continued)
GMP Monitoring Wells and Analyses

Monitoring Well ID	Sampling Rationale	VOCs	TPH-g	TPH-d	Dissolved Metals	Perchlorate	General Chemistry
01-PZ07	Monitor maximum detected perchlorate concentration at Site 1.					x	
01-PZ08	Monitor elevated perchlorate concentrations in perchlorate source area.					x	
01-PZ09	Monitor elevated perchlorate concentrations in perchlorate source area. Within area of potential hydrocarbon contamination.	x	x	x		x	
01-PZ11	Delineate perchlorate source area to 6 µg/L.					x	
01-PZ12	Delineate perchlorate source area to 6 µg/L.					x	
01-PZ21A	Monitor water quality changes.	x	x	x		x	
01-EW03	Monitor elevated perchlorate concentrations in perchlorate source area.					x	
IRP Site 2							
02_NEW02	Monitor Station boundary/ lateral extent of VOC plume.	x			x		
02_NEW07	Monitor water quality changes in relation to VOCs, most downgradient perchlorate well.	x			x	x	x
02_NEW08A	Monitor water quality changes in relation to VOCs.	x			x		x
02_NEW11	VOC upgradient (background).	x			x		x
02_NEW16	Monitor water quality changes in relation to VOCs. Delineate perchlorate plume downgradient of Site 2.	x			x	x	x
02_NEW19	Monitor water quality changes (Station boundary).	x			x		
02_NEW26	Monitor water quality changes in relation to VOCs. Monitor perchlorate concentrations downgradient from Station boundary.	x			x	x	x
02_NEW28	Monitor water quality changes in relation to VOCs. Monitor perchlorate concentrations downgradient from Station boundary.	x			x	x	x
02_NEW29	VOC hot spot monitoring	x			x		x
02PZ04	Monitor perchlorate concentrations downgradient from Site 2.					x	
02PZ12	Monitor water quality changes in relation to VOCs, maximum perchlorate concentration downgradient from Site 2.	x			x	x	x

Table ES-1 (continued)
GMP Monitoring Wells and Analyses

Acronyms and Abbreviations:

GMP – Groundwater Monitoring Program
ID – identification number
IRP – Installation Restoration Program
AA – Anomaly Area

TPH-d – total petroleum hydrocarbons, diesel range
TPH-g – total petroleum hydrocarbons, gasoline range
VOC – volatile organic compound
µg/L – micrograms per liter

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Acronyms and Abbreviations

AA3	Anomaly Area 3
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure
CDM	CDM Federal Programs Corporation
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chain-of-custody
DHS	California Department of Health Services
EOD	explosive ordnance disposal
EWI	Environmental Work Instruction
°F	degrees Fahrenheit
GIS	geographic information systems
GMP	groundwater monitoring program
IDW	investigation-derived waste
IRP	Installation Restoration Program
MCAS	Marine Corps Air Station
MCL	Maximum Contaminant Level
MSC R	miscellaneous refuse
MSL	mean sea level
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
NEDD	Naval Environmental Data Deliverable
NFESC	Naval Facilities Engineering Service Center
NIRIS	Naval Installation Restoration Information Solution
OEHHA	Office of Environmental Health Hazard Assessment
PHG	Public Health Goal
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RPM	remedial project manager
SAP	sampling and analysis plan
SOP	standard operating procedure
SQL	standard query language
TDS	total dissolved solids
TPH-d	total petroleum hydrocarbon, diesel range
TPH-g	total petroleum hydrocarbon, gasoline range

Acronyms and Abbreviations

UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound

Section 1

Introduction

CDM Federal Programs Corporation (CDM) has prepared this Work Plan for a groundwater monitoring program (GMP) at Anomaly Area 3 (AA3) and Installation Restoration Program (IRP) Sites 1 and 2 at the Former Marine Corps Air Station (MCAS) El Toro. The groundwater monitoring will be performed for Naval Facilities Engineering Command (NAVFAC) Southwest under Contract Number N68711-04-D-1110, Delivery Order Number 0006.

1.1 Purpose of the GMP

This Work Plan has been prepared to further characterize groundwater at AA3, and to update the current GMP activities at IRP Sites 1 and 2. Due to historic uses, AA3 and IRP Site 2 must be monitored as part of routine monitoring of constituents to support the remedy selection process.

Due to past disposal training activities, IRP Site 1 has shown elevated concentrations of perchlorate and will be monitored until a preferred remedial action is selected. The Navy evaluated each site individually to assess historical groundwater trends and site activities in order to recommend the GMP described in this Work Plan.

1.2 Work Plan Organization

This Work Plan is organized as indicated below:

Section 1.0	Introduction
Section 2.0	Site Background
Section 3.0	Environmental Setting
Section 4.0	Project Tasks
Section 5.0	Project Schedule
Section 6.0	Data Management Plan
Section 7.0	Investigation Derived Waste (IDW) Management Plan
Section 8.0	References

The following appendices are included:

Appendix A	Sampling and Analysis Plan
Appendix B	Site Health and Safety Plan

Appendix C Standard Operating Procedures

Appendix D Field Monitoring Forms

Section 2

Site Background

This section provides a brief description of the sites and their history.

2.1 Site Location and Description

Former MCAS El Toro is situated in south-central Orange County, California (Figure 2-1). Former MCAS El Toro is within the city of Irvine. The station is bordered on the east and southeast by the city of Lake Forest; to the southeast, south, and southwest by the city of Irvine; and to the west, north, and northeast by unincorporated portions of Orange County and Federal Aviation Administration (FAA) property.

At its maximum size, Former MCAS El Toro comprised approximately 4,712 acres. Since base closure, approximately 3,792 acres have been transferred for reuse. In 1998, the Bake Parkway/Interstate 5 public highway expansion project resulted in the transfer of approximately 23 acres in the southeast portion of the station to the California Department of Transportation. In 2001, approximately 897 acres in the northeast portion of the station were transferred to the FAA. In addition, approximately 74 acres in the northeast portion of the station are pending transfer to another federal agency. Approximately 2,798 acres were transferred by deed to Lennar Corporation in July 2005. The remaining 920 acres are being leased in furtherance of conveyance. The general layout of Former MCAS El Toro and locations of the sites included under this GMP are shown on Figure 2-2.

AA3

AA3 was designated as miscellaneous refuse (MSC R) 1, a "former refuse disposal area" in the *Draft Base Realignment and Closure (BRAC) Business Plan Year 2004 Update* (Navy 2005). Historically, the site was used as a source of borrow material. AA3 is located in the north-central part of Former MCAS El Toro, east of Irvine Boulevard, south of Pusan Way, and on the north side of Agua Chinon Wash. AA3 is located west of a former residential area.

IRP Site 1

IRP Site 1 was historically used for EOD training. IRP Site 1 is approximately 74 acres located in the northeast portion of Former MCAS El Toro, northeast of Magazine Road, and south west of Highway 241, in an undeveloped area.

IRP Site 2

IRP Site 2 was historically used as a landfill. IRP Site 2 is located in the southeast portion of Former MCAS El Toro, east of Magazine Road, and on the north side of Borrego Canyon Wash.

2.2 Site History

In March 1943, MCAS El Toro was commissioned as a Marine Corps pilot fleet operation training facility. In 1950, MCAS El Toro was selected for development as a master jet station and permanent center for Marine Corps aviation on the west coast to support the operations and combat readiness of Pacific Fleet Marine Forces. Since commissioning, MCAS El Toro was utilized for aviation activities. Other activities that have been performed on the base include aircraft maintenance and refurbishing operations, metal plating, sewage treatment, and incineration of trash. These activities have generated waste oils, paint residues, hydraulic fluid, used batteries, and other wastes. In March 1993, MCAS El Toro was placed on the BRAC list of proposed military facilities considered for base closure and was formally selected for closure in September of that year. During 1998 and early 1999, all of the aircraft squadrons were transferred to other Marine Corps and Naval Air Stations. All remaining military operations ceased when MCAS El Toro formally closed in July 1999.

As part of an ongoing GMP in place since 1992, 24 rounds of groundwater monitoring have been conducted at Former MCAS El Toro to evaluate different aspects of groundwater quality at the base. Rounds 1 and 2 (1992-1993) were conducted under the Comprehensive Long-Term Environmental Action Navy (CLEAN) I program and Rounds 3 through 7 (1995-1997) were conducted under the CLEAN II program. In 1999, the GMP was evaluated and revised for Rounds 8 through 11. Modifications to the number of wells sampled, and the analyses conducted at each well were implemented during Round 12. Wells were added and removed from the GMP during Rounds 13 through 24 based on discussions with the BRAC Cleanup Team (BCT) and regulatory agencies.

The results of Round 23 and 24 groundwater monitoring are presented in the 2006 Annual Groundwater Monitoring Report (CDM 2007). Recommendations presented in the report are as follows:

- Add Anomaly Area 3 (AA3) to the current basewide GMP for Former MCAS El Toro. Wells to be sampled at AA3 will include AA3MW01, AA3MW02, AA3MW06, AA3MW08, AA3MW11, and AA3MW12. Rationale for the sampling program at AA3 will be detailed in a work plan to be prepared prior to sampling in 2007.
- Continue analyses of general chemical parameters, including total dissolved solids, pH, electrical conductivity, chloride, nitrate, and sulfate at former landfill and refuse disposal sites at Former MCAS El Toro, including IRP Sites 1, 2, and AA3. Sampling of IRP Sites 3, 5, and 17 will be discontinued under the current basewide GMP as they will be monitored under site-specific remedial actions.
- Install dedicated bladder pump and tubing in well 02NEW07 and conduct low-flow sampling at all wells included in the current GMP.

- Conduct a detailed analysis of the current well fields and historical data at IRP Sites 1, 2, and AA3 and determine an appropriate sampling program for each of the sites. Rationale for the sampling program at each site will be detailed in a work plan to be prepared prior to sampling in 2007.
- Prepare a new detailed work plan to include recommendations above per the Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPP). The work plan should be implemented for the 2007 sampling rounds to be conducted in July (Round 25) and November (Round 26).
- Decommission and/or conduct maintenance to the existing monitoring well network as necessary based on discussions with the regulatory agencies.

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SENSITIVE RECORD

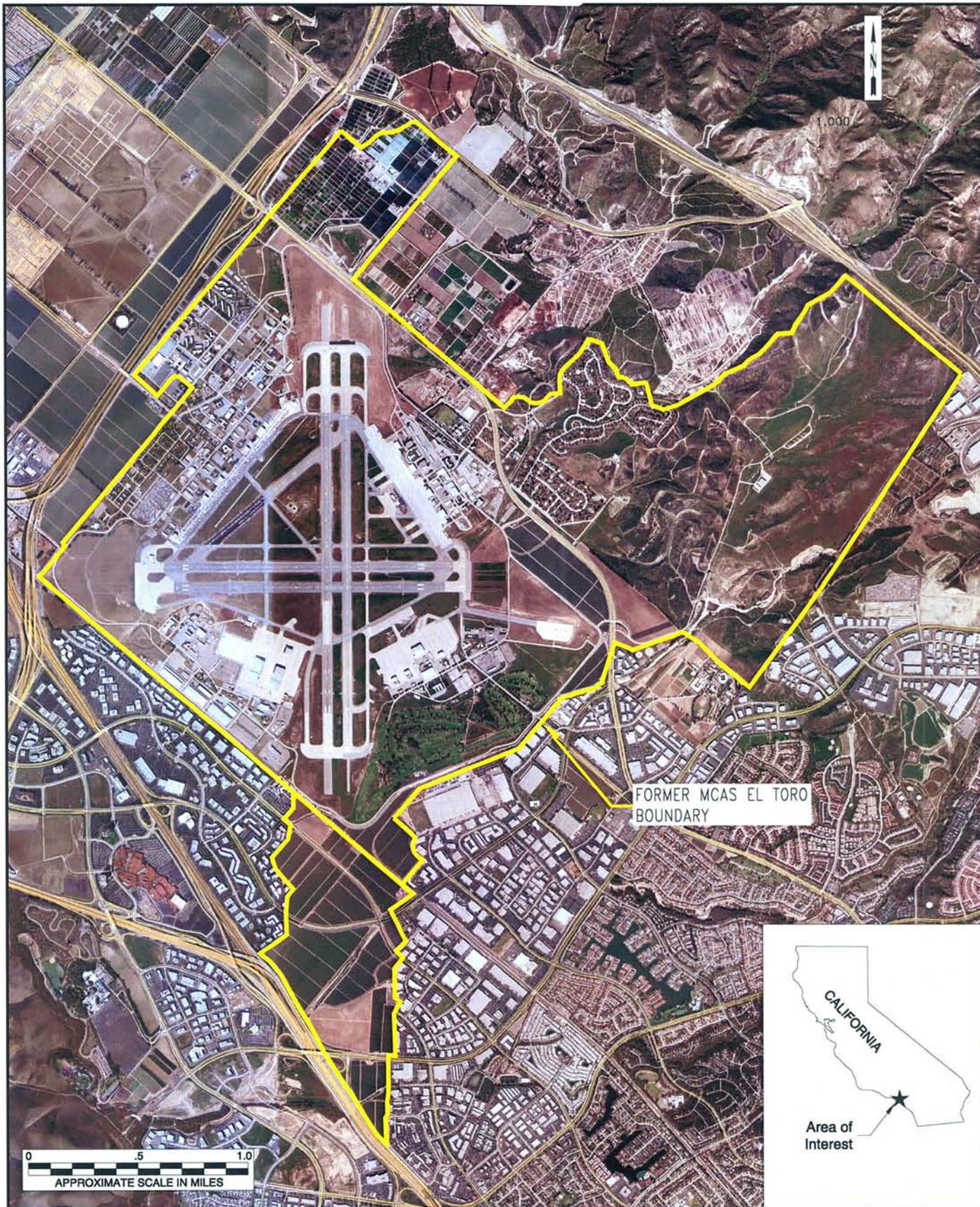
PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE
AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURES 2-1 AND 2-2

FOR ADDITIONAL INFORMATION, CONTACT:

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FORMER MCAS EL TORO
IRVINE, CALIFORNIA

AREA LOCATION MAP

FIGURE

CDM

DATE: 02/2007

FN: 003_WP

Work Plan for Groundwater Monitoring Program
Former MCAS El Toro, California

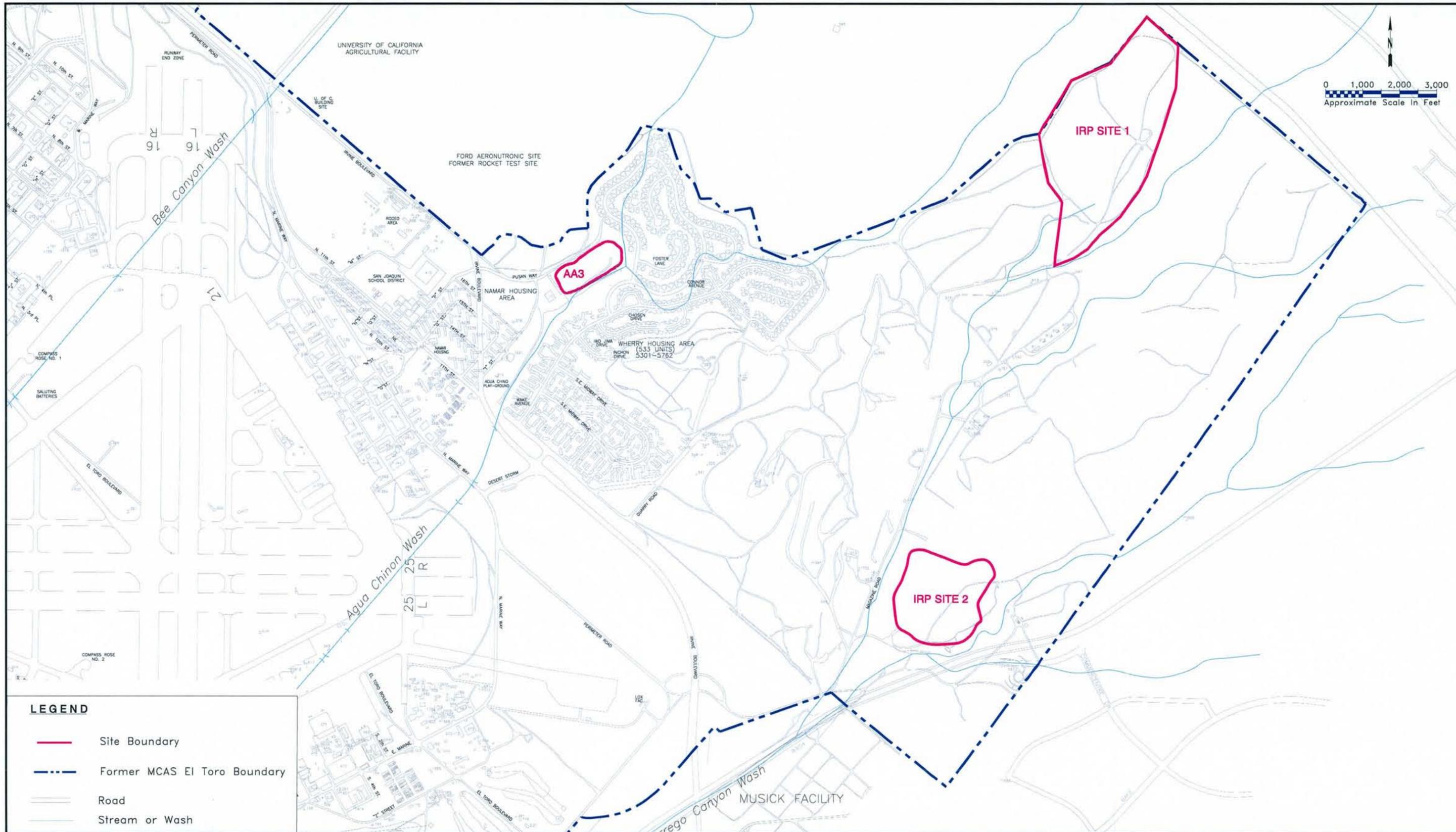
2-1

MODIFIED BY: *J. Brown*

PROJECT NO.: 6228-003

PAGE NO. 2-6

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LEGEND

- Site Boundary
- - - Former MCAS El Toro Boundary
- Road
- Stream or Wash

FORMER MCAS EL TORO
IRVINE, CALIFORNIA

CDM

DATE: 04/2007

FN: 003_WP

MODIFIED BY: *J. Brown*

PROJECT NO.: 6228-003

ANOMALY AREA 3 AND IRP SITES 1 AND 2

Work Plan for Groundwater Monitoring Program
Former MCAS El Toro, California

FIGURE

2-2

Section 3

Environmental Setting

This section discusses the local geology and soils, hydrogeology, surface hydrology, topography, and climate. Information in this section was obtained from the *Sampling and Analysis Plan for Groundwater Monitoring at MCAS El Toro* unless otherwise referenced (CDM 1995).

3.1 Site Geology and Soils

Former MCAS El Toro is predominantly underlain by Tertiary age sedimentary rocks, which are overlain by Holocene and Pleistocene surficial units (Fife 1974). The Holocene materials consist of isolated coarse grained, stream channel deposits contained within a matrix of fine-grained overbank deposits with a thickness up to 300 feet (Herndon and Reilly 1989). The Holocene alluvial materials conformably overlie Pleistocene age sediments composed predominantly of inter-layered fine-grained lagoonal and near-shore marine deposits (Singer 1973). The deeper Quaternary sediments may be equivalent to the lower Pleistocene San Pedro Formation, which consists of semi-consolidated silts, clays, and sands with inter-bedded limestone. These lagoonal and shallow marine deposits are considered to be a major water bearing unit in the region (Brown and Caldwell 1986).

The Pleistocene deposits unconformably overlie older semi-consolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene age; these units make up the Niguel, Fernando, and Capistrano Formations. These semi-consolidated sediments are considered to be the bedrock near Former MCAS El Toro. The lower Pliocene Fernando Formation is the base of the water-bearing units at Former MCAS El Toro (Herndon and Reilly 1989).

3.2 Regional Hydrogeology

Former MCAS El Toro is located in the Irvine Groundwater Subbasin and is underlain by unconsolidated alluvial sediments of Holocene and Pleistocene age. The alluvial sediments beneath the Former MCAS El Toro and the off-station area to the west and northwest are divided into three primary hydrogeologic units. These consist of a coarse-grained interval designated as the shallow groundwater unit, a deeper coarse-grained interval designated as the principal aquifer, and a fine-grained intermediate zone that appears to provide some hydraulic separation between the two aquifer zones. Low-permeability, semiconsolidated materials underlie the principal aquifer zone. The contact between the principal aquifer and the underlying low-permeability materials is considered to be the base of the water-bearing zone in this area (Herndon and Reilly 1989). Groundwater in the shallow groundwater unit is present under unconfined conditions, while groundwater in the principal aquifer is typically present under confined conditions.

The intermediate zone that separates the shallow groundwater unit from the deeper principal aquifer consists of fine-grained alluvial sediments and ranges from approximately 70 to 140 feet thick (JEG 1996). Although the vertical thickness and low-permeability suggest that the intermediate zone acts as an aquitard throughout much of the Irvine Subbasin, subsurface data also indicate that it is not a single, continuous, extensive geologic unit (JEG 1996). Historical monitoring data documenting the movement of volatile organic compounds (VOCs) from the shallow groundwater unit to the principal aquifer also indicate that some hydraulic interconnection occurs through the intermediate zone.

The principal aquifer is the main water-production zone in the Irvine area. The saturated thickness of the principal aquifer ranges from less than 50 feet in the eastern portion of the Irvine Subbasin to approximately 1,000 feet in the western portion (JEG 1996). Groundwater elevations in the principal aquifer under static (non-pumping) conditions range from approximately 58 feet above mean sea level (MSL) near the western end of the Irvine Subbasin to about 183 feet above MSL along its eastern margin beneath the western corner of the Former MCAS El Toro. Beneath the Former MCAS El Toro, the direction of groundwater flow is predominately toward the northwest and converges on a groundwater depression in the downgradient direction to the west of the Former MCAS El Toro. The most recent, available groundwater elevations at the GMP monitoring wells are listed in Table 3-1.

Highlands in the vicinity of IRP Sites 1 and 2 are composed of Miocene marine and non-marine sandstone and siltstone of the Sespe, Vaqueros, Topanga and Monterey Formations. Pleistocene semi-consolidated sand and gravel terrace deposits outcrop along the banks, and Holocene alluvium, consisting of unconsolidated clay, silt, sand, gravel and cobbles, occurs within Borrego Canyon Wash, which is an ephemeral stream that drains the foothills of the Santa Ana Mountains to the northeast. The former Magazine Road Landfill was constructed directly on Holocene alluvial deposits within Borrego Canyon Wash. Based on data collected at Tustin Ranch from 1927 to 2003, annual average precipitation in the area is approximately 12.8 inches.

3.3 Surface Hydrology

Surface drainage near Former MCAS El Toro generally flows southwest, following the slope of the land perpendicular to the trend of the Santa Ana Mountains. Several washes originate in the hills northeast of Former MCAS El Toro and flow through or adjacent to the base en route to San Diego Creek. Off-base drainage from the hills and from upgradient irrigated farmlands combines with base runoff at Former MCAS El Toro and flows into four main drainage channels: Borrego Canyon Wash, Agua Chinon Wash, Bee Canyon Wash, and Marshburn Channel. The southernmost channel is Borrego Canyon Wash, which flows along the southeast boundary of Former MCAS El Toro. Both Agua Chinon Wash and Bee Canyon Wash cross the central portion of Former MCAS El Toro. Marshburn Channel is a lined drainage channel that runs along the northwestern boundary of Former MCAS El Toro.

3.4 Topography

Former MCAS El Toro is situated on the southeastern edge of the Tustin Plain, a gently sloping surface of alluvial fan deposits derived mainly from the Santa Ana Mountains. The Tustin Plain, bounded on the north and east by the Santa Ana Mountains and on the south by the San Joaquin Hills, is at the southeast end of the Los Angeles Basin, a large sedimentary basin in the Peninsular Ranges Geologic Province. At the west corner of Former MCAS El Toro, the elevation is approximately 215 feet above MSL and rises to approximately 800 feet above MSL at the east corner, in the foothills of the Santa Ana Mountains.

3.5 Climate

Former MCAS El Toro has a Mediterranean climate, characterized by cool, moist winters and warm, dry summers. Early morning fog is typical in late spring and early summer. Annual precipitation averages 12.2 inches with most of the rainfall occurring from November through April. Winter temperatures seldom drop below freezing. The mean low temperature is 37 degrees Fahrenheit (°F) and summer temperatures rarely exceed 100°F.

**Table 3-1
GMP Monitoring Wells
Most Recent Groundwater Elevation Data**

Monitoring Well ID	Date	Depth to Groundwater (feet below TOC)	Groundwater Elevation (feet above MSL)
AA3MW01 ^a	5 February 2007	28.14	430.89
AA3MW02 ^a	5 February 2007	43.29	420.45
AA3MW06 ^a	5 February 2007	29.73	445.99
AA3MW08 ^a	5 February 2007	29.78	439.87
AA3MW11 ^a	5 February 2007	29.85	437.50
AA3MW12 ^a	5 February 2007	32.41	443.46
01MW201 ^e	2 November 2006	41.42	624.57
01MW204 ^b	23 March 2006	37.28	628.73
01MW211 ^c	8 June 2005	26.33	521.24
01MW215 ^c	8 June 2005	29.88	565.48
01MW223 ^b	24 October 2005	41.23	578.66
01PZ07 ^b	24 October 2005	31.87	631.30
01PZ21A ^b	23 March 2006	33.87	613.72
02_NEW02 ^e	31 October 2006	69.72	424.96
02_NEW07 ^e	31 October 2006	125.65	353.47
02_NEW08A ^e	31 October 2006	49.61	463.27
02_NEW11 ^e	31 October 2006	32.38	501.47
02_NEW16 ^e	31 October 2006	44.46	447.32
02_NEW19 ^f	11 January 2007	64.64	427.04
02_NEW26 ^f	9 January 2007	78.36	402.38
02_NEW28 ^f	10 January 2007	58.5	423.36
02_NEW29 ^f	10 January 2007	51.11	441.73
02PZ12 ^d	December 2005	54.81	441.18

Notes and Acronyms:

^aSource: Earth Tech 2006b; updated with results from the most recent groundwater sampling event conducted in February 2007

^bSource: ECS 2006

^cSource: Earth Tech 2006a

^dSource: Earth Tech 2006c

^eSource: CDM 2007

^fIRP Site 2 supplemental sampling event field data from January 2007, Earth Tech, Inc. report currently in preparation.

ECS = Environmental Compliance Solutions, Inc.

ID = identification number

MSL = mean sea level

TOC = top of casing

Section 4

Project Tasks

The following project tasks will be performed during the GMP at Former MCAS El Toro.

4.1 Procurement of Subcontractors for Field Work

Prior to beginning fieldwork, subcontractors for the following services will be procured:

- Analytical laboratory testing services; and
- Data validation services.

4.2 Field Work

The field work consists of mobilizing a groundwater sampling team, collecting groundwater level measurements and samples from existing groundwater monitoring wells, and IDW management and disposal. The field procedures to be conducted during implementation of this Work Plan are described in detail in the Sampling and Analysis Plan (SAP) included as Appendix A and CDM's Technical Standard Operating Procedures (SOPs) included as Appendix C.

4.2.1 Groundwater Sampling

A total of 37 groundwater monitoring wells will be sampled semi-annually under this GMP. Prior to the first sampling event under this Work Plan (scheduled for July 2007), dedicated bladder pump systems will be installed in all monitoring wells which are not already equipped with them, and missing monitoring well construction data will be gathered.

4.2.2 IDW Management

Disposal of IDW will be in accordance with SOP 2-2, Guide to Handling Investigation Derived Waste, provided in Appendix C. The IDW management plan is presented as Section 7 of this Work Plan.

4.3 Laboratory Analysis

All samples collected during this GMP will be submitted for off-site chemical analyses at a Naval Facilities Engineering Service Center (NFESC)-approved, California-certified analytical laboratory. Table 5-1 in the SAP provides the rationale for selected wells and analyses. Groundwater samples will be analyzed as follows:

AA3

- VOCs using United States Environmental Protection Agency (U.S. EPA) Method 8260B;

- Dissolved metals using U.S. EPA Method 6010/7000; and
- General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (total dissolved solids [TDS]).

IRP Site 1

- VOCs using U.S. EPA Method 8260B;
- Total petroleum hydrocarbons (TPH), gasoline range (TPH-g) using U.S. EPA Method 8015 Modified;
- TPH diesel range (TPH-d) using U.S. EPA Method 8015 Modified;
- Dissolved metals using U.S. EPA Method 6010/7000;
- Perchlorate using U.S. EPA Method 314; and
- General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (total dissolved solids [TDS]).

IRP Site 2

- VOCs using U.S. EPA Method 8260B;
- Perchlorate using U.S. EPA Method 314;
- Dissolved metals using U.S. EPA Method 6010/7000; and
- General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (TDS).

4.4 Data Validation and Evaluation

All data validation will be conducted in accordance with *Environmental Work Instruction (EWI) No. 1, Data Validation Guidelines for Chemical Analysis of Environmental Samples* (NAVFAC Southwest 2001) and updates from *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA 2004). EWI No. 1 is compiled from *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA 1994) and *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (U.S. EPA 1999). Section 12 of the SAP (Appendix A) provides additional details regarding data validation.

4.5 Review Meetings

Review meetings will be held after receipt of interim data packages from the data validators and at the discretion of the BRAC remedial project manager (RPM) to review and discuss the progress, details, findings, and conclusions pertaining to the GMP.

4.6 Reports

The reporting effort will consist of (1) preparation of Draft and Final Data Summary Reports after July sampling events, and (2) preparation of Preliminary Draft, Draft and Final Annual Reports after November sampling events.

The Data Summary Reports will include summary data tables, maps, and a description of field activities. Navy RPM comments to the Draft Data Summary Report will be incorporated into the Final Data Summary Report for submittal to the regulatory agencies. An analytical database in the Naval Electronic Data Deliverable (NEDD) format will also be prepared.

The Annual Reports will include summary data tables, maps, a description of field activities, evaluation of data from both July and November monitoring events, and recommendations. Analytical results will be screened against Maximum Contaminant Levels (MCLs) (California Department of Health Services [DHS] 2003) and Public Health Goals (PHGs) (Office of Environmental Health Hazard Assessment [OEHHA] 2004) as appropriate. NAVFAC Southwest comments to the Pre-Draft Annual Report will be incorporated and a Draft Annual Report will be prepared for submittal to the regulatory agencies. Regulator comments to the Draft Annual Report will be incorporated into the Final Annual Report. An analytical database in the NEDD format will also be prepared for the Annual Reports.

All reports will include text, tables, and graphics. The reports will be submitted in Microsoft Word, graphics will be in AutoCAD, and data tables will be in Microsoft Excel. The following are preliminary sections for the Data Summary and Annual Reports:

Introduction: Summary information on the site description, site history, and the contaminant sources, as well as a description of the GMP purpose, scope, and objectives.

Site Activities: Description of procedures used for the groundwater sampling, IDW management, sample handling and management, field quality control (QC) samples, decontamination procedures, laboratory analysis, and data management. Any deviations from the work plan or the SAP will also be addressed in the report.

Summary of Monitoring Results: Description of analytical data, summary of data evaluation results, and a summary of the nature and extent of contamination.

Quality Assurance (QA) and QC: Summary of QA/QC measures conducted on analytical data results obtained from site activities.

Conclusions and Recommendations (not included in Data Summary Reports): Conclusions from the groundwater monitoring and recommendations for continued monitoring or no further action at the sites.

Appendices: Field forms, laboratory reports (including completed chain-of-custody [COC] forms), and data validation report (provided only in the final reports).

Section 5

Project Schedule

The schedule for performing and reporting groundwater monitoring activities is presented in Table 5-1. The schedule lists the major tasks described in this Work Plan, their anticipated duration, and deliverable deadlines.

**Table 5-1
Project Schedule (UFP-QAPP Worksheet #16)**

Project Milestone	Scheduled Date
Contract Award	12 June 2006
Background Data Collection Visit	December 2006
Preliminary-Draft Work Plan	23 February 2007
NAVFAC Southwest Review Comments on Work Plan	9 June 2007
Draft Work Plan	27 June 2007
Regulatory Agency Comments on Work Plan	July 2007
Final Work Plan	05 October 2007
Spring Sampling Event	July 2007
Interim Data Package	August 2007
Draft Data Summary Report	October 2007
NAVFAC Southwest Comments	November 2007
Final Data Summary Report	December 2007
Fall Sampling Round	November 2007
Interim Data Package	December 2007
Preliminary Draft Annual Report	February 2007
NAVFAC Southwest Comments	March 2007
Draft Annual Report	April 2007
Regulatory Comments	June 2007
Final Annual Report	July 2007

Section 6

Data Management Plan

The objectives of data management are as follows:

- Standardize and facilitate the collection, formatting, transfer, and maintenance of sample data to the environmental database;
- Provide structured data sets that will support project planning and decision-making;
- Minimize the uncertainties associated with the data, data-derived products, and interpretation of results through QA/QC defined measures and practices;
- Provide accessible engineering and environmental data to support environmental quality characterization and monitoring, report generation, and other needs associated with the groundwater monitoring; and
- Provide data that are adequately documented with descriptive information for technical defensibility and legal admissibility.

Specify database procedures for delivering data in the client-specific NEDD file format. The data management and database scope of work will be implemented by CDM.

The data management system is composed of the database itself, the computer hardware and software, the data management protocols, application programs, relevant procedures, and the data management staff.

The data management system is divided into five functions:

- Data acquisition;
- Data maintenance;
- Data analysis;
- Data integrity checks; and
- Data export.

The five functions provide data organization, quality, reporting, electronic data submission, and graphics generation abilities.

6.1 Data Acquisition

Data management tasks begin during field sampling with data acquisition and sample tracking.

The following field information will be entered and tracked for the groundwater monitoring:

- Site data; and
- Sampling for laboratory analysis (including COC forms).

6.2 Data Maintenance

Data maintenance functions encompass all tasks associated with loading, verifying, storing, and reporting the data. Data are loaded and stored in the GMP database.

The following is a description of the data maintenance and loading process:

- COC information is hand entered in the field by the sampling coordinator and the COCs are scanned to an electronic format;
- Electronic data deliverables are submitted by subcontractors for submission of laboratory and validation data directly to the database;
- Within the data loading process, a majority of the QA/QC steps are performed electronically. The loading process electronically checks the analytical laboratory data for validity and integrity;
- Any errors discovered in the data loading process are reported to data management staff, who will determine the necessary actions needed; and
- After the analytical data have been successfully loaded, the data remain within the database to maintain data integrity, generate reports, and perform analyses.

6.3 Data Analysis

Data analysis is performed using standard query language (SQL) within the database. The analysis performed includes:

- Data summary reports;
- Detections only reports;
- QA/QC reports;
- Data files for statistical analyses; and
- Data files for geographic information system (GIS), AutoCAD, or graphics.

6.4 Data Integrity Checks

Within the data acquisition, data maintenance, and data analysis task areas described previously, several QC measures are applied including data verification and data validation. Data verification and validation are integral to the data management

process and are performed in each module of the system. Data loading and quality checks comprise the process of creating a complete record of sampling and analytical result information in the database. This process merges the field data created at the time of sample collection with the data received from the laboratory.

6.5 Data Export

Data export is performed with SQL from within the database. Queries are written to extract the desired data from the database into flat files (comma-separated, tab-delimited, or fixed width) having the required client specific specifications. The GMP will have Naval Installation Restoration Information Solution (NIRIS) export requirements for the NEDD standard.

6.6 Database Verification

Once in the final database, reports are generated presenting views of the data that allow the project manager and data analysts to perform a final review of data quality. Several report formats are available to group information for specific disciplines to facilitate this review.

The final data stored within the database are continuously checked for completeness and integrity. To ensure accuracy and consistency, the following electronic and manual checks are carried out on every subset of the data:

- Automated scripts are run to verify that the referential integrity exists throughout the permanent tables;
- Samples of the environmental data, as well as the QC data, are hand-checked against the hard copy for accuracy and consistency; and
- An electronic check is conducted to verify that the test method counts are consistent and as expected.

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Section 7

IDW Management Plan

Specific equipment decontamination procedures are described in CDM's SOP 4-5, *Equipment Decontamination at Non-Radioactive Sites* (Appendix C). IDW generated from this project will consist of following types:

- Personal protective equipment (PPE); and
- Purge water from groundwater sampling.

At the request of NAVFAC Southwest, purge water will be transferred to the onsite treatment system.

PPE (nitrile gloves) will be disposed of as non-hazardous waste.

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Section 8

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Appendix A
Sampling and Analysis Plan

**Final
Appendix A
Sampling and Analysis Plan
(Field Sampling Plan and Quality Assurance Project
Plan)
Groundwater Monitoring at Anomaly Area 3 and IRP
Sites 1 and 2
Former Marine Corps Air Station El Toro
Irvine, California**

Prepared for:



DEPARTMENT OF THE NAVY
Base Realignment and Closure
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Under subcontract to:

Jonas & Associates, Inc.
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Prepared under:

Naval Facilities Engineering Command Southwest
Contract Number: N68711-04-D-1110
Delivery Order Number: 0006
DCN: JNS-1110-0006-0119

05 October 2007

Final

Appendix A

Sampling and Analysis Plan

(Field Sampling Plan and Quality Assurance Project Plan)

Groundwater Monitoring at Anomaly Area 3 and IRP Sites 1 and 2

Former Marine Corps Air Station El Toro

Irvine, California

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Contract Number: N68711-04-D-1110
Delivery Order Number: 0006
DCN: JNS-1110-0006-0119

Prepared by: _____

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10/4/2007
Date

Approved by: _____

Randa Chichakli, P.E.
CDM Quality Assurance Coordinator

10/4/07
Date

Approved by: _____

Nars Ancoj
NAVFAC Southwest Quality Assurance Officer

10/4/2007
Date

CDM

Former MCAS El Toro GMP SAP

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Elements of the UFP-QAPP and EPA QA/R-5 in Relation to this SAP (UFP-QAPP Worksheet #2)

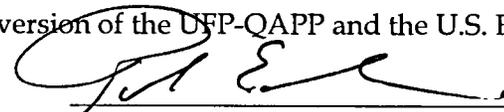
UFP-QAPP Worksheet	U.S. EPA QA/R-5	This SAP	Variance from UFP-QAPP
#1 Title and Approval Page	A1 Title and Approval Sheet	SAP title page, SAP approval page	
#2 QAPP Identifying Information	A2 Table of Contents	SAP title page, SAP Sections 1 and 2, this "crosswalk" table	
#3 Distribution List	A3 Distribution List	SAP page v	
#4 Project Personnel Sign-Off Sheet	A4 Project Task Organization	SAP page vii	
#5 Project Organization Chart	A4 Project Task Organization	SAP Figure 2-1	
#6 Communication Pathways	A4 Project Task Organization	SAP Section 2, Table 2-1 and Figure 2-1	
#7 Personnel Responsibilities and Qualifications Table	A4 Project Task Organization	SAP Section 2	
#8 Special Personnel Training Requirements Table	A8 Special Training/Certification	SAP Section 9	
#9 Project Scoping Sessions Participants Sheet	A6 Project/Task Description	Not in SAP	Sign in sheets and meeting minutes of scoping sessions are maintained in the Navy project file.
#10 Problem Definition	A5 Problem Definition/Background	SAP Sections 3 and 4, Table 4-1 (Step 1)	
#11 Project Quality Objectives/Systematic Planning Process Statements	A7 Quality Objectives and Criteria	SAP Sections 4 and 6	
#12 Measurement Performance Criteria Table	A7 Quality Objectives and Criteria	SAP Tables 7-2 and 7-4	
#13 Secondary Data Criteria and Limitations Table	A7 Quality Objectives and Criteria	SAP Section 4	
#14 Summary of Project Tasks	A6 Projects/Task Description	SAP Sections 6 and 11	
#15 Reference Limits and Evaluation Table	A7 Quality Objectives and Criteria	SAP Table 7-1	
#16 Project Schedule/Timeline Table	A6 Projects/Task Description	Work Plan Section 5	
#17 Sampling Design and Rationale	B1 Sampling Process Design (Experimental Design)	SAP Sections 4 and 5, SAP Table 5-1	
#18 Sampling Locations and Methods/SOP Requirement Table	B2 Sampling Methods	SAP Table 6-2	
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#20 Field Quality Control Sample Summary Table	B5 Quality Control	SAP Table 7-3	
#21 Project Sampling SOP Reference Table	B2 Sampling Methods	SAP Table 6-2	
#22 Field Equipment Calibration, Maintenance, Testing, and Inspection Table	B6 Inst/Equip Testing, Inspection, and Maintenance B7 Instrument/Equipment Calibration and Frequency	SAP Table 8-1	

Elements of the UFP-QAPP and EPA QA/R-5 in Relation to this SAP (UFP-QAPP Worksheet #2) (continued)

UFP-QAPP Worksheet	U.S. EPA QA/R-5	This SAP	Variance from UFP-QAPP
#23 Analytical SOP Reference Table		Not in SAP	Lab not available at SAP preparation. Information will be provided with full laboratory data package.
#24 Analytical Instrument Calibration Table		Not in SAP	Lab not available at SAP preparation. Information will be provided with full laboratory data package.
#25 Analytical Instrument and Equipment, Maintenance, Testing, and Inspection Table	B6 Inst/Equip Testing, Inspection, and Maintenance B7 Instrument/Equipment Calibration and Frequency	Not in SAP	Lab not available at SAP preparation. Information will be provided with full laboratory data package.
#26 Sampling Handling System	B3 Sample Handling and Custody	SAP Section 6.6	
#27 Sample Custody Requirements	B3 Sample Handling and Custody	SAP Section 6.7	
#28 QC Samples Table	B5 Quality Control	SAP Tables 7-2, 7-3, and 7-4	
#29 Project Documents and Records Table	A9 Documents and Records	SAP Table 10-1	
#30 Analytical Services Table		SAP Table 6-1	
#31 Planned Project Assessment Table	C1 Assessments and Response Actions	SAP Section 11.1	
#32 Assessment Findings and Response Actions	C2 Reports to Management	SAP Section 11.2	
#33 QA Management Reports Table	B10 Data Management	SAP Section 11.3	
#34 Sampling and Analysis Verification (Step 1) Process Table	D2 Verification and Validation Methods	SAP Section 12.1 and Table 12-1	
#35 Sampling and Analysis Validation (Steps 2a and 2b) Process Table	D2 Verification and Validation Methods	SAP Sections 12.2 and 12.3	
#36 Sampling and Analysis Validation (Steps 2a and 2b) Summary Table	D1 Data Review, Verification, and Validation	SAP Sections 12.2 and 12.3	
#37 Data Usability Assessment	D3 Reconciliation with User Requirements	SAP Sections 12.2 and 12.3	

I certify that this SAP is in compliance with the latest version of the UFP-QAPP and the U.S. EPA QA/R-5.

Randa E. Chichakli
PRINT NAME (Contractor QA Representative)


SIGNATURE

10/4/07
DATE

Distribution List (UFP-QAPP Worksheet #3)

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Project Personnel Sign Off Sheet (UFP-QAPP Worksheet #4)

Project Personnel	Organization	Title	Signature	Date SAP Read
Jacob Dunk	CDM	Project Manager		
David Lange	CDM	Field Team Leader, Site Health and Safety Officer		
Analytical Laboratory	To be determined	Quality Assurance Coordinator		*Note
Data Validator	To be determined	Project Manager		*Note

Note:

Relevant sections of the Sampling and Analysis Plan (SAP) will be included in the subcontractor scopes of work. Subcontractors will sign to indicate that they have read only those relevant sections of the SAP.

A copy of the completed (signed) Project Personnel Sign-Off Sheet will be included in the Data Summary Reports and Annual Reports.

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Acronyms and Abbreviations

AA3	Anomaly Area 3
ASTM	American Society for Testing and Materials
BAI	Barajas and Associates, Inc.
BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure
bgs	below ground surface
CAR	Corrective Action Request
CDM	CDM Federal Programs Corporation
°C	degrees Celsius
CFR	Code of Federal Regulations
CHSM	corporate health and safety manager
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	chain-of-custody
COPC	contaminant of potential concern
CPM	cycles per minute
DCE	dichloroethene
DHS	California Department of Health Services
DOD	Department of Defense
DQO	data quality objective
EBS	Environmental Baseline Study
ELAP	Environmental Laboratory Accreditation Program
EOD	explosive ordnance disposal
ESI	Expanded Site Inspection
eV	electron volt
EWI	Environmental Work Instruction
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulations
FS	feasibility study
GMP	Groundwater Monitoring Program
HCl	hydrochloric acid
HNO ₃	nitric acid
HSO	health and safety officer
ID	identification
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation-derived waste
IRP	Installation Restoration Program
JEG	Jacobs Engineering Group, Inc.
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate

Acronyms and Abbreviations

MCAS	Marine Corps Air Station
MCL	maximum contaminant level
MDL	method detection limit
µg/L	micrograms per liter
mg/L	milligrams per liter
ml	milliliter
MS	matrix spike
MSC R	miscellaneous refuse
MSD	matrix spike duplicate
MSL	mean sea level
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
NEDD	Naval Electronic Data Deliverable
NFESC	Naval Facilities Engineering Service Center
NIRIS	Naval Installation Restoration Information Solution
NTU	nephelometric units
OEHHA	Office of Environmental Health Hazard Assessment
OU	operable unit
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCE	tetrachloroethene
P.E.	Professional Engineer
P.G.	Professional Geologist
PHG	Public Health Goal
PID	photoionization detector
PP	proposed plan
ppm	parts per million
QA	quality assurance
QAO	quality assurance officer
QAPP	quality assurance project plan
QC	quality control
QSM	Quality System Manual
%R	percent recovery
RI	remedial investigation
RL	reporting limit
ROD	Record of Decision
ROICC	resident officer in charge of construction
RPD	relative percent difference
RPM	remedial project manager
RSE	Removal Site Evaluation
RWQCB	Regional Water Quality Control Board
SAP	sampling and analysis plan
SHASP	site health and safety plan
SOP	standard operating procedure
SRA	screening risk assessment

TCE	trichloroethylene
TDS	total dissolved solids
TPH	total petroleum hydrocarbon
TPH-d	TPH as diesel
TPH-g	TPH as gasoline
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
U.S. EPA	United States Environmental Protection Agency
VOA	volatile organic analyte
VOC	volatile organic compound

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Section 1

Introduction

CDM Federal Programs Corporation (CDM) has prepared this sampling and analysis plan (SAP) for a groundwater monitoring program (GMP) at Anomaly Area 3 (AA3) and Installation Restoration Program (IRP) Sites 1 and 2 at the Former Marine Corps Air Station (MCAS) El Toro. The GMP will be performed for Naval Facilities Engineering Command (NAVFAC) Southwest under Contract Number N68711-04-D-1110, Delivery Order Number 0006.

1.1 Site Location and Description

Former MCAS El Toro is situated in south-central Orange County, California (Figure 1-1). Former MCAS El Toro is within the city of Irvine. The station is bordered on the east and southeast by the city of Lake Forest; to the southeast, south, and southwest by the city of Irvine; and to the west, north, and northeast by unincorporated portions of Orange County and Federal Aviation Administration (FAA) property.

At its maximum size, Former MCAS El Toro comprised approximately 4,712 acres. Since base closure, approximately 3,792 acres have been transferred for reuse. In 1998, the Bake Parkway/Interstate 5 public highway expansion project resulted in the transfer of approximately 23 acres in the southeast portion of the station to the California Department of Transportation. In 2001, approximately 897 acres in the northeast portion of the station were transferred to the FAA. In addition, approximately 74 acres in the northeast portion of the station are pending transfer to another federal agency. Approximately 2,798 acres were transferred by deed to Lennar Corporation in July 2005. The remaining 920 acres are being leased in furtherance of conveyance. The general layout of Former MCAS El Toro and locations of the sites included under this GMP are shown on Figure 1-2.

AA3

AA3 was designated as miscellaneous refuse (MSC R) 1, a "former refuse disposal area" in the *Draft Base Realignment and Closure (BRAC) Business Plan Year 2004 Update* (Navy 2005). Historically, the site was used as a source of borrow material. AA3 is located in the north-central part of Former MCAS El Toro, east of Irvine Boulevard, south of Pusan Way, and on the north side of Agua Chionon Wash. AA3 is located west of a residential area.

IRP Site 1

IRP Site 1 was historically used for explosive ordnance disposal (EOD) training. IRP Site 1 is approximately 74 acres located in the northeast portion of Former MCAS El Toro, northeast of Magazine Road, and south west of Highway 241, in an undeveloped area.

IRP Site 2

IRP Site 2 was historically used as a landfill. IRP Site 2 is located in the southeast portion of Former MCAS El Toro, east of Magazine Road, and on the north side of Borrego Canyon Wash.

1.2 Purpose of GMP

This SAP has been prepared to further characterize groundwater at AA3, and to update the current GMP activities at IRP Sites 1 and 2. Due to historic uses, AA3 and IRP Site 2 must be monitored as part of routine monitoring of constituents to support the remedy selection process.

Due to past disposal training activities, IRP Site 1 has shown elevated concentrations of perchlorate and will be monitored until a preferred remedial action is selected. The Navy evaluated each site individually to assess historical groundwater trends and site activities in order to recommend the updated GMP described in this SAP.

1.3 Technical or Regulatory Standards

The format and contents of this SAP include both a field sampling plan and required elements from the United States Environmental Protection Agency (U.S. EPA) *Requirements for Quality Assurance Project Plans, USEPA QA/R-5* (U.S. EPA 2001), for a quality assurance project plan (QAPP). This SAP also meets the requirements of the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) (Intergovernmental Data Quality Task Force [IDQTF] 2005). A comparison of UFP-QAPP elements and U.S. EPA QAPP elements with the location of correlating sections in this document is provided at the beginning of this SAP.

SENSITIVE RECORD

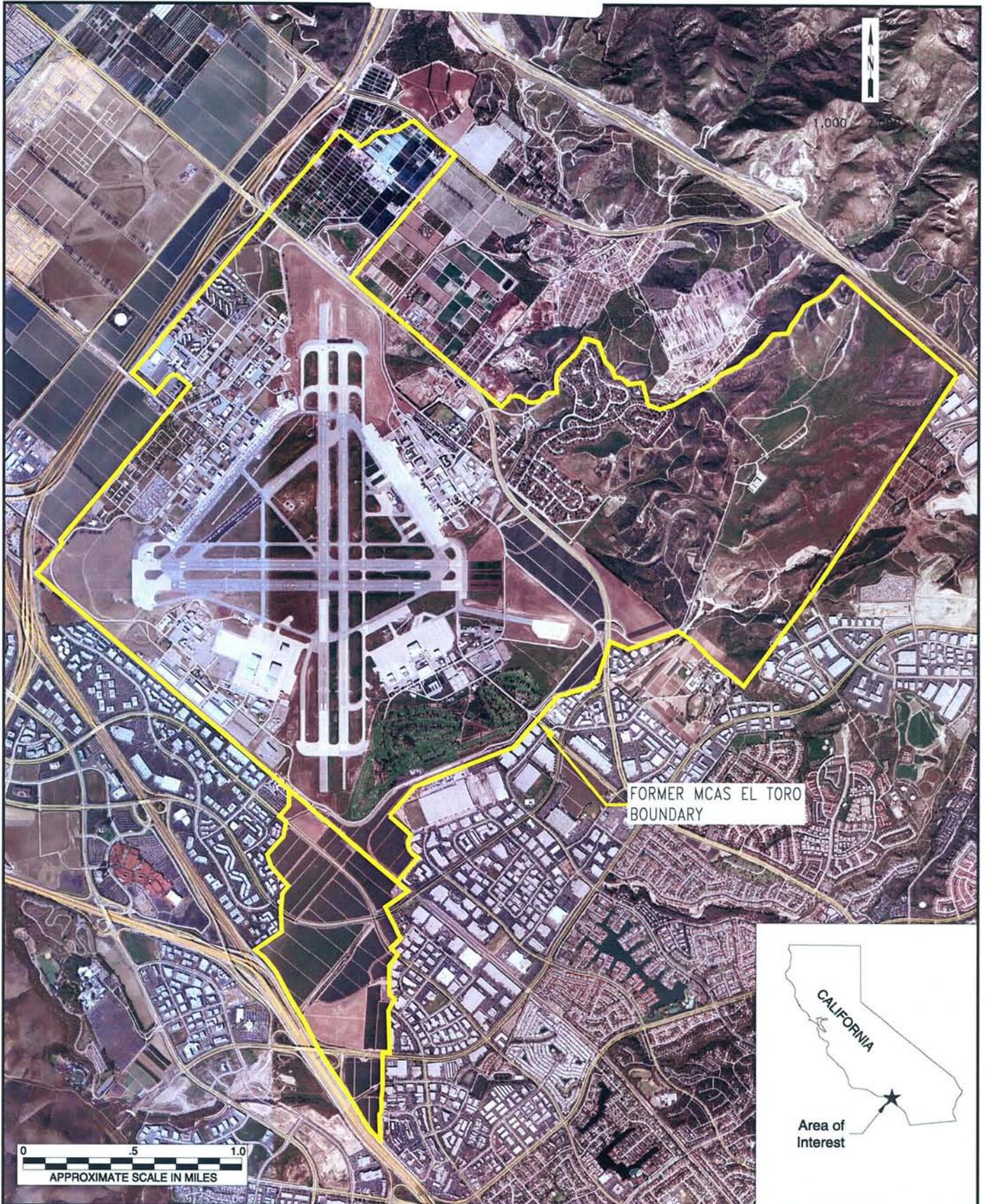
**PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE
AND ARE NOT AVAILABLE FOR PUBLIC VIEWING**

FIGURES 1-1 AND 1-2

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**



FORMER MCAS EL TORO
IRVINE, CALIFORNIA

AREA LOCATION MAP

FIGURE

CDM

DATE: 02/2007

FN: 003_SAP

1-1

MODIFIED BY: *J. Brown*

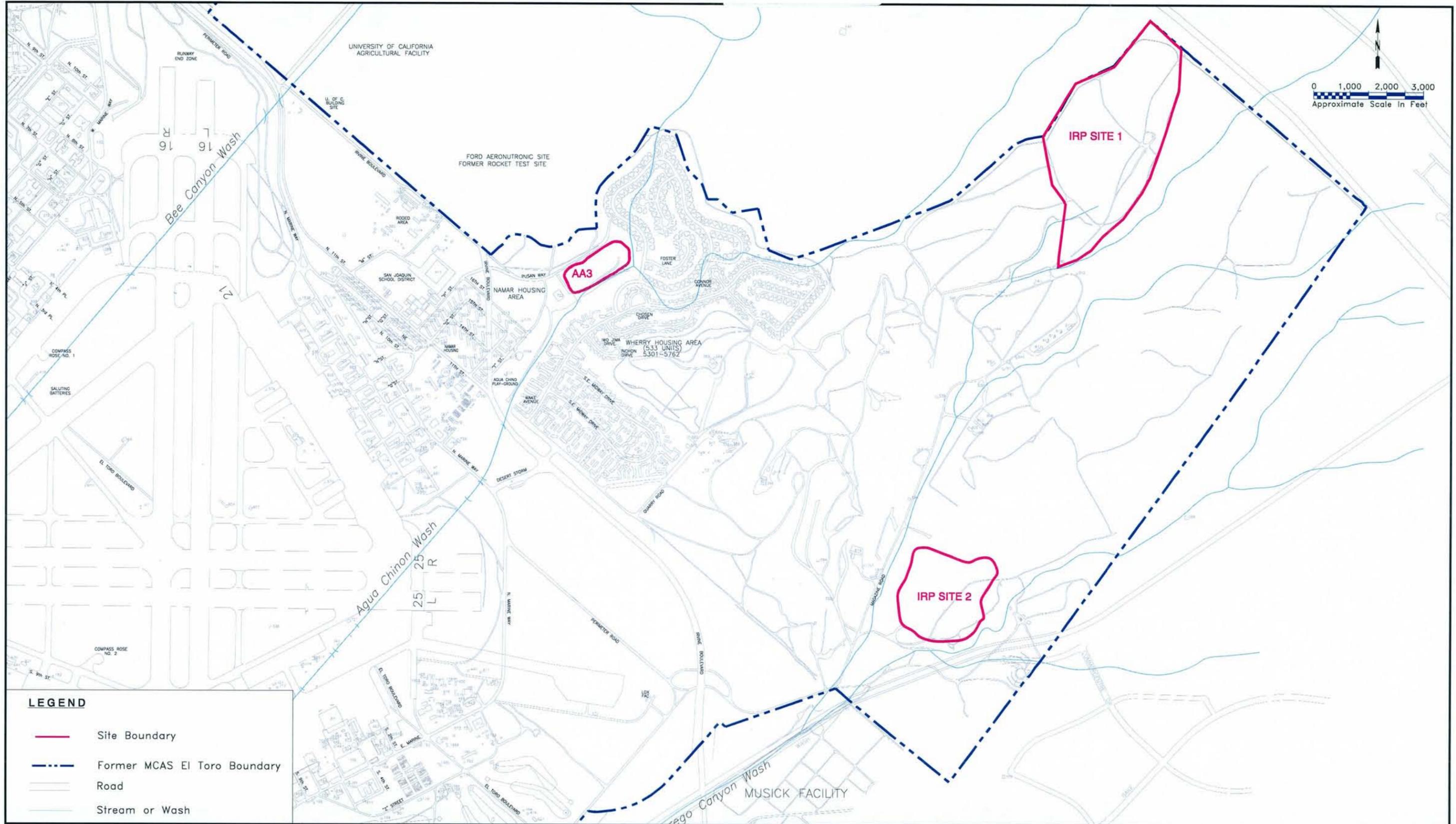
PROJECT NO.: 6228-003

Groundwater Monitoring Program
Former MCAS El Toro, California

PAGE NO. 1-4

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SENSITIVE



LEGEND

- Site Boundary
- - - Former MCAS El Toro Boundary
- Road
- Stream or Wash

FORMER MCAS EL TORO IRVINE, CALIFORNIA	
CDM	DATE: 02/2007
	FN: 003_SAP
MODIFIED BY: <i>J. Brown</i>	PROJECT NO.: 6228-003

ANOMALY AREA 3 AND IRP SITES 1 AND 2

Groundwater Monitoring Program
Former MCAS El Toro, California

FIGURE
1-2

SENSITIVE

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Section 2

Project Organization

Organization and responsibilities specific to the GMP are discussed below. An organizational chart is provided in Figure 2-1. Table 2-1 provides an outline of project related communication pathways between CDM, NAVFAC Southwest, and the Regional Water Quality Control Board (RWQCB) Santa Ana region.

2.1 CDM Project Team

The CDM project team will consist of the program manager, project manager, field team leader, field team support staff, corporate health and safety manager (CHSM), site health and safety officer (HSO), corporate Quality Assurance (QA) director, QA coordinator, and project staff.

The program manager, Larry Davidson, Professional Engineer (P.E.), will have overall responsibility for all aspects of the project and for communications between CDM and NAVFAC Southwest.

Day-to-day operations, subcontractor oversight, and site characterization will be the responsibility of the acting project manager, Jacob Dunk, who will report regularly to the program manager. The project manager will be assisted by the field team leader and HSO, Dave Lange, who will be responsible for on site coordination. In addition, Mr. Lange will be responsible for plan implementation and policy conformance by all field personnel and subcontractors at the site. Jacob Dunk, will have the overall responsibility to oversee all sampling activities including the reviewing and interpretation of data.

The CHSM, Chuck Myers, will be responsible for project oversight and review of the site health and safety plan (SHASP) (Appendix B of the Work Plan).

The corporate QA director, Doug Updike, will delegate project QA activities to the local QA coordinator, Randa Chichakli. Ms. Chichakli will be responsible for ensuring that analytical QA requirements are met, as well as in-house QA requirements for project deliverables and subcontractor work products associated with the project.

In accordance with CDM's QA program, all documents will be reviewed for technical accuracy and internal consistency prior to submittal to NAVFAC Southwest and regulatory agencies. Senior staff members are designated as official technical reviewers by CDM's Chief Technical Officer based on their education and relevant experience in specific technical subject matters. Technical reviewers must be independent of the document and when appropriate, multiple technical reviewers will be used for the document.

2.2 Subcontractors

A competitive bidding process, in accordance with the Federal Acquisition Regulations (FAR), will be used in the procurement of subcontractor services. Prior to beginning fieldwork, subcontractors for the following services will be procured:

- Analytical laboratory testing services; and
- Data validation services.

2.3 NAVFAC Southwest Personnel

Responsibilities of the NAVFAC Southwest personnel assigned to the GMP are as follows:

- The NAVFAC Southwest Contracting Specialist can authorize changes to the contract that affect schedule and cost. The Contract Specialist is Gracy Tinker, who can be reached at (619) 532-0782.
- The NAVFAC Southwest Quality Assurance Officer (QAO) provides government oversight of the QA program, including review and approval of SAPs. The QAO has authority to suspend affected projects or site activities if NAVFAC Southwest-approved quality requirements are not maintained. The NAVFAC Southwest QAO is Nars Ancog, who can be reached at (619) 532-3046.
- The Lead Remedial Project Manager (RPM) is the NAVFAC Southwest manager directly responsible for project execution. The Lead RPM for this project is Content Arnold who can be reached at (619) 532-0790. The Lead RPM will oversee the Technical Advisor for this project.
- The Technical Advisor is responsible for project execution and coordination with base representatives, regulatory agencies, and the NAVFAC Southwest management team and is the direct point of contact for questions regarding any aspect of the project. The Technical Advisor for this project is Louie Cardinale, who can be reached at (619) 532-0979.
- The Navy resident officer in charge of construction (ROICC), Mr. Scott Kehe, will be the alternate point of contact for the Navy. He can be reached at (949) 726-2506.

2.4 Regulatory Oversight and Communication Pathways

The RWQCB Santa Ana Region will be the lead regulatory agency for this GMP. See Table 2-1 for project related communication pathways between CDM, NAVFAC Southwest, and RWQCB Santa Ana Region.

**Table 2-1
Communication Pathways (UFP-QAPP Worksheet #6)**

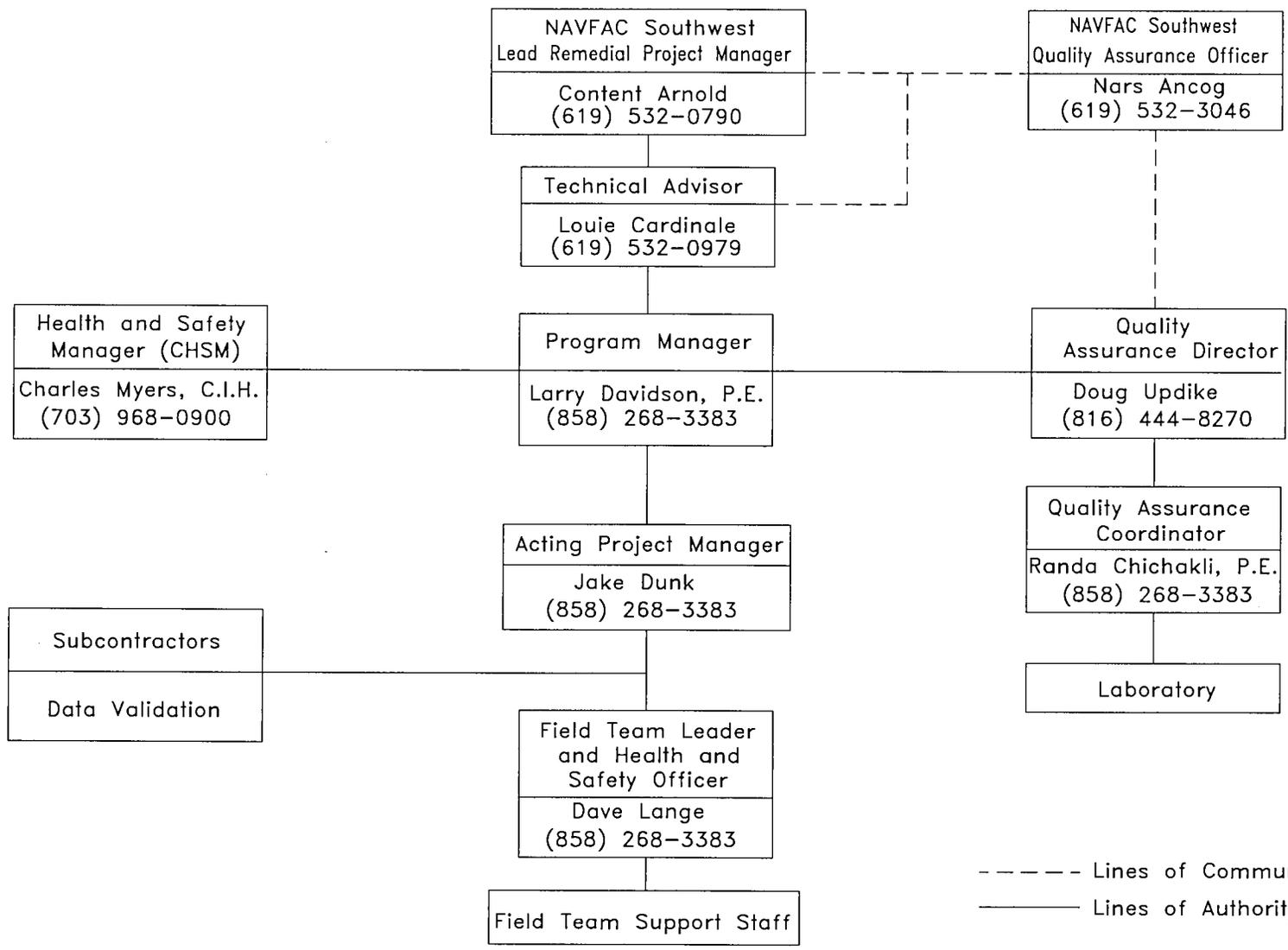
Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Approval of amendments to the SAP	NAVFAC Southwest	Nars Ancog	(619) 532-3046	CDM submits amended SAP through CDM QA Coordinator to NAVFAC Southwest QAO
Initiation or approval of delays or changes to field work	CDM	Jacob Dunk	(858) 268-3383	Field staff alerts Project Manager to need for delays or modifications
Corrective actions	NAVFAC Southwest	Louie Cardinale	(619) 532-0979	CARs submitted by CDM Project Manager to NAVFAC Southwest Technical Advisor
Data quality issues	Laboratory	TBD		Laboratory Project Manager alerts CDM Project Manager to any issue affecting data quality or delivery
Health and safety issues	CDM	Chuck Myers	(703) 968-0900	Field staff alerts CDM CHSM directly or through CDM Project Manager
Status reports	CDM	Jacob Dunk	(858) 268-3383	Status reports are e-mailed monthly to NAVFAC Southwest RPM
Updates to RWQCB-Santa Ana	NAVFAC Southwest	Louie Cardinale	(619) 532-0979	NAVFAC Southwest Technical Advisor communicates with RWQCB-Santa Ana on all necessary project related business

Acronyms and Abbreviations:

- CAR - Corrective Action Request
- CHSM – Corporate Health and Safety Manager
- NAVFAC – Naval Facilities Engineering Command
- QA – Quality Assurance
- QAO – Quality Assurance Officer
- SAP – Sampling and Analysis Plan
- RPM – Remedial Project Manager
- RWQCB – Regional Water Quality Control Board

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----- Lines of Communication
 _____ Lines of Authority

FORMER MCAS EL TORO IRVINE, CALIFORNIA	
CDM	DATE: 03/2007
	FN: 003_SAP
MODIFIED BY: <i>J. Brown</i>	PROJECT NO.: 6228-003

PROJECT ORGANIZATIONAL CHART
(UFP-QAPP WORKSHEET #5)
 Sampling and Analysis Plan for Basewide Groundwater Monitoring
 Former MCAS El Toro, California

FIGURE
2-1

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Section 3

Project Background

This section presents a site description and summary of previous investigations related to AA3 and IRP Sites 1 and 2.

3.1 Former MCAS El Toro

In March 1943, MCAS El Toro was commissioned as a Marine Corps pilot fleet operation training facility. In 1950, MCAS El Toro was selected for development as a master jet station and permanent center for Marine Corps aviation on the west coast to support the operations and combat readiness of Pacific Fleet Marine Forces. Since commissioning, MCAS El Toro was utilized for aviation activities. Other activities that have been performed on the base include aircraft maintenance and refurbishing operations, metal plating, sewage treatment, and incineration of trash. These activities have generated waste oils, paint residues, hydraulic fluid, used batteries, and other wastes. In March 1993, MCAS El Toro was placed on the BRAC list of proposed military facilities considered for base closure and was formally selected for closure in September of that year. During 1998 and early 1999, all of the aircraft squadrons were transferred to other Marine Corps and Naval Air Stations. All remaining military operations ceased when MCAS El Toro formally closed in July 1999.

3.2 Former MCAS El Toro GMP

The objectives of the GMP have changed over time based on the requirements of the IRP. As part of the Operable Unit (OU)-1, OU-2A, OU-2C and OU-3 Remedial Investigation/Feasibility Study (RI/FS) conducted between 1992 and 1997, a network of on- and off-station monitoring locations (single wells, cluster wells, and Westbay multipoint wells) were installed and sampling was conducted to determine groundwater flow patterns and to evaluate groundwater quality basewide. Two rounds of groundwater sampling and analyses were performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) I program in 1992 (Round 1) and in 1993 (Round 2).

When groundwater contamination was discovered in several areas, additional rounds of sampling (Rounds 3 through 7) were conducted between 1995 and 1997 under the CLEAN II program with the objectives of monitoring potential impacts of IRP sites on groundwater quality, identifying contaminants of potential concern (COPCs), monitoring the extent and movement of existing plumes, evaluating changes in groundwater over time, and providing data necessary to determine groundwater flow direction and hydraulic gradients. These rounds were conducted in accordance with an initial RI/FS Groundwater Monitoring Plan that was developed in 1995. The plan was modified continually to reflect additions of new wells, deletions of wells where contaminants were not reported, and evaluation of information gathered.

The draft final GMP (Bechtel National, Inc. 1999) was developed to assess groundwater conditions during the time remaining until implementation of final remedies at IRP Sites 2, 3, 5, 17, 18, and 24 and during the subsequent post-closure period. GMP Rounds 8 through 11 were conducted in general accordance with the provisions of the draft final GMP, with modifications as necessary.

Modifications to the number of wells sampled and analyses conducted at each well were implemented during Round 12. Wells were removed from the sampling list if they generated redundant data, were outside of the plume area, or were located within formerly closed sites. Analytical testing of samples collected from each well during Round 12 was selected to be consistent with contaminants at each site and to support basewide evaluations of contaminants. The GMP report for Round 12 describes changes to the GMP in detail (CDM 2001).

Additional wells were added and removed from the program during Rounds 13 through 24 based on discussions with the BRAC Cleanup Team (BCT) and regulatory agencies. Table 3-1 provides a breakdown of the previous groundwater monitoring rounds. The GMP is intended as an interim program until the remedial actions for each of the sites have been initiated.

The results of Round 23 and 24 groundwater monitoring are presented in the 2006 Annual Groundwater Monitoring Report (CDM 2007). Recommendations presented in the report are as follows:

- Add AA3 to the current basewide GMP for Former MCAS El Toro. Wells to be sampled at AA3 will include AA3MW01, AA3MW02, AA3MW06, AA3MW08, AA3MW11, and AA3MW12. Rationale for the sampling program at AA3 will be detailed in a work plan to be prepared prior to sampling in 2007.
- Continue analyses of general chemical parameters, including total dissolved solids, pH, electrical conductivity, chloride, nitrate, and sulfate at former landfill and refuse disposal sites at Former MCAS El Toro, including IRP Sites 1, 2, and AA3. Sampling of IRP Sites 3, 5, and 17 will be discontinued under the current basewide GMP as they will be monitored under site-specific remedial actions.
- Install dedicated bladder pump and tubing in well 02NEW07 and conduct low-flow sampling at all wells included in the current GMP.
- Conduct a detailed analysis of the current well fields and historical data at IRP Sites 1, 2, and AA3 and determine an appropriate sampling program for each of the sites. Rationale for the sampling program at each site will be detailed in a work plan to be prepared prior to sampling in 2007.
- Prepare a new detailed work plan to include recommendations above per the Uniform Federal Policy (UFP) for Quality Assurance Project Plans (QAPP). The work plan should be implemented for the 2007 sampling rounds to be conducted in July (Round 25) and November (Round 26).

- Decommission and/or conduct maintenance to the existing monitoring well network as necessary based on discussions with the regulatory agencies.

3.3 AA3

AA3 was designated as MSC R 1, a “former refuse disposal area” in the *Draft BRAC Business Plan Year 2004 Update* (Navy 2005). Historically, the site was used as a source of borrow material. A Draft Expanded Site Inspection (ESI) Report (Earth Tech 2003) was prepared and submitted to regulatory agencies in 2003. The report presented results of previous investigations and the portion of the Removal Site Evaluation (RSE) field investigation that was performed between Fall 2002 and Winter 2003. The report also included results of a human health screening risk assessment (SRA) and an ecological SRA for AA3. The Navy received and responded to regulatory agency comments on the Draft ESI Report on 28 June 2004. Based on the regulatory agency comments and subsequent discussions during BCT meetings, the Navy agreed that additional site characterization of AA3 pursuant to a RI/FS was required and that a “no further action” determination was not appropriate at that time. Therefore, the preparation of the RI/FS document was initiated. The regulatory agency comments on the Draft ESI Report (Earth Tech 2003) were incorporated into the RI/FS Report (Earth Tech and Barajas and Associates, Inc. [BAI] 2006).

Although a significant portion of the RSE investigation was performed between Fall 2002 and Winter 2003, periodic groundwater sampling and well installation was still occurring through April 2005. An evaluation of the most recent RSE groundwater sampling data, February and April 2005, from AA3 indicates that antimony was reported in concentrations exceeding the maximum contaminant level (MCL) (6 micrograms per liter [$\mu\text{g}/\text{L}$]) at MW-06 (9.7 $\mu\text{g}/\text{L}$), MW-12 (11.7 $\mu\text{g}/\text{L}$), and MW-13 (9.7 $\mu\text{g}/\text{L}$). Arsenic was reported in concentrations exceeding the MCL (50 $\mu\text{g}/\text{L}$) at MW-12 (62.2 $\mu\text{g}/\text{L}$). Additionally, selenium was reported in concentrations exceeding the MCL (50 $\mu\text{g}/\text{L}$) at MW-13 (97.9 $\mu\text{g}/\text{L}$), and thallium was reported in concentrations exceeding the MCL (5 $\mu\text{g}/\text{L}$) at MW-01 (7.8 $\mu\text{g}/\text{L}$), MW-06 (5.3 $\mu\text{g}/\text{L}$), and MW-08 (5.5 $\mu\text{g}/\text{L}$) (Earth Tech 2007).

3.4 IRP Site 1

IRP Site 1 was historically used as an EOD range (Navy 2005). The center of the site (approximately 33.5 acres) was used for EOD training. The Navy conducted the following investigation activities at IRP Site 1:

- 1985 - Initial Assessment Survey;
- 1993 - Phase I RI;
- 1998 - Verification of perchlorate in groundwater;
- 1998 - EOD Range Identification and Assessment;
- 1999 - Verification of perchlorate in soil;

- 2000-2006 – Radiological Assessment;
- 2001 – Site-specific Environmental Baseline Study (EBS);
- 2002-2005 – Phase II RI; and
- 2005-2006 – Aquifer test.

An RI is currently being conducted at IRP Site 1. Several wells within the site have been sampled as part of the RI to further delineate groundwater contamination. Perchlorate is the COPC at IRP Site 1.

One IRP Site 1 monitoring well was sampled during Rounds 23 and 24 of the Former MCAS El Toro basewide GMP. Volatile organic compounds (VOCs) were not detected above reporting limits in either round. Perchlorate was reported in the sample collected during Round 23 at a concentration of 376 µg/L and during Round 24 at a concentration of 320 µg/L. Results from both rounds exceeded the Navy action level of 24 µg/L (CDM 2007).

3.5 IRP Site 2

IRP Site 2 was historically used as the Magazine Road Landfill (OU-2B) (Navy 2005). The Record of Decision (ROD), signed in April 2000, implemented construction of a cap on the landfill and habitat restoration for the endangered California Gnatcatcher. The cap design was finalized and the Navy began construction in fall 2005 (U.S. EPA 2007).

A groundwater treatment pilot project was completed in Spring 2003 at IRP Site 2. Seven IRP Site 2 monitoring wells were sampled during Rounds 23 and 24. During Round 23, tetrachloroethene (PCE) was detected in monitoring wells 02NEW7 and 02NEW8A at concentrations of 0.9 µg/L and 8 µg/L, respectively. During Round 24, PCE was detected in well 02NEW8A at a concentration of 8.8 µg/L, but was not detected in well 02NEW7. Trichloroethylene (TCE) was reported in the sample collected from well 02NEW7 during Round 23 at a concentration of 32 µg/L, which is greater than previous analytical results and the MCL of 5 µg/L; however, TCE was not detected during Round 24.

**Table 3-1
Summary of Reports
Rounds 1 through 24**

Round	Date	Contractor	Comments
1	1992-1993	JEG	Phase I RI
2	1992-1993	JEG	Phase I RI
3	January - February 1996	CDM	182 Wells/Ports
4	November - December 1996	CDM	182 Wells/Ports
5	March 1997	CDM	182 Wells/Ports
6	July 1997	CDM	80 Wells/Ports
7	October 1997	CDM	80 Wells/Ports
8	October 1998	CDM	115 Wells/Ports
9	January - February 1999	CDM	23 Wells/Ports
10	April - May 1999	CDM	46 Wells/Ports
11	July - August 1999	CDM	115 Wells/Ports
12	June 2000	CDM	55 Wells/Ports
13	February 2001	CDM	78 Wells/Ports
14	September 2001	CDM	85 Wells/Ports
15	March 2002	CDM	94 Wells/Ports
16	September 2002	CDM	97 Wells/Ports
17	March 2003	CDM	98 Wells/Ports
18	September 2003	CDM	97 Wells/Ports
19	March 2004	CDM	100 Wells/Ports
20	September 2004	CDM	113 Wells/Ports
21	March 2005	CDM	114 Wells/Ports
22	September 2005	CDM	132 Wells/Ports
23	March 2006	CDM	19 Wells
24	October 2006	CDM	19 Wells

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Section 4

Quality Objectives and Criteria

The data quality objective (DQO) process is a series of seven planning steps based on the scientific method, designed to specify the type, quantity, and quality of environmental data needed to support defensible decisions based on current conditions and proposed activities at an environmental site (U.S. EPA 2006). The U.S. EPA seven-step DQO process was used as general guidance during the development of these DQOs.

DQOs are qualitative and quantitative statements derived from the outputs of each step of the DQO process that:

- Clarify study objectives;
- Define data needs (type, quality, etc.); and
- Specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision.

The derived statements are then used to develop scientific, resource-effective, and defensible sampling designs. A DQO summary table is provided in Table 4-1.

**Table 4-1
Data Quality Objectives Summary Table**

PROCESS	RESPONSE
STEP 1 State the problem.	This SAP has been prepared to further characterize groundwater at AA3, and to update the current GMP activities at IRP Sites 1 and 2. AA3 was a former refuse disposal area and IRP Site 2 was used as a landfill. Both need to be monitored as part of routine monitoring of constituents to support the remedy selection process. IRP Site 1 was historically used for EOD training.
STEP 2 Identify the decision question(s).	Do COPCs at IRP Site 1 (VOCs, TPH-d, TPH-g, and perchlorate), IRP Site 2 (VOCs, dissolved metals, perchlorate, and general chemistry), and AA3 (VOCs, dissolved metals, and general chemistry) exceed screening criteria (Table 7-1)?
STEP 3 Identify inputs that affect the decision.	<ul style="list-style-type: none"> ▪ Validated analytical data for VOCs, TPH-d, TPH-g, perchlorate, dissolved metals, and/or general chemistry (chloride, nitrate, sulfate, alkalinity and TDS) in groundwater collected during a sampling event. ▪ The following secondary data will be used: <ul style="list-style-type: none"> ▪ MCLs (California DHS 2003); ▪ Public Health Goals for perchlorate (OEHHA 2004); ▪ Laboratory achievable RLs; and ▪ Previously collected analytical groundwater data from these 37 monitoring wells and piezometers.
STEP 4 What are the boundaries of the study?	<ul style="list-style-type: none"> ▪ Vertical boundaries of the sampling event extend from the top of the shallowest screened interval to the bottom of the deepest screened interval. ▪ The horizontal boundaries include the lateral extent of the monitoring wells being sampled during a field event. ▪ Temporal boundaries include data collected since 1992 to present.
STEP 5 Identify decision rules.	<p>If COPCs at IRP Site 1 (VOCs, TPH-d, TPH-g, and perchlorate), IRP Site 2 (VOCs, dissolved metals, perchlorate, and general chemistry), and AA3 (VOCs, dissolved metals, and general chemistry) do not exceed screening criteria (Table 7-1), then the GMP will be re-evaluated (frequency, analytes, and/or monitoring locations) until preferred RA or no further action has been selected.</p> <p>If COPCs at IRP Site 1 (VOCs, TPH-d, TPH-g, and perchlorate), IRP Site 2 (VOCs, dissolved metals, perchlorates, and general chemistry), and AA3 (VOCs, dissolved metals, and general chemistry) exceed screening criteria (Table 7-1), then the GMP will continue until preferred RA has been selected.</p>
STEP 6 Limits on decision errors.	<ul style="list-style-type: none"> ▪ A judgmental sampling approach will be used; therefore, limits on decision errors are not quantifiable. A review of past site operations and investigation results has been performed and best professional judgment will be used to determine the optimum sampling locations and limit the possibility of sampling design and decision errors. ▪ Data quality will be evaluated using quality assurance and quality control procedures. ▪ Measurement quality objectives established for analytical data are described in Section 7 of the SAP.

**Table 4-1 (continued)
Data Quality Objectives Summary Table**

PROCESS	RESPONSE
STEP 7 Optimize the design.	<p>The sample design is based on project objectives, known information, and the DQO problem statements. The proposed sampling locations have been selected in order to address RWQCB comments regarding the adequacy of the groundwater characterization at AA3, and to make changes to ongoing semi-annual groundwater monitoring protocol at IRP Sites 1 and 2 based on results of sampling conducted in 2006.</p> <p>Samples will be collected using low-flow sampling techniques with a dedicated bladder pump system. All samples collected during this groundwater sampling event will be analyzed by a NFESC-approved, California-certified analytical laboratory as follows:</p> <p>AA3</p> <ul style="list-style-type: none"> ▪ VOCs using U.S. EPA Method 8260B; ▪ Dissolved metals using U.S. EPA Method 6010/7000; and ▪ General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (TDS). <p>IRP Site 1</p> <ul style="list-style-type: none"> ▪ VOCs using U.S. EPA Method 8260B; ▪ TPH-g and TPH-d using U.S. EPA Method 8015 Modified; ▪ Dissolved metals using U.S. EPA Method 6010/7000; ▪ Perchlorate using U.S. EPA Method 314; and ▪ General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (TDS). <p>IRP Site 2</p> <ul style="list-style-type: none"> ▪ VOCs using U.S. EPA Method 8260B; ▪ Perchlorate using U.S. EPA Method 314; ▪ Dissolved metals using U.S. EPA Method 6010/7000; and ▪ General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (TDS).

Acronyms and Abbreviations:

AA3	=	Anomaly Area 3
bgs	=	below ground surface
COPC	=	contaminant of potential concern
DHS	=	California Department of Health Services
DQO	=	data quality objective
EOD	=	explosives ordnance disposal
GMP	=	groundwater monitoring program
IRP	=	Installation Restoration Program
MCL	=	maximum contaminant level
NFESC	=	Naval Facilities Engineering Service Center
PHG	=	public health goals (California EPA)
RWQCB	=	Regional Water Quality Control Board
SAP	=	sampling and analysis plan
TDS	=	total dissolved solids
TPH-d	=	total petroleum hydrocarbons, diesel range
TPH-g	=	total petroleum hydrocarbons, gasoline range
U.S. EPA	=	United States Environmental Protection Agency
VOC	=	volatile organic compound

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Section 5

Sample Design and Rationale

This section describes the sampling location rationale, field sampling program, sample analysis, and sample evaluation to be followed during the performance of the GMP. Samples will be collected as described in this section and in accordance with the quality control (QC) criteria in this SAP. The field procedures are designed so that:

- Samples collected are consistent with project objectives; and
- Samples are collected in a manner so that data represent actual site conditions.

5.1 Sampling Location Rationale

The sample design is based on project objectives, known information, and the DQO problem statements. The proposed sampling locations have been selected in order to fill existing data gaps to address RWQCB comments regarding the adequacy of the groundwater characterization of groundwater at AA3, and to make changes to ongoing semi-annual GMP at IRP Sites 1 and 2 based on historical sampling results. The proposed GMP wells are shown on Figures 5-1 through 5-6, and individual well specifications and sampling rationale are included as Table 5-1.

A review of past site operations and investigation results was performed and best professional judgment was used to determine the groundwater monitoring locations listed above. If adjustments are made during the field sampling event, they will be noted in the field logbook and as a deviation in the report.

5.2 Field Sampling Program

Groundwater sampling will be conducted using dedicated bladder pump systems at each monitoring location. New dedicated bladder pumps, including new, dedicated Teflon® lined sample tubing, will be installed in monitoring wells which are not already equipped as such. Sampling protocols will adhere to low-flow (minimal drawdown) sampling procedures (U.S. EPA 1996). Procedurally required water quality parameters, including initial wellhead photoionization detector (PID) readings, will be recorded on a sampling and purging log (Appendix D). The dedicated bladder pumps will be set for intake at the mid-point of each screened interval. One sample will be collected from each of the 37 monitoring wells, totaling 37 primary groundwater samples.

5.3 Groundwater Sample Analysis

Table 5-2 summarizes the analytical and extraction methods to be employed for groundwater samples collected during the GMP. All groundwater samples collected will be submitted to a Naval Facilities Engineering Service Center (NFESC)-approved and California-certified laboratory. Groundwater samples will be analyzed as follows:

IRP Site 1

- VOCs using U.S. EPA Method 8260B;
- TPH-g using U.S. EPA Method 8015;
- TPH-d using U.S. EPA Method 8015;
- Perchlorate using U.S. EPA Method 314; and
- Dissolved metals using U.S. EPA Method 6010/7000.

AA3

- VOCs using U.S. EPA Method 8260B;
- Dissolved metals using U.S. EPA Method 6010/7000; and
- General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (TDS).

IRP Site 2

- VOCs using U.S. EPA Method 8260B;
- Perchlorate using U.S. EPA Method 314;
- Dissolved metals using U.S. EPA Method 6010/7000; and
- General chemistry using U.S. EPA Methods 300 (chloride, nitrate, and sulfate), 310.1 (alkalinity), and 160.1 (TDS).

U.S. EPA Method 314 has been used at IRP Sites 1 and 2 and augmented with Liquid Chromatography/Mass Spectrometer (LC/MS) Method 331 and Ion Chromatography/Mass Spectrometer (IC/MS) Method 332. Comparison of the U.S. EPA Method 314 to LC/MS Method 331 and IC/MS Method 332 results has ensured that U.S. EPA Method 314 is yielding precise, accurate, and usable results. Therefore, U.S. EPA Method 314 will be used for continued groundwater monitoring at IRP Sites 1 and 2.

**Table 5-1
Sample Location Rationale and Frequency**

Monitoring Well ID	Location	Justification	Frequency
Site AA3			
AA3MW01	Downgradient	Monitor water quality changes.	semi-annual
AA3MW02	Downgradient	Monitor water quality changes.	semi-annual
AA3MW06	Upgradient	Upgradient (background).	semi-annual
AA3MW08	Near Wash; Cross gradient	Monitor water quality changes.	semi-annual
AA3MW11	Possible release location	First evidence of release.	semi-annual
AA3MW12	Possible release location	First evidence of release.	semi-annual
IRP Site 1			
01MW102	Upgradient from perchlorate source area	Monitor low perchlorate concentrations in northern portion of Site 1.	semi-annual
01MW201	Release location/ Within perchlorate source area	Monitor elevated perchlorate concentrations in the north-central portion of Site 1. Within area of potential hydrocarbon contamination.	semi-annual
01-MW202	Upgradient of perchlorate source area	Monitor elevated perchlorate concentrations in the north-central portion of Site 1.	semi-annual
01-MW203	Upgradient of perchlorate source area	Monitor elevated perchlorate concentrations in the north-central portion of Site 1.	semi-annual
01-MW204	Upgradient of perchlorate source area / Within area of potential hydrocarbon contamination	Delineate perchlorate source area to 6 µg/L. Within area of potential hydrocarbon contamination.	semi-annual
01-MW209	Within perchlorate source area	Monitor elevated concentrations in perchlorate source area. Within area of potential hydrocarbon contamination.	semi-annual
01-MW211	Downgradient - within perchlorate plume	Monitor elevated perchlorate concentrations between Sites 1 and 2.	semi-annual
01-MW215	Downgradient - within perchlorate plume	Monitor elevated perchlorate concentrations between Sites 1 and 2.	semi-annual
01-MW218	Cross-gradient – outside perchlorate plume	Delineate perchlorate source area to 6 µg/L.	semi-annual
01-MW219	Within perchlorate source area	Monitor elevated perchlorate concentrations in perchlorate source area and to delineate perchlorate source area to 6 µg/L.	semi-annual
01-MW223	Downgradient - within perchlorate plume	Monitor elevated perchlorate concentrations in between Sites 1 and 2.	semi-annual

**Table 5-1 (continued)
Sample Location Rationale and Frequency**

Monitoring Well ID	Location	Justification	Frequency
IRP Site 1 (cont.)			
01-PZ01	Upgradient of perchlorate source area	Monitor marginal perchlorate concentrations in the north portion of Site 1.	semi-annual
01-PZ06	Upgradient of perchlorate source area	Delineate perchlorate source area to 6 µg/L.	semi-annual
01-PZ07	Within perchlorate source area	Monitor maximum detected perchlorate concentration at Site 1.	semi-annual
01-PZ08	Within perchlorate source area	Monitor elevated perchlorate concentrations in perchlorate source area.	semi-annual
01-PZ09	Within perchlorate source area	Monitor elevated perchlorate concentrations in perchlorate source area. Within area of potential hydrocarbon contamination.	semi-annual
01-PZ11	Downgradient - outside perchlorate plume	Delineate perchlorate source area to 6 µg/L.	semi-annual
01-PZ12	Cross-gradient - outside perchlorate plume	Delineate perchlorate source area to 6 µg/L.	semi-annual
01-PZ21A	Downgradient - within perchlorate plume	Monitor water quality changes.	semi-annual
01-EW03	Within perchlorate source area	Monitor elevated perchlorate concentrations in perchlorate source area.	semi-annual
IRP Site 2			
02_NEW02	Down/cross gradient- outside of plume; east of plume	Station boundary/lateral extent of VOC plume.	semi-annual
02_NEW07	NW bank of Borrego Wash- outside of plume	Monitor water quality changes in relation to VOCs, most downgradient perchlorate well.	semi-annual
02_NEW08A	PCE Plume	Monitor water quality changes in relation to VOCs.	semi-annual
02_NEW11	Upgradient	VOC upgradient (background).	semi-annual
02_NEW16	Within Borrego Wash, upgradient of TCE plume	Monitor water quality changes in relation to VOCs. Delineate perchlorate plume downgradient of Site 2.	semi-annual
02_NEW19	western boundary midplume; just outside of plume	Monitor water quality changes (station boundary).	semi-annual
02_NEW26	SE bank of Borrego Wash; southern leading edge of plume	Monitor water quality changes in relation to VOCs. Monitor perchlorate concentrations downgradient from Station boundary.	semi-annual

**Table 5-1 (continued)
Sample Location Rationale and Frequency**

Monitoring Well ID	Location	Justification	Frequency
IRP Site 2 (cont.)			
02_NEW28	Within Borrego Wash; edge of the mid-plume	Monitor water quality changes in relation to VOCs. Monitor perchlorate concentrations downgradient from Station boundary.	semi-annual
02_NEW29	Within Borrego Wash; northern portion of plume	VOC hot spot monitoring	semi-annual
02PZ04	Mid-plume	Monitor perchlorate concentrations downgradient from Site 2.	semi-annual
02PZ12	East of Borrego Wash, within the perchlorate plume	Monitor water quality changes in relation to VOCs, maximum perchlorate concentration downgradient from Site 2.	semi-annual

Acronyms and Abbreviations:

- ID – identification number
- IRP – Installation Restoration Program
- NA – not applicable

**Table 5-2
 Laboratory Analytical and Preparation Methods**

Laboratory Analysis	Method Number	Preparation Method
Perchlorate	U.S. EPA Method 314	NA
TPH-g	U.S. EPA Method 8015 Modified	U.S. EPA Method 5030B
TPH-d	U.S. EPA Method 8015 Modified	U.S. EPA Method 3510C
Volatile Organic Compounds	U.S. EPA Method 8260B	U.S. EPA Method 5030B
Dissolved Metals	U.S. EPA Method 6010/7000	U.S. EPA Method 3010A
General chemistry (chloride, nitrate, and sulfate, alkalinity, and TDS)	U.S. EPA Methods 300, 310.1, and 160.1	NA

Acronyms and Abbreviations:

- TPH-d – Total petroleum hydrocarbons, diesel range
- TPH-g – Total petroleum hydrocarbons, gasoline range
- U.S. EPA – United States Environmental Protection Agency
- NA – Not applicable
- TDS – total dissolved solids

SENSITIVE RECORD

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

FIGURES 5-1 THROUGH 5-3

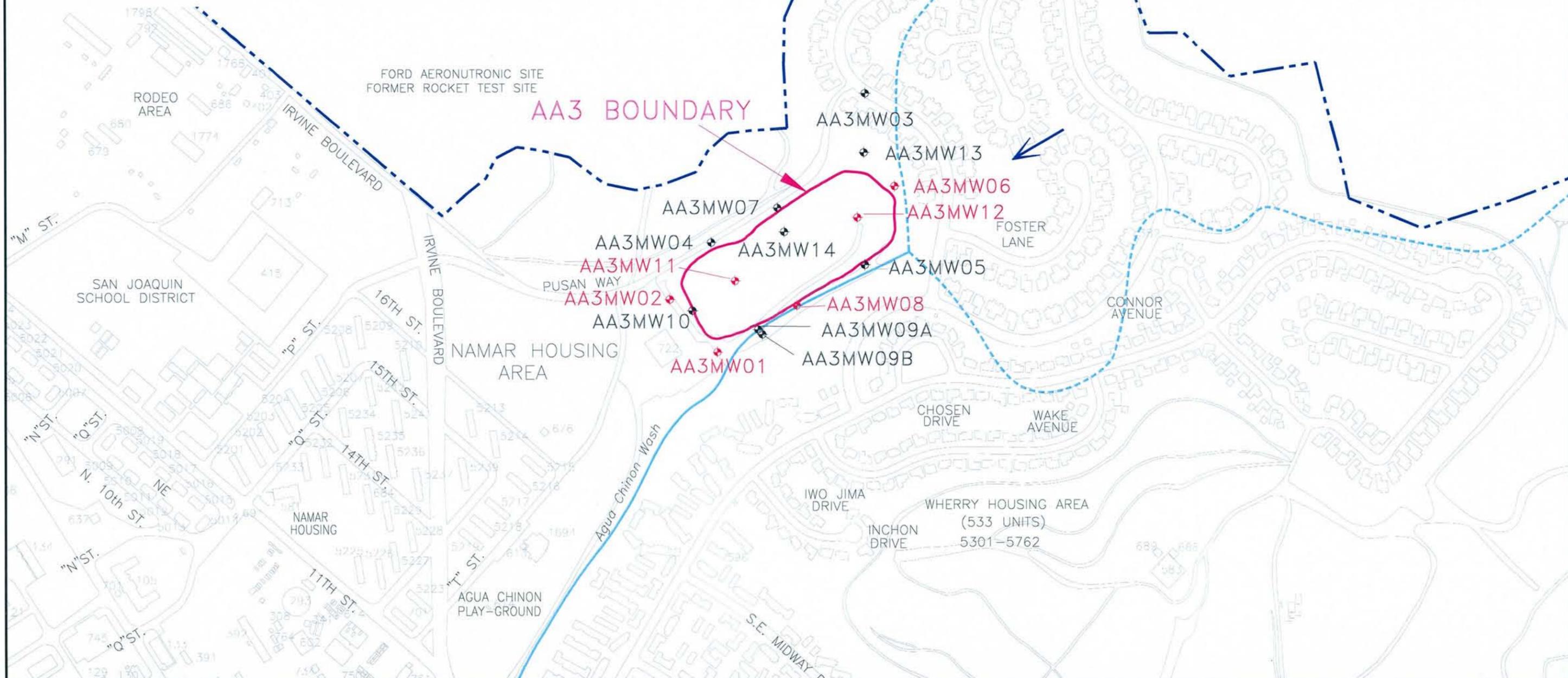
FOR ADDITIONAL INFORMATION, CONTACT:

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

LEGEND

-  EXISTING MONITORING WELLS
-  WELLS TO BE SAMPLED SEMI-ANNUALLY UNDER THIS GROUNDWATER MONITORING PROGRAM
-  SITE BOUNDARY
-  STREAM OR WASH (DASHED WHERE INFERRED)
-  FORMER MCAS EL TORO STATION BOUNDARY
-  PRESUMED GROUNDWATER FLOW DIRECTION



FORMER MCAS EL TORO IRVINE, CALIFORNIA	
CDM	DATE: 02/2007
	FN: 003_SAP
	PROJECT NO.: 6228-003
MODIFIED BY: J. Brown	

ANOMALY AREA 3

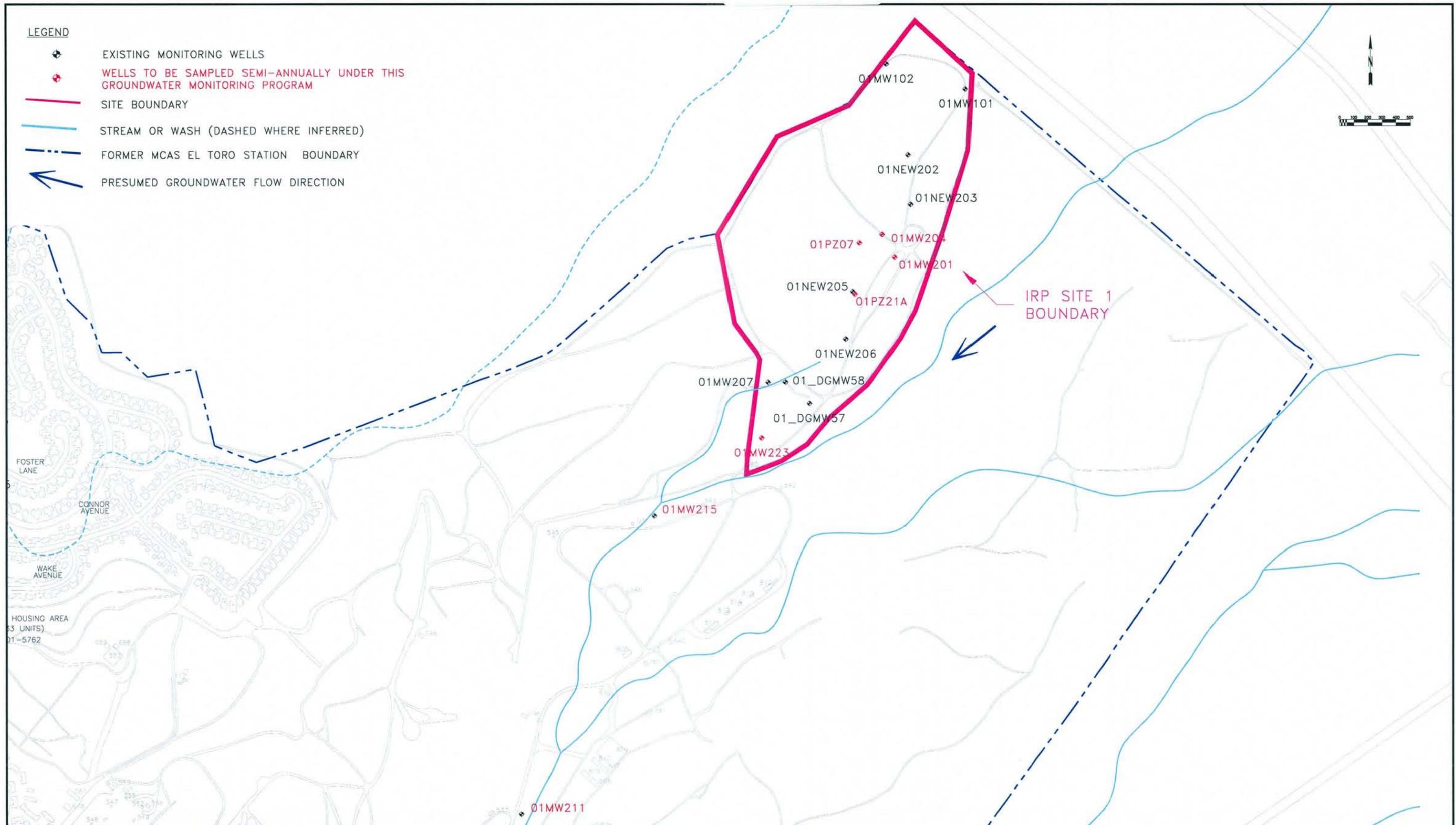
FIGURE 5-1

Groundwater Monitoring Program
Former MCAS El Toro, California

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FORMER MCAS EL TORO IRVINE, CALIFORNIA	
CDM	DATE: 02/2007
	FN: 003_SAP
MODIFIED BY: <i>J. Brown</i>	PROJECT NO.: 6228-003

IRP SITE 1

FIGURE
5-2

Groundwater Monitoring Program
Former MCAS El Toro, California

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Section 6

Project Task Descriptions

The following tasks will be performed during the groundwater sampling at Former MCAS El Toro.

6.1 Procurement of Subcontractors for Field Work

Prior to beginning fieldwork, subcontractors for the services identified below will be procured.

- Analytical laboratory testing services; and
- Data validation services.

6.2 Project Personnel Acknowledgement

A Project Personnel Sign Off Sheet is at the beginning of this SAP. Key project personnel will sign this form to indicate that they have read this SAP (or the applicable sections of this SAP, as appropriate) and will perform the tasks as described. Completed (signed) Project Personnel Sign Off Sheet(s) will be included in the Verification Sampling Report.

6.3 Field Work Preparation

The following CDM standard operating procedures (SOPs) are applicable to this project and are compiled in Appendix C of the Work Plan. The field personnel will be trained in the application of these SOPs (see Section 9 of this SAP). The SOPs will be reviewed during the field planning meeting conducted by the QA Coordinator for the field personnel.

- SOP 1-2, Sample Custody;
- SOP 1-10, Field Measurement of Organic Vapors;
- SOP 2-1, Packaging and Shipping of Environmental Samples;
- SOP 2-2, Guide to Handling of IDW;
- SOP 4-1, Field Logbook Content and Control;
- SOP 4-2, Photographic Documentation of Field Activities;
- SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites;
- SOP 5-1, Control of Measurement and Test Equipment; and
- *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA Ground Water Issue, EPA/540/S-95/504, 1996.

The field team leader will coordinate with the subcontracted analytical laboratory in advance of field work to obtain sample containers (pre-preserved as required), chain-of-custody (COC) forms, and coolers. The number and type of containers needed for samples are presented in Table 6-1. This table also lists preservatives and holding times for each analytical method.

6.4 Groundwater Sampling

Low-flow groundwater sampling will be conducted using dedicated bladder pump systems according to *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA Ground Water Issue, EPA/540/S-95/504, 1996. Prior to the first sampling event under this Work Plan (scheduled for July 2007), dedicated bladder pump systems will be installed in all monitoring wells which are not already equipped as such, and missing monitoring well construction data will be gathered. Table 6-2 provides the current status and recommendations for the sampling systems at each of the 37 monitoring wells under this GMP.

The locking cap will be removed from each well prior to sampling and a PID will be used to obtain the initial maximum reading for organic vapors. Water levels in all wells will be allowed to reach their static levels, measured, and recorded prior to the start of sampling.

For monitoring well locations not already equipped with dedicated bladder pump systems, a new QED SamplePro® MicroPurge Bladder Pump will be set up for installation according to manufacturer's specifications. The bladder pump will be decontaminated using a Liquinox®, and deionized water, three-rinse system before installation. The newly dedicated pump will be set for intake at the mid-point of each screened interval by pre-measuring new, Teflon® lined sample tubing for both air supply and water to the appropriate length.

When sampling using the dedicated bladder pump systems, the dedicated tubing will be attached to the QED MP15 Digital Pressure Controller and Power Pack. The pressure controller will be set up for 3 cycles per minute (cpm), at 16.0 seconds of air refill and 4.0 seconds of groundwater discharge at approximately 50 to 75 psi. A YSI 6820, or comparable flow-through multi-parameter sonde, will be used to measure specific conductivity, pH, dissolved oxygen, turbidity, and temperature. Once the parameters stabilize within 10 percent for three measurements, and turbidity is below 10 nephelometric units (NTUs) (or is stabilized within 10 percent if above 10 NTUs), sample collection will begin. Groundwater parameters will be recorded on a sampling and purging log (Appendix D).

Purge water derived during sampling will be transferred to the onsite treatment plant in accordance with previous practices (Section 7).

6.5 Sample Documentation

Sample documentation will be tracked on COC forms and shipping documents. Copies of these documents will be maintained in the project files, as well as annotated in the field logbook. The field logbook provides a means of recording all data collection activities performed at the site. As such, entries should be as descriptive and detailed as possible so that a sample's history can be reconstructed without relying on the collector's memory. The field logbook will be completed, tracked, and maintained in accordance with CDM's SOP 4-1, Field Logbook Content and Control (Appendix C). Any deviations from the SOP will be noted in the field logbook.

6.6 Sample Labeling

The field team will use an alphanumeric coding system to label each sample collected. Samples will be labeled according to SOP 1-2, Sample Custody (Appendix B). A unique number code to indicate the sampling location will identify each sample using the procedure described below.

Sample identification will correlate to the monitoring well, for example, "02NEW18". The second character of the sample identification will be either -1,-3,-5,-7 which represents the sample as a primary sample, a duplicate sample, a source blank sample, or a trip blank sample, respectively. The last character will represent the sampling round during which the sample was collected (e.g. 25).

Table 6-3 provides the anticipated sample numbers for primary samples. Field QC samples are not included in this table but will be collected as described in Section 7.2. Sample labels will be completed and affixed to the appropriate sample containers. Preprinted labels may be used. These labels will be secured with clear tape and will include the sample identification number, the parameter(s) to be analyzed, the sampler's initials, and the preservative used. At the time of sample collection, a member of the field team will add the date and time of sample collection.

6.7 Sample Handling

After a sample has been collected it will be immediately prepared for shipment. Sample packaging and sample shipment will follow the requirements in SOP 2-1, Packaging and Shipping of Environmental Samples (Appendix C).

6.8 Sample Custody

Sample COC procedures will follow the requirements in SOP 1-2, Sample Custody (Appendix C).

6.9 Field Decontamination

Equipment decontamination minimizes the risk of cross-contamination of samples and ensures the collection of representative samples. All equipment decontamination will conform to SOP 4-5, Field Equipment Decontamination at Non-radioactive Sites (Appendix C). Any deviations will be noted in the field logbook.

6.10 IDW Management Plan

The IDW management plan is presented in Section 7 of the Work Plan.

6.11 Reports

The reporting effort will consist of (1) preparation of Draft and Final Data Summary Reports after July sampling events, and (2) preparation of Preliminary Draft, Draft and Final Annual Reports after the November sampling events.

The Data Summary Reports will include summary data tables, maps, and a description of field activities. Navy RPM comments to the Draft Data Summary Report will be incorporated into the Final Data Summary Report for submittal to the regulatory agencies. An analytical database in the Naval Electronic Data Deliverable (NEDD) format will also be prepared. Reporting of data will be in accordance with *Environmental Work Instruction (EWI) No. 6, Environmental Data Management and Required Electronic Delivery Standards* (NAVFAC Southwest 2005).

The Annual Reports will include summary data tables, maps, a description of field activities, evaluation of data from both July and November monitoring events, and recommendations. Analytical results will be screened against MCLs (DHS 2003) and PHGs (OEHHA 2004) as appropriate. NAVFAC Southwest comments to the Pre-Draft Annual Report will be incorporated and a Draft Annual Report will be prepared for submittal to the regulatory agencies. Regulator comments to the Draft Annual Report will be incorporated into the Final Annual Report. An analytical database in the NEDD format will also be prepared for the Annual Reports.

All reports will include text, tables, and graphics. The reports will be submitted in Microsoft Word, graphics will be in AutoCAD, and data tables will be in Microsoft Excel. The following are preliminary sections for the Data Summary and Annual Reports:

Introduction: Summary information on the site description, site history, and the contaminant sources, as well as a description of the GMP purpose, scope, and objectives.

Site Activities: Description of procedures used for the groundwater sampling, IDW management, sample handling and management, field quality control (QC) samples, decontamination procedures, laboratory analysis, and data management. Any deviations from the work plan or the SAP will also be addressed in the report.

Summary of Monitoring Results: Description of analytical data, summary of data evaluation results, and a summary of the nature and extent of contamination.

QA/QC: Summary of QA/QC measures conducted on analytical data results obtained from site activities.

Conclusions and Recommendations (not included in Data Summary Reports):

Conclusions from the groundwater monitoring and recommendations for continued monitoring or no further action at the sites.

Appendices: Field forms, laboratory reports (including completed COC forms), and data validation report (provided only in the final reports).

**Table 6-1
Analytical Methods, Containers, Preservatives, and Holding Times (UFP-QAPP Worksheets #19 and #30)**

Matrix	Analytical Group	Analytical/ Preparation Method	Analytical SOP	Containers (number, size, type)	Preservation (chemical, temperature)	Maximum Holding Time		Lab data package TAT
						Extraction	Analysis	
Aqueous	VOCs	U.S. EPA Method 8260B/ U.S. EPA Method 5030B	TBD	2 x 40ml VOA	HCl (pH<2), Ice 2 - 6 °C	NA	14 days	30 days
Aqueous	TPH-g	U.S. EPA Method 8015B/ U.S. EPA Method 5030B	TBD	2 x 40ml VOA	HCl (pH<2), Ice 2 - 6 °C	NA	14 days	30 days
Aqueous	TPH-g	U.S. EPA Method 8015B/ U.S. EPA Method 3510C	TBD	1L amber glass	Ice 2 - 6°C	NA	14 days	30 days
Aqueous	Perchlorate	U.S. EPA Method 314	TBD	1 x 250ml plastic	Ice 2 - 6°C	NA	14 days	30 days
Aqueous	Dissolved Metals	U.S. EPA Method 6010 and 7000/ U.S. EPA Method 3010A	TBD	1 x 500ml plastic	HNO ₃ (pH<2)	NA	*6 months/ 28 days	30 days
Aqueous	General Chemistry	U.S. EPA Methods 300, 310.1, and 160.1	TBD	1L amber glass	Ice 2 - 6°C	NA	2 days	30 days

Acronyms and Abbreviations:

*	=	holding time for mercury is 28 days, all other metals is 6 months
°C	=	degrees Celsius
HCl	=	hydrochloric acid
HNO ₃	=	nitric acid
ml	=	milliliters
NA	=	not applicable
SOP	=	standard operating procedure
TAT	=	turn around time
TBD	=	to be determined
VOC	=	volatile organic compound
U.S. EPA	=	United States Environmental Protection Agency
VOA	=	volatile organic analyte

**Table 6-2
GMP Monitoring Wells and Sampling System Status**

Monitoring Well ID	Screened Interval (feet bgs)	Sampling System
Site AA3		
AA3MW01	16.5-46.5	dedicated tubing, recommend new dedicated pump
AA3MW02	21-51	dedicated tubing, recommend new dedicated pump
AA3MW06	20-40	dedicated tubing, recommend new dedicated pump
AA3MW08	25-55	dedicated tubing, recommend new dedicated pump
AA3MW11	22-37	dedicated tubing, recommend new dedicated pump
AA3MW12	24-39	dedicated tubing, recommend new dedicated pump
IRP Site 1		
01MW102	95-135	dedicated pump system in place
01MW201	27-57	dedicated pump system in place
01-MW202	10-35	dedicated pump system in place
01-MW203	33-58	dedicated pump system in place
01-MW204	24-54	dedicated pump system in place
01-MW209	25-45	dedicated pump system in place
01-MW211	50-60	dedicated tubing, recommend new dedicated pump
01-MW215	35-50	dedicated tubing, recommend new dedicated pump
01-MW218	45-60	dedicated tubing, recommend new dedicated pump
01-MW219	40-55	dedicated tubing, recommend new dedicated pump
01-MW223	35-70	dedicated tubing, recommend new dedicated pump
01-PZ01	65-90	dedicated tubing, recommend new dedicated pump
01-PZ06	55-80	dedicated tubing, recommend new dedicated pump
01-PZ07	30-55	dedicated tubing, recommend new dedicated pump
01-PZ08	55-80	dedicated tubing, recommend new dedicated pump
01-PZ09	30-55	dedicated tubing, recommend new dedicated pump
01-PZ11	35-60	dedicated tubing, recommend new dedicated pump
01-PZ12	70-95	dedicated tubing, recommend new dedicated pump
01-PZ21A	21-46	TBD
01-EW03	40-70	TBD
IRP Site 2		
02_NEW02	75-95	dedicated pump system in place
02_NEW07	103-143	recommend new dedicated pump system
02_NEW08A	84-104	dedicated pump system in place
02_NEW11	45-65	dedicated pump system in place
02_NEW16	25-65	dedicated pump system in place
02_NEW19	86-113	dedicated pump system in place
02_NEW26	70-95	recommend new dedicated pump system
02_NEW28	60-70	recommend new dedicated pump system
02_NEW29	47-67	recommend new dedicated pump system
02PZ04	60-80	recommend new dedicated pump system
02PZ12	70-100	recommend new dedicated pump system

Acronyms and Abbreviations:

bgs = below ground surface
ID = identification number
TBD = to be determined

**Table 6-3
Primary Sample IDs, Sample Depths, and Sample Analyses
(UFP-QAPP Worksheets #18 and 21)**

Sample ID ^a	Sampling Equipment	Pump Intake Depth (feet bgs)	Analysis	SOP/SAP
AA3MW01-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	31.5	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
AA3MW02-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	36	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
AA3MW06-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	30	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
AA3MW08-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	40	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
AA3MW11-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	29.5	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
AA3MW12-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	31	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01MW102-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	115	U.S. EPA Methods 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01MW201-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	42	U.S. EPA Methods 8260B, 8015 Modified, 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-MW202-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	22.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-MW203-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	45.5	U.S. EPA Methods 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01MW204-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	39	U.S. EPA Methods 8260B, 8015 Modified, 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-MW209-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	35	U.S. EPA Methods 8260B, 8015 Modified, 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b

Table 6-3 (continued)
Primary Sample IDs, Sample Depths, and Sample Analyses
(UFP-QAPP Worksheets #18 and 21)

Sample ID ^a	Sampling Equipment	Pump Intake Depth (feet bgs)	Analysis	SOP/SAP
01NEW211-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	55	U.S. EPA Methods 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01NEW215-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	42.5	U.S. EPA Methods 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-MW218-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	52.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-MW219-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	47.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01NEW223-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	52.5	U.S. EPA Methods 6010/7000, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-PZ01-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	77.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-PZ06-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	67.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01PZ07-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	42.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-PZ08-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	67.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-PZ09-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	42.5	U.S. EPA Methods 8260B, 8015 Modified, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-PZ11-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	47.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01-PZ12-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	82.5	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
01PZ21A-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	33.5	U.S. EPA Methods 8260B, 8015 Modified, 314, 310.1, 160.1 and 300	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b

Table 6-3 (continued)
Primary Sample IDs, Sample Depths, and Sample Analyses
(UFP-QAPP Worksheets #18 and 21)

Sample ID ^a	Sampling Equipment	Pump Intake Depth (feet bgs)	Analysis	SOP/SAP
01-EW03-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	55	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW02-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	85	U.S. EPA Methods 8260B and 6010/7000	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW07-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	123	U.S. EPA Methods 8260B, 6010/7000, 314, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW08A-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	94	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW11-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	55	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW16-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	45	U.S. EPA Methods 8260B, 6010/7000, 314, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW19-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	99.5	U.S. EPA Methods 8260B and 6010/7000	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW26-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	82.5	U.S. EPA Methods 8260B, 6010/7000, 314, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW28-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	65	U.S. EPA Methods 8260B, 6010/7000, 314, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02NEW29-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	57	U.S. EPA Methods 8260B, 6010/7000, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02PZ04-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	70	U.S. EPA Method 314	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b
02PZ12-1X	QED SamplePro® MicroPurge Bladder Pump, QED MP15 Digital Pressure Controller and Power Pack, YSI 6920, PID	85	U.S. EPA Methods 8260B, 6010/7000, 314, 300, 310.1, and 160.1	CDM SOPs 1-4, 1-10, 3-1, SAP Section 6.3, U.S. EPA low-flow ^b

Notes:

^a X is used to represent the numerical sampling round number, will start with 25 in July 2007

^b Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (U.S. EPA 1996)

Table 6-3 (continued)
Primary Sample IDs, Sample Depths, and Sample Analyses
(UFP-QAPP Worksheets #18 and 21)

Acronyms and Abbreviations:

ID	–	identification
PID	–	photoionization detector
SAP	–	sampling and analysis plan
SOP	–	standard operating procedure
TBD	–	to be determined, well log not available at time of SAP preparation
U.S. EPA	–	United States Environmental Protection Agency

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Section 7

Quality Control Criteria

The field QA program has been designed in accordance with CDM's *Quality Assurance Manual* (CDM 2002), *Guidance for the Data Quality Objectives Process* (U.S. EPA 2006), the *Navy Installation Restoration Chemical Data Quality Manual* (NFESC 1999), *EPA Requirements for Quality Assurance Project Plans* (U.S. EPA 2001), and *UFP-QAPP* (IDQTF 2005). Additionally, the laboratory will implement and meet appropriate requirements of the *Department of Defense Quality Systems Manual (QSM) for Environmental Laboratories* (Department of Defense [DOD] 2006).

All project deliverables will receive technical and QA reviews prior to being issued to the client; completed review forms will be maintained in the project file. Corrective action of any deficiencies will be the responsibility of the project manager, with assistance from the QA staff.

This section describes the QC criteria used to ensure that the data collected during this GMP will be used appropriately to meet the project objectives.

7.1 Analytical Methods

All samples will be submitted to a fixed-base laboratory certified by the California Department of Health Services through Environmental Laboratory Accreditation Program (ELAP). The selected laboratory will also have received prior approval by NFESC for the requested analyses. The samples collected during this investigation will be analyzed using the methods provided in Table 5-1. These methods are described in detail in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition* (U.S. EPA 1997).

Table 7-1 provides the aqueous reporting limits (RLs), PHGs, and MCLs, for analytes included for the proposed analytical methods for this project. Table 7-1 provides the laboratory achievable method detection limits (MDLs), laboratory achievable RLs, and the project RLs. Project RLs were developed by considering the laboratory achievable RLs, the project screening criteria, and the DQOs.

In the event that the project RL exceeds the screening criteria for an analyte, the following strategies will be employed:

1. If the result is above the project RL, the concentration will be considered to be indicative of contamination.
2. If the result is non-detect (below project RL) but the sample was diluted, the undiluted sample results will be evaluated, if available. The laboratory will be instructed to provide all sample results, including undiluted sample results.
3. If the result is non-detect (below project RL) for a diluted sample and undiluted sample results are unavailable, the sample will be:

- a. Reanalyzed if it is still within holding time; or
 - b. Resampled.
4. If the result is non-detect (below project RL) for an undiluted sample, and the reporting limit is the lowest reporting limit that is reasonably achievable, the reporting limit will be used as the screening criteria.

The laboratory can typically detect analytes at concentrations of up to an order of magnitude lower than the project RLs. When a positive detection is less than the project RL, the value will be reported and qualified as an estimated concentration. RLs are attained contingent upon instrument sensitivity and sample matrix effects. It is important to monitor the sensitivity of data-gathering instruments to ensure data quality through constant checks of instrument performance.

Holding time is the maximum time allowed between sample collection and extraction (if applicable) and sample analysis, during which the designated preservation and storage techniques are employed. The method of shipment will be chosen to meet required holding times. Maximum holding times for each analytical method are provided in Table 6-1.

7.2 Field QC Samples

The following sections describe the types of field QC samples that will be required during sampling. All QC samples will be analyzed for the same parameters as the primary samples except trip blanks which will only be analyzed for VOCs. Table 7-2 presents the measurement performance criteria for the field QC samples and Table 7-3 provides a summary of the number of field QC samples to be collected for this field effort.

7.2.1 Field Duplicate

Duplicates will be collected in separate containers, but from the same location, immediately after the primary samples are collected. These will be analyzed as a separate sample from the primary sample. This type of field duplicate measures the total system variability (field and laboratory variance). Field duplicates will be collected at a frequency of one per ten primary samples.

7.2.2 Trip Blank

A trip blank consists of target analyte-free water provided by the laboratory. The trip blank is a sealed container that accompanies the samples from collection through shipment. This QC sample serves as a check for cross-contamination of VOCs. Trip blanks will be submitted to the laboratory at a frequency of one per cooler (for VOC analysis only) for those coolers containing aqueous samples to be analyzed for VOCs.

7.2.3 Temperature Indicator

A temperature indicator will be used to notify the receiving laboratory if and when the samples exceeded the acceptable temperature (4 degrees Celsius ($^{\circ}\text{C}$) \pm 2 $^{\circ}\text{C}$) during transport. This QC measure serves as a check of adequate cooling of samples to be analyzed. The temperature indicator will show the current temperature in addition to the maximum temperature to which the samples were exposed during transport. Temperature indicators will be submitted to the laboratory at a frequency of one per cooler.

7.3 Laboratory QC Samples

Laboratory QC data are necessary to determine precision and accuracy and to demonstrate the absence of interference by and/or contamination of laboratory glassware and reagents. Table 7-4 presents a summary of the laboratory QC samples for this project, their frequency, and the measurement performance criteria. Laboratory QC results will be included in the data package.

The types of QC spike samples the laboratory will use include laboratory control samples (LCSs) (or method blank spikes), matrix spikes (MSs), and surrogates. An LCS is a clean matrix (i.e., the same used for a method blank) spiked with known concentration(s) of target analyte(s). The LCS will be carried through the entire analytical procedure to assess the overall accuracy of the method. An MS is an aliquot of a parent sample spiked with target analyte(s) of known concentration(s) prior to sample preparation. The impact of the sample matrix on target analyte recovery (i.e., accuracy) and precision will be assessed by QC sampling MSs and matrix spike duplicates (MSDs). A surrogate is a non-target analyte spiked at a known concentration prior to sample preparation. Surrogate analytes will be used to monitor method performance on a matrix-specific/sample-specific basis.

For this project, acceptance limits for precision and accuracy for MSs and surrogate percent recovery are presented in Table 7-4. Each analytical preparation batch must contain an MS/MSD pair.

Matrix QC samples will be analyzed with each batch of 20 samples or fewer analyzed by the laboratory.

A calibration standard is prepared in the laboratory by dissolving a known amount of a pure compound in an appropriate matrix or dilution of commercially obtained solution. The final concentration calculated from the known quantities is the true value of the standard. Where applicable, reference standard solutions will be traceable to National Institute of Standards and Technology or another nationally recognized reference standard source. The analytical results obtained for these standards are used to prepare a standard curve and thereby quantify the compounds found in the environmental samples. The number of calibration standards is prescribed by each analytical method procedure.

**Table 7-1
Aqueous Reporting Limits (UFP-QAPP Worksheet #15)**

Analyte	CAS Number	MCL ^a	Project RL ^e	Laboratory Achievable MDL	Laboratory Achievable RL
		µg/L	µg/L	µg/L	µg/L
VOCs USEPA Method 8260B					
1,1,1,2-Tetrachloroethane	630-20-6	NP	1	0.2	1
1,1,1-Trichloroethane	71-55-6	200	1	0.2	1
1,1,2,2-Tetrachloroethane	79-34-5	1	1	0.2	1
1,1,2-Trichloroethane	79-00-5	5	1	0.2	1
1,1-Dichloroethane	75-34-3	5	1	0.2	1
1,1-Dichloroethene	75-35-4	6	1	0.2	1
1,1-Dichloropropene	563-58-6	NP	1	0.2	1
1,2,3-Trichlorobenzene	87-61-6	NP	1	0.2	1
1,2,3-Trichloropropane	96-18-4	0.005 ^d	1	0.5	1
1,2,4-Trichlorobenzene	120-82-1	5	1	0.2	1
1,2,4-Trimethylbenzene	95-63-6	NP	1	0.2	1
1,2-Dibromo-3-chloropropane	96-12-8	NP	1	0.5	1
1,2-Dibromomethane	106-93-4	NP	1	0.2	1
1,2-Dichlorobenzene	95-50-1	600	1	0.2	1
1,2-Dichloroethane	107-06-2	0.5	0.5	0.2	0.5
trans-1,2-Dichloroethene	156-60-5	10	1	0.2	1
cis-1,2-Dichloroethene	156-59-2	6	1	0.2	1
1,2-Dichloropropane	78-87-5	5	1	0.2	1
1,3,5-Trimethylbenzene	108-67-8	NP	1	0.2	1
1,3-Dichlorobenzene	541-73-1	NP	1	0.2	1
1,3-Dichloropropane	142-28-9	NP	1	0.2	1
1,4-Dichlorobenzene	106-46-7	NP	1	0.2	1
2-Butanone (methyl ethyl ketone)	78-93-3	NP	10	5	10
2-Chlorotoluene (o-chlorotoluene)	95-49-8	NP	1	0.2	1
2-Hexanone	591-78-6	NP	10	5	10
4-Chlorotoluene	106-43-4	NP	1	0.2	1
4-Methyl-2-Pentanone (methyl isobutyl ketone)	108-10-1	NP	10	5	10
Acetone	67-64-1	NP	10	5	10
Benzene	71-43-2	1	1	0.2	1
Bromobenzene	108-86-1	NP	1	0.2	1
Bromochloromethane	74-97-5	NP	1	0.2	1
Bromodichloromethane	75-27-4	NP	1	0.2	1
Bromoform	75-25-2	NP	1	0.3	1
Bromomethane	74-83-9	NP	1	0.2	1
Carbon disulfide	75-15-0	NP	1	0.2	1
Carbon tetrachloride	56-23-5	0.5	0.5	0.2	0.5
Chlorobenzene	108-90-7	NP	1	0.2	1
Chlorodibromomethane (dibromochloromethane)	124-481	NP	1	0.2	1
Chloroethane	75-00-3	NP	1	0.2	1
Chloroform	67-66-3	NP	1	0.2	1
Chloromethane	74-87-3	NP	1	0.2	1
cis-1,3-Dichloropropene	10061-01-5	5	1	0.2	1
Dibromomethane	74-95-3	NP	1	0.2	1
Dichlorodifluoromethane	75-71-8	0.5	1	0.3	1
Ethylbenzene	100-41-4	300	1	0.2	1
Hexachlorobutadiene	87-68-3	NP	1	0.2	1
Isopropylbenzene (cumene)	98-82-8	NP	1	0.2	1

**Table 7-1 (continued)
Aqueous Reporting Limits (UFP-QAPP Worksheet #15)**

Analyte	CAS Number	MCL ^a	Project RL ^e	Laboratory Achievable MDL	Laboratory Achievable RL
		µg/L	µg/L	µg/L	µg/L
VOCs (continued)					
Methylene Chloride	75-09-2	NP	1	0.5	1
N-Butylbenzene	104-51-8	NP	1	0.2	1
Naphthalene	91-20-3	NP	1	0.5	1
Sec-butylbenzene	135-98-8	NP	1	0.2	1
Styrene	100-42-5	100	1	0.2	1
Tert-Butylbenzene	98-06-6	NP	1	0.2	1
Tetrachloroethene	127-18-4	5	1	0.2	1
Toluene	108-88-3	150	1	0.2	1
m,p-Xylene	136777-61-2	NP	2	0.5	2
o-Xylene	95-47-6	NP	1	0.2	1
Total Xylenes	See xylenes above	1750	1	0.2	1
Trans-1,3-Dichloropropene	10061-02-6	NP	1	0.2	1
Trichloroethene	79-01-6	5	1	0.2	1
Trichlorofluoromethane	75-69-4	150	1	0.2	1
Vinyl Chloride	75-01-4	0.5	0.5	0.3	0.5
TPH USEPA 8015B					
TPH-diesel	NA	NP	130	34	130
TPH-gasoline	NA	NP	25	7.59	25
Perchlorate USEPA Method 314					
Perchlorate	14797-73-0	6 ^c	2	0.5	2
Dissolved Metals USEPA 6010B/7000					
		mg/L	mg/L	mg/L	mg/L
Aluminum	7429-90-5	0.2 ^b	0.2	0.06	0.2
Antimony	7440-36-0	0.006	0.06	0.04	0.06
Arsenic	7440-38-2	0.05	0.01	0.004	0.01
Barium	7440-39-3	1.0	0.2	0.002	0.2
Beryllium	7440-41-7	0.004	0.004	0.001	0.005
Cadmium	7440-43-9	0.005	0.005	0.001	0.005
Calcium	7440-70-2	NP	5	0.1	5
Chromium	7440-47-3	0.05	0.01	0.005	0.01
Cobalt	7440-48-4	NP	0.05	0.01	0.05
Copper	7440-50-8	1.0 ^b	0.025	0.005	0.025
Iron	7439-89-6	0.3 ^b	0.1	0.04	0.1
Lead	7439-92-1	0.015	0.003	0.003	0.003
Magnesium	7439-95-4	NP	5	0.1	5
Manganese	7439-96-5	0.05 ^b	0.015	0.003	0.015
Mercury	7439-97-6	0.002	0.002	0.001	0.002
Nickel	7440-02-0	0.1	0.04	0.015	0.04
Potassium	7440-09-07	NP	5	1	5
Selenium	7782-49-2	0.05	0.005	0.005	0.005
Silver	7440-22-4	0.1 ^b	0.01	0.01	0.01
Sodium	7440-23-5	NP	5	0.25	5
Thallium	7440-28-0	0.002	0.01	0.005	0.01
Vanadium	7440-62-2	NP	0.05	0.005	0.05
Zinc	7440-66-6	5.0 ^b	0.02	0.005	0.02
General Chemistry					
Sulfate (USEPA 300.0)	14808-79-8	500 ^b	0.5	0.25	0.5
Nitrate (USEPA 300.0)	17778-88-0	45	0.1	0.05	0.1
Chloride (USEPA 300.0)	16887-00-6	500	0.2	0.1	0.2
Alkalinity (USEPA 310.1)	10-09-3	NP	5	1	5
TDS (USEPA 160.1)	10-33-3	1000 ^b	10	5	10

Table 7-1 (continued)
Aqueous Reporting Limits (UFP-QAPP Worksheet #15)

Notes:

- ^a Primary MCL for drinking water (California Department of Health Services, August 2006)
- ^b Where primary MCLs are not established, secondary MCLs for drinking water will be used (California DHS, September 2006).
- ^c Where primary and secondary MCLs are not established, California EPA PHGs will be used (March 2006).
- ^d Where primary and secondary MCLs and PHGs are not established, California DHS notification levels will be used (<http://www.dhs.ca.gov/ps/ddwem/chemicals/AL/notificationoverview.pdf>).
- ^e If RLs change when the laboratory subcontract is awarded, then new RLs will be noted in the project file with the laboratory subcontract documentation.

Acronyms and Abbreviations:

mg/L	– milligrams per liter
µg/L	– micrograms per liter
pCi/L	– picocuries per liter
DHS	– Department of Health Services (California)
MCL	– maximum contaminant level (California Department of Health Services August 2006)
NA	– no screening criteria (or CAS number) has been established for this analyte
NP	– not promulgated
PHG	– Public Health Goal
RL	– reporting limit
TPH	– total petroleum hydrocarbons
USEPA	– United States Environmental Protection Agency
VOC	– volatile organic compound

**Table 7-2
Measurement Performance Criteria – Field QC Samples (UFP-QAPP Worksheets #12 and 28)**

QC Sample	Analytical Methods ^c	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	Corrective Action/ Responsible Party	Assesses Error For
Field Duplicates	U.S. EPA Methods 8260B, 8015 Modified, 6010/7000, 314, 300, 310.1, 160.1	1 per 10 primary samples	Precision	RPD < 30% ^a	Qualify Data/ Data Validation PM	Sampling and Analytical
Trip Blanks	U.S. EPA Method 8260B	1 per cooler containing aqueous samples collected for VOC analysis	Contamination – Accuracy/Bias	≤ Project RL ^b	Qualify Data/ Data Validation PM	Sampling
Temperature Blank	NA	1 per cooler	Accuracy/Bias	4 degrees Celsius ± 2 degrees	Qualify Data/ Data Validation PM	Sampling

Notes:

- ^a The RPD will be calculated for all results reported above the project RL (Table 7-1). RPDs will not be calculated where results are reported as non-detect.
- ^b See Table 7-1 of this SAP.
- ^c Analytical methods for field QC samples will be site specific

Acronyms and Abbreviations:

- DQI – data quality indicator
- NA – not analyzed
- PM – project manager
- RL – reporting limit
- RPD – relative percent difference
- SAP – sampling and analysis plan
- U.S. EPA – United States Environmental Protection Agency

**Table 7-3
Field QC Sample Summary (UFP-QAPP Worksheets #20 and 28)**

Matrix	Analytical Method*	SOP/SAP Reference	Number of Primary Sampling Locations	Number of Field Duplicates	Number of MS/MSDs	Number of Rinsate Blanks	Number of Source Blanks	Number of Trip Blanks	Total Number of Samples to Lab
Aqueous	U.S. EPA Methods 8260B, 8015 Modified, 6010/7000, 314, 300, 310.1, 160.1	SOP 1-4, SAP Section 6.4	37	4	2	0	0	15	55

Acronyms and Abbreviations:

- * - analytical methods for field QC samples will be determined site specifically
- MS - matrix spike
- MSD - matrix spike duplicate
- SAP - sampling and analysis plan
- SOP - standard operating procedures
- U.S. EPA - United States Environmental Protection Agency

Table 7-4
Measurement Performance Criteria – Laboratory QC Samples (UFP-QAPP Worksheets #12 and 28)

QC Sample	Analytical Methods ^g	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	Corrective Action ^f / Responsible Party	Assesses Error For
Laboratory Duplicates	U.S. EPA Methods 8260B, 8015B, 6010/7000, 314, 300, 310.1, 160.1	One per sample batch or 5% whichever is more frequent ^a	Precision	RPD < 30% ^b	Serial dilution check and post-digestion spike/ Analytical laboratory QA coordinator	Analytical
Method Blanks	U.S. EPA Methods 8260B, 8015B, 6010/7000, 314, 300, 310.1, 160.1	One per sample batch or 5% whichever is more frequent ^a	Contamination – Accuracy/Bias	≤ Project RL ^{b c}	Evaluate and flag ^e or re-extract and re-analyze/ Analytical laboratory QA coordinator	Analytical
Matrix Spike/Matrix Spike Duplicate	U.S. EPA Methods 8260B, 8015B, 6010/7000, 314, 300, 310.1, 160.1	One per sample batch or 5% whichever is more frequent ^a	Precision/ Accuracy	%R = 70-130% ^d and RPD < 30% ^b	Inorganics: Serial dilution check and post-digestion spike Organics: Evaluate and flag ^e / Analytical laboratory QA coordinator	Analytical
Laboratory Control Sample/ Laboratory Control Sample Duplicate	U.S. EPA Methods 8260B, 8015B, 6010/7000, 314, 300, 310.1, 160.1	One per sample batch or 5% whichever is more frequent ^a	Precision/ Accuracy	%R = 80-120% and RPD < 30% ^b	Re-extract and re-analyze/ Analytical laboratory QA coordinator	Analytical
Laboratory Control Sample/ Laboratory Control Sample Duplicate	U.S. EPA Methods 8260B, 8015B, 6010/7000, 314, 300, 310.1, 160.1	One per sample batch or 5% whichever is more frequent ^a	Precision/ Accuracy	%R = 50-150% and RPD < 30% ^b	Re-extract and re-analyze/ Analytical laboratory QA coordinator	Analytical
Surrogates	U.S. EPA Methods 8260B, 8015B, 6010/7000, 314, 300, 310.1, 160.1	All samples for organic analysis	Accuracy	%R = 50-150% ^d	Re-extract and re-analyze/ Analytical laboratory QA coordinator	Analytical
Surrogates	U.S. EPA Methods 8260B, 8015B, 6010/7000, 314, 300, 310.1, 160.1	All samples for organic analysis	Accuracy	%R = 70-130% ^d	Re-extract and re-analyze/ Analytical laboratory QA coordinator	Analytical

Table 7-4 (continued)
Measurement Performance Criteria – Laboratory QC Samples (UFP-QAPP Worksheets #12 and 28)

Notes:

- ^a A batch is a group of up to 20 samples analyzed together.
- ^b The RPD will be calculated for all results reported above the reporting limit (Table 7-1). RPDs will not be calculated where results are reported as non-detect.
- ^c See Table 7-1 of this SAP.
- ^d Per Method 8000 Section 8, 70-130 percent recovery may be used until laboratory specific in-house performance criteria are received.
- ^e Flagged data will be qualified as appropriate during data validation process.
- ^f General corrective actions are listed in this table; specific corrective actions for each analytical method will be provided in laboratory-specific analytical SOPs.
- ^g Analytical methods for laboratory QC samples will be site specific.

Acronyms and Abbreviations:

- %R – percent recovery
- DQI – data quality indicator
- QA – quality assurance
- QC – quality control
- RL – reporting limit
- RPD – relative percent difference
- SOP – standard operating procedure
- U.S. EPA – United States Environmental Protection Agency

Section 8

Instruments/Equipment and Supplies

8.1 Field Instruments/Equipment

All field and laboratory instruments/equipment will be calibrated and tested in accordance with laboratory SOPs or manufacturer's specifications, as applicable.

Table 8-1 presents a summary of the field instruments/equipment to be used for this project and their associated calibration and testing requirements.

8.2 Laboratory Instruments/Equipment

Calibration of laboratory equipment will be based on written procedures approved by laboratory management. Instruments and equipment will be initially and continuously calibrated at approved intervals as specified by either the manufacturer or other requirements (e.g., methodology requirements). The laboratory will also be compliant with appropriate requirements of the QSM (DOD 2006).

8.3 Inspection/Acceptance of Supplies and Consumables

Prior to acceptance, supplies and consumables will be inspected to ensure that they are in satisfactory condition and free of defects.

Section 8
Instrument/Equipment and Supplies

Table 8-1
Field Instrument/Equipment Calibration and Testing (UFP-QAPP Worksheet #22)

Field Equipment	Maintenance Activity	Calibration/Testing Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Mini – RAE PID Toxic Gas Monitor with 12.6 eV lamp	Equipment will be rented and will be maintained by the rental company per manufacturer's instructions	Measure known concentration of Isobutylene 100 ppm (calibration gas)	Beginning of each day	±10% of the calibration gas value	Manually zero meter or service as necessary and recalibrate	Field team leader	Manufacturers specification
YSI 6820 or comparable	Equipment will be rented and will be maintained by the rental company per manufacturer's instructions	Measure known concentration of auto-calibration solution	Beginning of each day	±10% of the auto-calibration solution value	Recalibrate or service as necessary	Field team leader	Manufacturers specification
QED SamplePro® MicroPurge Bladder Pump	Equipment will be maintained per manufacturer's instructions	NA	NA	NA	Service as necessary	Field team leader	Manufacturers specification
QED MP15 Digital Pressure Controller and Power Pack	Equipment will be rented and will be maintained by the rental company per manufacturer's instructions	NA	NA	NA	Service as necessary	Field team leader	Manufacturers specification

Acronyms and Abbreviations:

- eV – electron voltage
- NA – not applicable
- PID – photoionization detector
- ppm – parts per million
- SOP – standard operating procedure

Section 9 Special Training and Certification

All CDM and subcontractor field personnel will be required to demonstrate successful completion of an approved 40-Hour HAZWOPER and annual 8-Hour refresher training (if applicable) prescribed by 29 Code of Federal Regulations 1910.120, as described in the SHASP (Appendix B of the Work Plan).

The program manager for this investigation is a California P.E. All groundwater sample collection will be performed by CDM staff under the direction of a CDM California P.G. All field personnel will be required to read and understand the SOPs prior to beginning field work. The CDM QA Coordinator will conduct a field planning meeting with field personnel prior to commencement of field work to discuss the understanding of the SOPs. Upon commencement of field work, experienced field personnel will train/mentor junior field personnel in the correct application of applicable SOPs (Appendix C of the Work Plan), specifically:

- SOP 1-2, Sample Custody;
- SOP 1-10, Field Measurement of Organic Vapors;
- SOP 2-1, Packaging and Shipping of Environmental Samples;
- SOP 2-2, Guide to Handling of IDW;
- SOP 4-1, Field Logbook Content and Control;
- SOP 4-2, Photographic Documentation of Field Activities;
- SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites;
- SOP 5-1, Control of Measurement and Test Equipment; and
- *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, EPA Ground Water Issue, EPA/540/S-95/504, 1996.

All samples will be submitted to a laboratory that has been evaluated and approved by NFESC and certified by the state of California through the ELAP.

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Section 10

Documentation and Records

Table 10-1 provides a summary of the documents to be maintained for this project. CDM's local administrative staff has the responsibility for maintenance of the document control system for the project. This system includes a document inventory procedure and a filing system. Project personnel will be responsible for project documents in their possession while working on a particular task.

Electronic copies of project deliverables, including graphics, will be routinely backed up and archived. Final reports will be submitted to NAVFAC Southwest on compact discs in Microsoft Word, Microsoft Excel for certain tables, and AutoCAD for figures.

10.1 Laboratory Data

The laboratory will submit an analytical data report to CDM. The data report will contain a case narrative that briefly describes the numbers of samples, the analyses, and noteworthy analytical difficulties or QA/QC issues associated with the submitted samples. The data report will include signed COC forms, cooler receipt forms, analytical data, a QC package, raw data, and an electronic copy of the data in NEDD format. The data package will also include all QC sample results and associated calculations (i.e., percent recovery [%R] and relative percent difference [RPD]).

Hard copies and electronic copies of the data report on compact discs will be archived by CDM at offsite storage for a minimum of five years and will be made available to the regulatory agencies upon request by the NAVFAC Southwest. The analytical results and environmental data will be submitted to the NIRIS data management system using the tabular submittal requirements specified in the NEDD standard. All data submittals will be compliant with *EWI No. 6, Environmental Data Management and Required Electronic Delivery Standards* (NAVFAC Southwest 2005). CDM will submit a paper copy of all project records including documents, raw laboratory data, photos, correspondence, validation reports, and all responses to Navy and regulatory agency comments to the Navy for the NAVFAC Southwest Administrative Record after the completion of the final report.

10.2 Field Logbook and Records

A permanently bound and consecutively paginated field logbook will be maintained daily by the field team in accordance with SOP 4-1, Field Logbook Content and Control. Documentation modification requirements are also described in SOP 4-1, Field Logbook Content and Control. In general, a single strikeout, initialed and dated, is required for each documentation change.

Table 10-1
Project Documents (UFP-QAPP Worksheet #29)

Document	Where Maintained
Field notes/logbook	Project file
Chain of custody forms	Project file
Laboratory raw data package	Project file
Corrective action forms/reports	Project file and analytical laboratory
Laboratory equipment calibration logs	Analytical laboratory
Sample preparation logs	Analytical laboratory
Run logs	Analytical laboratory
Sample disposal records	Analytical laboratory
Validated analytical data	Project file and NAVFAC Southwest Administrative Record
Paper copy of all records (including Validated analytical data)	NAVFAC Southwest Administrative Record

Section 11

Assessment and Oversight

11.1 Planned Project Assessments

Prior to initiating field work, a Field Planning Meeting will be held to assess the readiness for field work start up. The Field Planning Meeting will be documented using the form presented in Figure 11-1. The project manager is responsible for holding the Field Planning Meeting and is responsible for responding to or correcting any deficiencies identified during the meeting prior to the initiation of field work.

At the start of field work, the project manager or field team leader will conduct a Field Sampling Technical Systems Assessment. This qualitative audit will assess the equipment, facilities, personnel, training, procedures, record-keeping, and data management aspects of the field work to ensure conformance with the SAP. The project manager or field team leader is responsible for conducting the Field Sampling Technical Systems Assessment, reporting the results of the assessment in the field logbook, and responding to or correcting any deficiencies identified during the assessment prior to the start of field work.

Performance assessments are quantitative checks on the quality of a measurement system (e.g., proficiency testing) and are appropriate to analytical work. A performance assessment is not currently scheduled for this project.

System assessments are qualitative reviews of different aspects of project work (e.g., field audits and office audits) to check on the use of appropriate QC measures and the functioning of the QA system. Determinations for project assessments will be performed under the direction of the CDM QA director, who reports directly to the CDM president. Quality Procedure 6.2, as defined in the CDM Quality Assurance Manual, Part Two (CDM 2002), defines CDM's corporate assessments procedures and requirements. A system assessment is not currently scheduled for this project.

NAVFAC Southwest staff will have the opportunity to review site activities and verify that the procedures described in planning documents such as the SAP are being followed.

11.2 Assessments Findings and Response Actions

Any conditions or problems identified during routine activities or through assessments that may impair the quality of work will be addressed through either rapid corrective response actions or formal corrective action processes. All response actions will be implemented on a case by case basis to correct quality problems.

Minor rapid response actions taken in the field immediately (within 24 hours) to correct a quality problem will be documented in the field logbook and verbally reported to the CDM project manager.

Major rapid response actions taken in the field will require notification (within 24 hours) and approval by the NAVFAC Southwest RPM, NAVFAC Southwest QAO, CDM QA Coordinator, and CDM project manager prior to implementation. Such actions may include revising procedures in the field, resampling, or retesting.

Minor or major quality problems that cannot be corrected quickly through rapid routine procedures require implementation of a corrective action request (CAR) form (Figure 11-2). The CAR will be initiated by the person identifying the problem and forwarded to the CDM QA Coordinator within 48 hours of identifying the problem. In consultation with the CDM QA Director, the CDM QA Coordinator will be responsible for investigating and following up on the quality problem; the timeframe for response will be determined by the CDM QA Coordinator based on the specific quality problem.

The NAVFAC Southwest QAO will approve any major response actions in writing and any changes will be compliant with *EWI No. 2 Review, Approval, Revision, and Amendment of Sampling and Analysis Plans* (NAVFAC Southwest 2006).

11.3 Reports to Management

During active months of the project, CDM will submit a written monthly status report to NAVFAC Southwest identifying activities performed, significant conversations, planned activities, and an updated schedule.

QA reports will be provided to management when significant quality problems are encountered. Field staff will note quality problems on field data sheets. The CDM project manager will inform the CDM QA coordinator upon encountering quality issues that cannot be immediately corrected. Monthly QA reports will be submitted to CDM's QA director by the CDM QA coordinator. These reports will be provided upon request of the NAVFAC Southwest QAO.

The measurement report (to be prepared by CDM) will contain a QA section that will discuss adherence to governing documents, extent to which DQOs were met, deviations from the work plan and the SAP, data precision and accuracy goals met, and changes, if any, to the governing documents. It will also provide a summary of QA activities performed as well as a description of quality problems encountered and corrective actions implemented. QA reports and CARs will be included in the measurement report as appropriate. A schedule for submittal of reports is provided in the Work Plan.

**Figure 11-1
Field Planning Meeting Form**

CDM FIELD PLANNING MEETING FORM

Assignment No./Name: _____

Date of Meeting: _____

ATTENDEES

Project Manager: _____

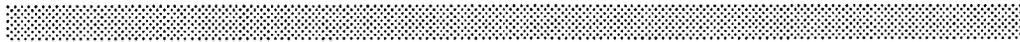
Field Team Leader: _____

Site Health and Safety Officer: _____

Additional Sampling Personnel: _____

QA Coordinator: _____

AGENDA



I. PERSONNEL, FIELD SCHEDULES, TASKS

A. Who is doing the sample collection? List personnel and responsibilities.

B. What media are being sampled? List here.

C. Identify sample locations and requested analytical parameters here. Attach map if needed.

D. How long will personnel be in the field?



Figure 11-1 (continued)
Field Planning Meeting Form

II. PRE-PLANNING

- A. Are site-specific Work Plan, SAP and H&SP ready?

- B. Have other necessary documents been assembled (Client SOPs, CDM SOPs, other applicable client documents)?

- C. Review status of procurement of field supplies, equipment and subcontracts

- D. Reservation of Laboratory Space

- E. Arrangement for QC Samples (Spikes, trip blanks, rinsates, temperature blank, duplicates, MS/MSD, others if necessary)

- F. Coordination with client project manager and subcontractors



III. TRAINING

- A. Are sampling personnel familiar with sample collection procedures and requirements, CDM SOP requirements, or other applicable client requirements?

- B. Review sampling procedures as needed (logbook entries, non-CLP tracking form, spike submittal, etc)



Figure 11-1 (continued)
Field Planning Meeting Form

IV. CHAIN-OF-COMMAND

A. Who will talk to client project manager?

B. Have back-ups been established for the client project manager and the CDM Project Manager?

C. If applicable, has a client contract specialist or client technical/field procedure contact been established?



Figure 11-2
Corrective Action Request Form

CAR No. _____

CDM CORRECTIVE ACTION REQUEST

Project: _____

Contract/Project No: _____ Project Manager: _____

Description of problem and date identified:

Requested by: _____ Date: _____

Submit this form to the QA Director promptly.

Significant Condition Adverse to Quality? Yes / No

Responsible for Action: _____ Response Due: _____

Submit completed response to: _____

[To be completed by the responsible person. Attach additional pages as required.
Include evidence that corrective action has been implemented.]

State cause of problem (if known or suspected): _____

Corrective Action(s) Taken to Correct Problem and Prevent Recurrence: _____

Signature: _____ Date: _____

Corrective Action Plan Accepted: _____ Date: _____

Corrective Action Verified By: _____ Date: _____

Corrective Action Accepted: _____ Date: _____

Section 12

Data Review

The data review process includes three distinctive steps to evaluate and ensure that project data quality will meet the project needs and requirements. The data review process is comprised of verification, validation and usability assessments. Each of these is conducted to ensure that project data are of known and documented quality. The following sections provide details associated with each step in the data review process.

12.1 Data Verification

Data verification consists of a completeness review that is performed in order to ensure that required information is available. This step provides examination of objective evidence to ensure that sampling and analytical requirements have been completed. Several inputs will be examined. Table 12-1 provides a summary of the verification steps for this project.

12.2 Data Validation

The data validation process consists of two steps to be completed. The first step consists of determining compliance with methods, procedures, and contracts for sampling and analysis. The second step of the data validation process consists of comparing information collected with measurement performance criteria presented in the SAP and data validation guidance. Several validation inputs will be examined.

All data validation will be conducted in accordance with *EWI No. 1, Data Validation Guidelines for Chemical Analysis of Environmental Samples* (NAVFAC Southwest 2001) and updates from *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA 2004). *EWI No. 1* is compiled from *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (U.S. EPA 1994) and *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (U.S. EPA 1999).

The data validation strategy to be employed during the GMP is to validate 20 percent of the data according to U.S. EPA Level IV protocols and the remaining 80 percent according to U.S. EPA Level III protocols. Data validation will be conducted by an independent data validation subcontractor.

12.3 Data Usability Assessment

The data usability assessment will be performed on the validated data by a team of personnel at CDM under the responsibility of the project manager. The results of the data usability assessment will be presented in the measurement report and data deemed appropriate for use will be used in the project decision making process. Data qualified as rejected are considered unusable. All other data are considered to be

valid and acceptable including those analytes that have been qualified as estimated or non-detect.

The following sections describe the precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) goals for this project (presented in Tables 7-2 and 7-4) and describe how they will be used to conduct the data usability assessment.

12.3.1 Precision

The precision of a measurement is an expression of mutual agreement among individual measurements of the same property taken under prescribed similar conditions. Precision is quantitative and most often expressed in terms of RPD. Precision of reported results is a function of inherent field-related variability plus laboratory analytical variability. Various measures of precision exist, depending upon "prescribed similar conditions." Field duplicate samples will be collected to provide a measure of the contribution to overall variability of field-related sources. Contribution of laboratory-related sources to overall variability is measured through various laboratory QC samples. Chemical analytical data will be validated for precision using field duplicates, laboratory duplicates, MS/MSDs, and LCS/laboratory control sample duplicates (LCSDs), as applicable.

Precision of the laboratory analysis will be assessed by comparing the analytical results and the laboratory duplicate results. The RPD will be calculated for each pair of duplicate analyses using the following equation:

$$RPD = (|S - D| / (S + D) / 2) \times 100$$

Where S = First sample value (original value); and
D = Second sample value (duplicate value).

A discussion summarizing the results of laboratory and field precision and any limitations on the use of the data will be described in the measurement report.

12.3.2 Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference or true value, and is a measure of the bias in a system. Accuracy is quantitative and usually expressed as the %R of a sample result. Ideally, it is desirable that the reported concentration equals the actual concentration present in the sample. Acceptable QC limits for %R are 70% to 130% for water LCS/LCSDs; 70% to 130% for surrogates; and 70% to 130% for MS/MSDs. Chemical analytical data will be validated for accuracy using surrogates, MS/MSDs, and LCS/LCSDs, as applicable.

The %R of spiked samples will be calculated using the following equation:

$$\%R = ((A - B) / C) \times 100$$

Where A = Analyte concentration determined experimentally from the spiked sample;
 B = Background level determined by a separate analysis of the unspiked sample; and
 C = Amount of the spike added.

A discussion summarizing the results of laboratory accuracy and any limitation on the use of the data will be described.

12.3.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent: (a) a characteristic of a population, (b) parameter variations at a sampling point, and/or (c) an environmental condition. Representativeness is a qualitative and quantitative parameter that is most concerned with the proper design of the sampling plan and the absence of cross-contamination. Good representativeness will be achieved through:

- Careful, informed selection of sampling sites;
- Selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter RLs;
- Proper gathering and handling of samples to avoid interference and prevent contamination and loss; and
- Collection of a sufficient number of samples to allow characterization.

Representativeness is a consideration that will be employed during sample location and collection efforts and will be assessed qualitatively by reviewing field procedures and reviewing actual sampling locations versus planned locations.

Representativeness will be reviewed quantitatively using blank samples. If a concentration in a sample is less than five times the concentration in an associated blank, the sample concentration is considered non-detect. Conclusions drawn based on these reviews will be presented and any impacts discussed in the measurement report.

12.3.4 Completeness

Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Usability will be assessed by evaluating the PARCCS parameters. Those data that are validated and need no qualification, or are qualified as estimated data, are considered usable. Rejected data are not considered usable. Completeness will be calculated following data evaluation. For this work, a completeness goal of 90% is projected for each analytical test. If this goal is not met, additional sampling may be necessary to adequately achieve project objectives. An

evaluation of the impact of missing information and any project limitations with respect to completeness will be discussed in the measurement report.

12.3.5 Comparability

Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Where appropriate, the results of analyses obtained will be compared with the results obtained in previous studies. Standard U.S. EPA analytical and QC methods will be used to ensure comparability of results with other analyses performed in a similar manner. Comparability is a qualitative parameter and cannot be assessed using QC samples. Any comparability limitations will be presented and discussed in the measurement report.

12.3.6 Sensitivity

Sensitivity is the ability of the method or instrument to detect target analytes at the level of interest. Examples of QC measures for determining sensitivity include method detection limit studies, and low initial calibration standards at the quantitation/RL. A review of initial calibration data (specifically low standards at the RL) will be completed to determine if project required sensitivities (RLs) were achieved. The measurement report will discuss sensitivity and any impacts and limitations on the use of project data.

**Table 12-1
Verification Process (UFP-QAPP Worksheet #34)**

Verification Input	Description	Internal/ External	Responsible for Verification
Chain of custody forms	Chain of custody forms will be reviewed internally upon their completion and verified against the packed sample coolers prior to shipment to the laboratory. Copies of the chain of custody forms will be reviewed again and verified against field logs, analytical laboratory reports, and the SAP prior to completion of the measurement report.	Internal	Field team leader
Field logbooks and field forms	Field logbooks and field forms will be reviewed to ensure accuracy and completeness. The field logbook will be maintained in the project file and field forms will be included in the measurement report.	Internal	Field team leader
Laboratory Data Reports	Data validation reports will be reviewed to ensure they represent the data collected during the project. The laboratory data will be evaluated against the project data quality objectives and measurement performance criteria established in the SAP.	Internal	Project manager and/or database coordinator
Sampling Procedures	The implementation of sampling procedures will be reviewed and evaluated through the use of audit reports, sampling reports, field change request forms, the SAP, and/or field logbooks to determine proper equipment use and sampling processes.	Internal	Field team leader
Naval Electronic Data Deliverables (NEDD)	The electronic data deliverable will be compared to the NEDD guidance for compliance with required fields and format. The results will be reviewed to ensure that they have been transferred correctly from laboratory data printouts to the laboratory report and to the NEDD.	Internal	Database coordinator
SAPs	All planning documents (including the SAP) will be reviewed to evaluate whether planned activities and objectives were actually implemented and to document deviations to the plans as necessary.	Internal and External	All data users
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work and by the data validators for completeness and technical accuracy prior to submittal to CDM.	Internal and External	Subcontracted analytical laboratory and data validators

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Section 13

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Appendix B
Site Health and Safety Plan

Final

Appendix B

Site Health and Safety Plan

**Groundwater Monitoring at Anomaly Area 3 and IRP
Sites 1 and 2**

Former Marine Corps Air Station El Toro

Irvine, California

Prepared for:



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Prepared under:

Naval Facilities Engineering Command Southwest
Contract Number: N68711-04-D-1110
Delivery Order Number: 0006
DCN: JNS-1110-0006-0119

05 October 2007

Final

Appendix B

Site Health and Safety Plan

**Groundwater Monitoring at Anomaly Area 3 and IRP
Sites 1 and 2**

Former Marine Corps Air Station El Toro

Irvine, California

Contract Number: N68711-04-D-1110

Delivery Order Number: 0006

DCN: JNS-1110-0006-0119

Prepared by: _____
Jake Dunk
CDM Scientist



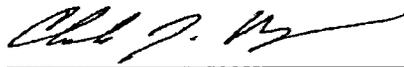
10/5/07
Date

Approved by: _____
Larry Davidson, P.E.
CDM Program Manager



10/5/07
Date

Approved by: _____
Charles Myers, CIH
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10/5/07
Date

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Acronyms and Abbreviations

APR	air-purifying respirator
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CDM	CDM Federal Programs Corporation
CFR	Code of Federal Regulations
CHSM	corporate health and safety manager
CIH	certified industrial hygienist
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
DOT	Department of Transportation
°F	degrees Fahrenheit
HSO	health and safety officer
IDW	investigation-derived waste
JEG	Jacobs Engineering Group
JP	jet propellant
MCAS	Marine Corps Air Station
MHSA	Mine Health and Safety Administration
NFESC	Naval Facilities Engineering Service Center
NAVY	United States Department of Navy
NAVFAC	Naval Facilities Engineering Command
NIOSH	National Institute of Safety and Health
OCHCA	Orange County Health Care Agency
OHM	OHM Remediation Services Corporation
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PM	project manager
PPE	personal protective equipment
ppm	parts per million
RPM	remedial project manager
RWQCB	Regional Water Quality Control Board
SA	site assessment
SHASP	site health and safety plan
SOP	standard operating procedure
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons as diesel

Acronyms and Abbreviations

TPH-g	total petroleum hydrocarbons as gasoline
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

Section 1

Introduction

CDM Federal Programs Corporation (CDM) has prepared this Site Health and Safety Plan (SHASP) for groundwater monitoring program (GMP) at Anomaly Area 3 (AA3) and Installation Restoration Program (IRP) Sites 1 and 2 at the Former Marine Corps Air Station (MCAS) El Toro. The GMP will be performed for Naval Facilities Engineering Command (NAVFAC) Southwest under Contract Number N68711-04-D-1110, Delivery Order Number 0006.

This SHASP describes the minimum safety, health, and emergency response requirements for CDM field activities associated with the groundwater monitoring. All CDM field personnel and subcontractors are required to adhere to the SHASP requirements. References to "employees" throughout the SHASP refer to CDM employees and all subcontractors' employees supporting CDM's field effort. The SHASP addresses accident prevention, personnel protection, and emergency response procedures. It also establishes protocols necessary for protecting workers from the hazards of site contaminants and activities. Copies of the SHASP will be kept with the employees during field work.

1.1 Purpose and Objectives

This Work Plan has been prepared to further characterize groundwater at AA3, and to update the current GMP activities at IRP Sites 1 and 2. Due to historic uses, AA3 and IRP Site 2 must be monitored as part of routine monitoring of constituents to support the remedy selection process.

Due to past disposal training activities, IRP Site 1 has shown elevated concentrations of perchlorate and will be monitored until a preferred remedial action is selected. The Navy evaluated each site individually to assess historical groundwater trends and site activities in order to recommend the updated GMP described in the Work Plan.

1.2 Scope

This SHASP will apply to work performed by CDM at AA3 and IRP Sites 1 and 2. This SHASP will address the reasonable possibility for employee and subcontractor exposure to safety or health hazards associated with the groundwater monitoring, as well as emergency response requirements.

CDM's proposed field program is described in detail in the Work Plan. The groundwater monitoring will consist of the following elements:

- Screen monitoring wells for organic vapors using an organic vapor analyzer (OVA) equipped with a photoionization detector (PID);
- Measure water levels in all monitoring wells;

- Install dedicated bladder pump systems in monitoring wells not already equipped as such;
- Collect groundwater samples using dedicated bladder pump systems;
- Submit groundwater samples for analysis of volatile organic compounds (VOCs), perchlorate, metals, and general chemistry parameters at a Naval Facilities Engineering Service Center (NFESC) pre-approved, State of California certified laboratory;
- Maintain a field logbook for all site activities performed by CDM and subcontractors;
- Transfer all purge and decontamination water to the onsite treatment system; and
- Prepare and submit a report documenting field activities, findings, and analytical results for NAVFAC Southwest approval.

1.3 Plan Updates and Revisions

Once accepted by the Navy, this SHASP will be amended only with review and approval of the CDM corporate health and safety manager (CHSM) and the site health and safety officer (HSO). The Navy will be notified in advance of any required changes and will receive a copy of these amendments and approve them prior to implementation.

Section 2 Site Description

Former MCAS El Toro is situated in south-central Orange County, California (Figure 2-1). Former MCAS El Toro is within the city of Irvine. The station is bordered on the east and southeast by the city of Lake Forest; to the southeast, south, and southwest by the city of Irvine; and to the west, north, and northeast by unincorporated portions of Orange County and Federal Aviation Administration (FAA) property.

At its maximum size, Former MCAS El Toro comprised approximately 4,712 acres. Since base closure, approximately 3,792 acres have been transferred for reuse. In 1998, the Bake Parkway/Interstate 5 public highway expansion project resulted in the transfer of approximately 23 acres in the southeast portion of the station to the California Department of Transportation. In 2001, approximately 897 acres in the northeast portion of the station were transferred to the FAA. In addition, approximately 74 acres in the northeast portion of the station are pending transfer to another federal agency. Approximately 2,798 acres were transferred by deed to Lennar Corporation in July 2005. The remaining 920 acres are being leased in furtherance of conveyance. The general layout of Former MCAS El Toro and locations of the sites included under this GMP are shown on Figure 2-2.

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SENSITIVE RECORD

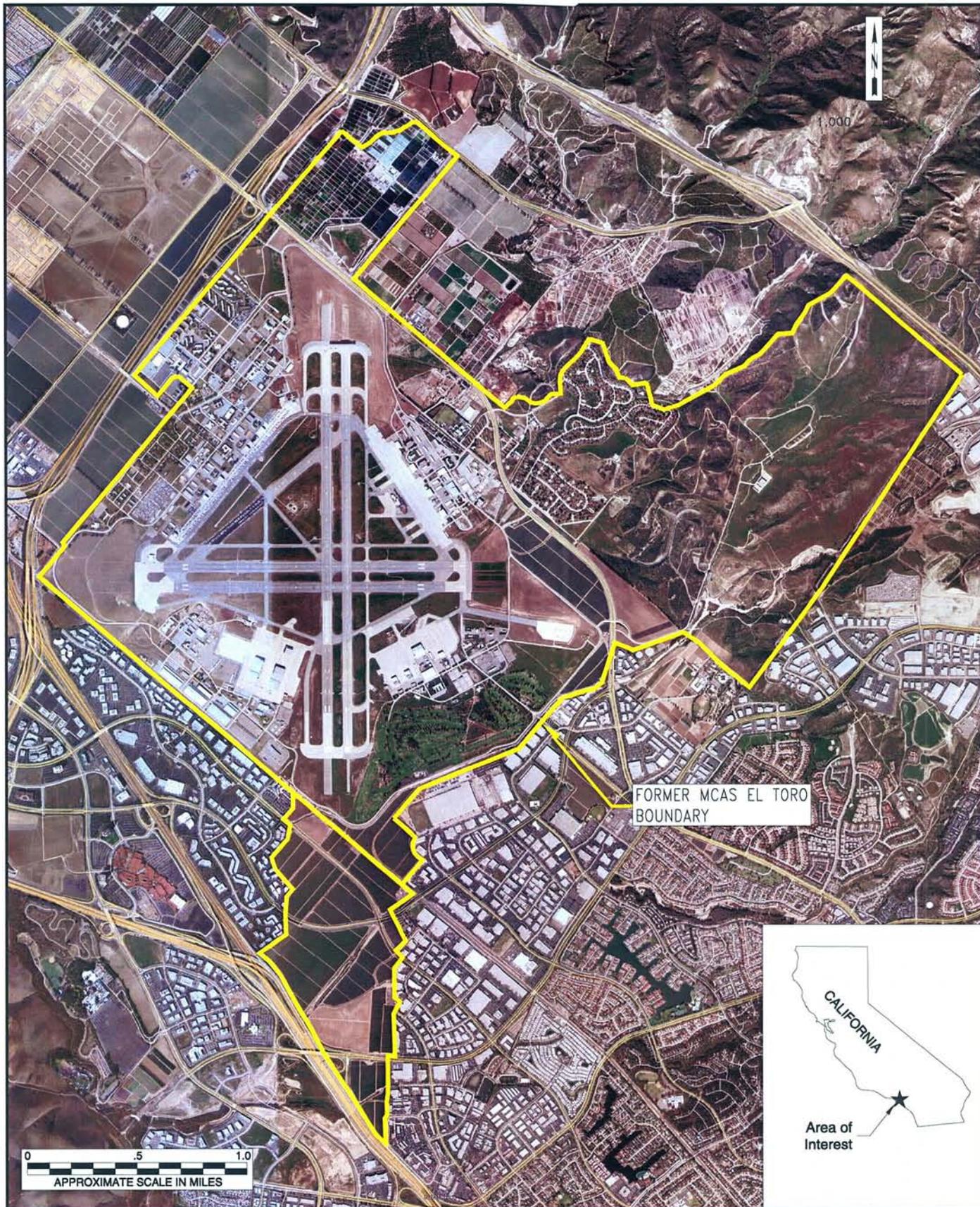
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AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURES 2-1 AND 2-2

FOR ADDITIONAL INFORMATION, CONTACT:

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

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FORMER MCAS EL TORO
IRVINE, CALIFORNIA

AREA LOCATION MAP

FIGURE

CDM

DATE: 02/2007

FN: 003_SHASP

2-1

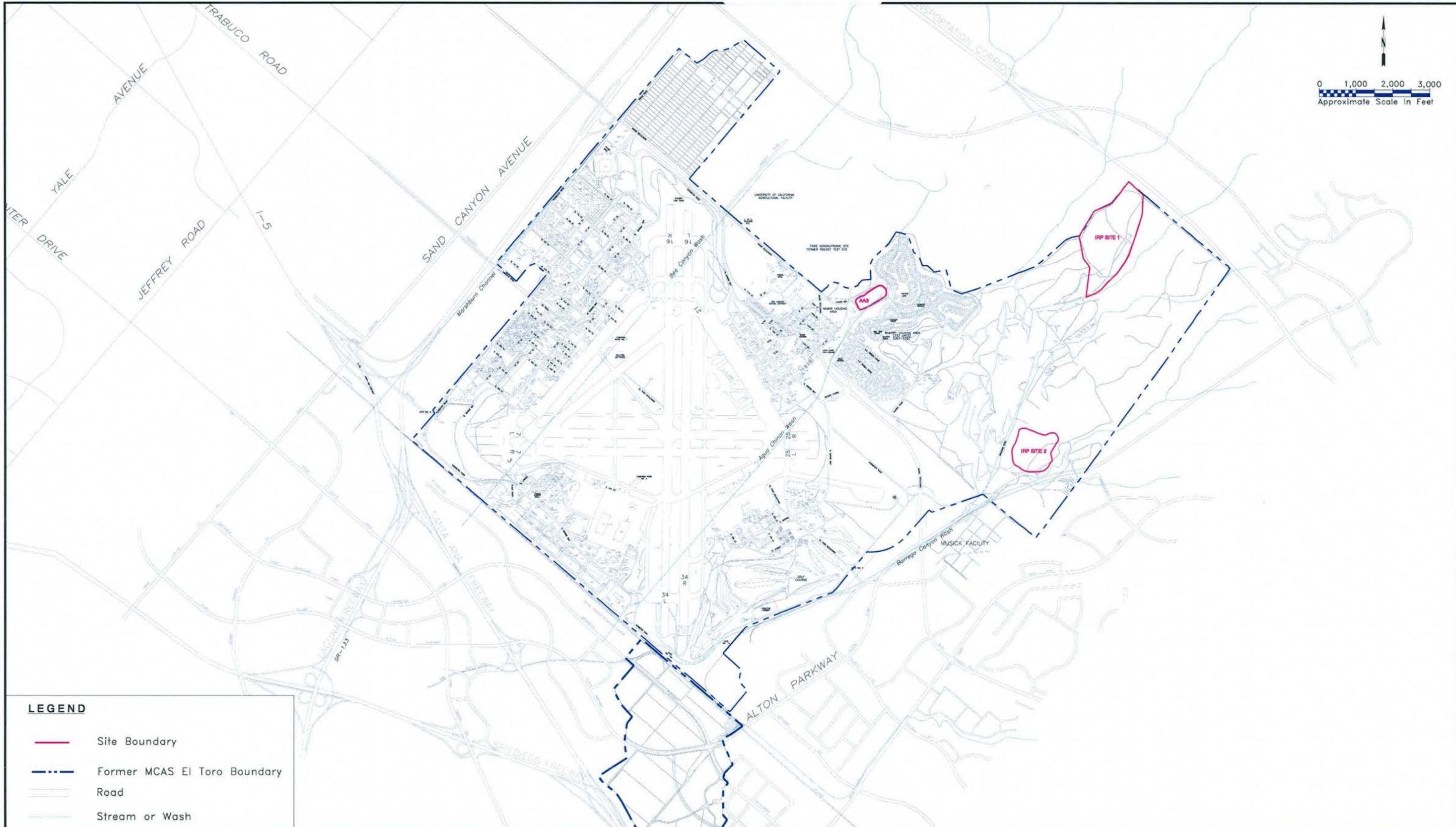
MODIFIED BY: *J. Brown*

PROJECT NO.: 6228-003

Groundwater Monitoring Program
Former MCAS El Toro, California

PAGE NO. 2-4

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LEGEND

- Site Boundary
- - - Former MCAS El Toro Boundary
- Road
- Stream or Wash

FORMER MCAS EL TORO
IRVINE, CALIFORNIA

ANOMALY AREA 3 AND IRP SITES 1 AND 2

FIGURE

CDM

DATE: 02/2007

FN: 003_SHASP

MODIFIED BY: *J. Brown*

PROJECT NO.: 6228-003

Groundwater Monitoring Program
Former MCAS El Toro, California

2-2

Section 3

Responsibilities

CDM's responsibilities and chain of command are discussed below.

3.1 CDM Responsibilities

CDM is responsible for taking all necessary precautions and providing the necessary protection to prevent damage, injury, or loss (as a result of project activities) to the following:

- All individuals at or near the location of the work performed;
- All CDM employees;
- All equipment or materials used in the work performed; and
- Other property at or adjacent to the site or work location.

The field team leader will establish emergency communications with all potential emergency responders, as well as, verify the emergency telephone numbers, prior to starting site work. CDM will notify the NAVFAC Southwest Remedial Project Manager (RPM) immediately when work may affect adjacent properties. CDM will obtain full compliance with this plan by its employees and its subcontractors.

3.2 Chain of Command

Overall accountability for implementing and enforcing this SHASP lies with the CDM CHSM. Day-to-day onsite accountability is delegated to the site HSO. Each CDM employee is responsible for performing the tasks assigned to him/her in this SHASP. The individuals who fill these positions and the responsibilities assigned to them are detailed in Sections 3.2.1 and 3.2.2.

3.2.1 CDM Corporate Health and Safety Manager

Mr. Charles J. Myers, certified industrial hygienist (CIH), is the CDM CHSM for the SA. Mr. Myers is certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene. He is also certified by the Institute of Hazardous Materials Management. Mr. Myers has over 25 years of experience in the implementation and maintenance of health and safety programs and over 20 years of experience in the hazardous waste remediation industry.

Mr. Myers' responsibilities will include the following:

- Implementing and maintaining a program that is consistent with the intent of CDM's Health and Safety philosophy;
- Acting as a focal point for all health and safety issues and concerns;

- Ensuring that individuals who have functional health and safety responsibilities have necessary resources and support to discharge those responsibilities effectively;
- Resolving any health and safety-related differences of opinion that may occur at individual branch offices or project locations;
- Ensuring that awareness levels with regard to health and safety are maintained highly visible throughout all layers of the management organization;
- Providing a mechanism for the preparation and appropriate level of review of site-specific health and safety plans and task-specific safe operating procedures;
- In conjunction with the site HSO, developing and implementing specific project and/or equipment safety operating procedures, where appropriate;
- Maintaining CDM's corporate health and safety program;
- Supervising the activities of the site HSO in his/her performance of health and safety activities;
- Overseeing the occupational hazard training for CDM employees;
- Developing standard worksite safety and health practices; and
- Developing heat stress monitoring procedures for employees working in protective clothing or respirators.

3.2.2 Site Health and Safety Officer

The site HSO will be Mr. Dave Lange. The alternate site HSO will be Mr. Andy Greazel. The site HSO will report to the CHSM and will have the following duties and responsibilities:

- Implementing and enforcing the SHASP;
- Determining the proper personal protective equipment (PPE) for each appropriate work zone and work task;
- Monitoring the breathing zone, as described in Section 5.4.7;
- Conducting site safety checks;
- Assisting in the training of employees assigned to the site;
- Conducting field health and safety meetings;
- Enforcing use of proper PPE for each appropriate work zone and work task;
- Enforcing observance of standard work site safety and health practices;

- Monitoring decontamination methods to ensure their effectiveness;
- Implementing heat stress monitoring procedures;
- Performing additional tasks as necessary to ensure the health and safety of employees and subcontractors;
- Performing first aid and notifying appropriate authorities in emergencies; and
- Site-specific training in the hazards associated with the SA, as necessary.

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Section 4

Coordination and Integration

The intent of this section is to ensure that the appropriate level of coordination and integration of health and safety and emergency response issues exists between CDM and the various onsite entities affected by site activities.

4.1 Coordination with Onsite Entities

For all field activities, CDM will provide formal notification and scheduling of upcoming events with the NAVFAC Southwest RPM. CDM will provide a minimum notice of two weeks.

Daily safety meetings will be held by the site HSO to update CDM personnel and subcontractors on any changes in health and safety concerns. An overview of the CDM activities will be presented in the meeting. The site HSO will note any potential impact that other site activities may have on CDM activities.

4.2 Contingency Plans

If unexpected hazards are encountered, such as unknown odors or unsafe conditions, field personnel will stop work and move a safe distance from the site, preferably upwind. In case of emergencies all CDM workers and subcontractors will meet at a predetermined area that is specified daily.

Work will continue once the site HSO indicates it is safe to return to the site. If unsafe conditions persist, CDM field personnel will notify the NAVFAC Southwest RPM and CDM's project manager (PM). The CDM CHSM will be notified by the PM, as needed.

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Section 5

Accident and Illness Prevention

This section discusses various accident and illness prevention techniques that will be implemented.

5.1 Introduction

CDM believes that the health and safety of each of its employees is of the utmost importance. CDM's objective is a health and safety program that reduces the number of illnesses and injuries to an absolute minimum. The CDM medical surveillance program, designed and administered by a board-certified, occupational physician, consists of a combination of (1) baseline, annual, interim, exit, and return to work examinations; (2) services for the evaluation and follow-up of occupationally-related injuries and illnesses; and (3) emergency medical services required to stabilize severely injured or ill patients prior to their transport to an offsite medical care facility. The prevention of occupationally induced illnesses and injuries takes precedence over operating productivity at all times. CDM provides quality supervision, training and educational opportunities, and protective clothing and equipment to ensure maximum employee health and safety protection.

5.2 Safety Promotion

The training and subsequent implementation of the health and safety program, as well as the scheduled site-specific training, are all designed to instill a high level of safety consciousness in all personnel working at the SA area. These programs, in conjunction with the high level of experience and professionalism of the personnel working onsite and the periodic safety audits and inspections, will maintain safety as a prime concern for all involved. Additionally, the performance of work in a safe manner is expected and required from each CDM employee.

5.3 Medical and First Aid Requirements

Notification of and arrangement with medical facilities, ambulance service, and medical personnel will be established to ensure their readiness and availability for prompt attention to the injured prior to implementation of field activities. The list of emergency contacts is included in Table 9-1. The field team leader and site HSO have been trained in cardiopulmonary resuscitation (CPR) and first aid as well as blood born pathogens. At least two personnel onsite will be trained in CPR, first aid and the dangers of blood-borne pathogens.

At least one first aid kit will be maintained onsite during field operations. These kits have been reviewed by a medical consultant for their adequacy. The first aid kit will be stored in the field vehicle. If it becomes necessary for the field vehicle to leave the site, the first aid kit will be stored in the support zone (refer to Section 5.4.3).

5.4 Standard Work Practices

Standard work practices have been developed for general as well as for specific task activities. Some minimum standard general work practices are outlined below.

5.4.1 Site Control and Personal Hygiene

The following site control and personal hygiene activities will be followed:

- All site workers potentially exposed to hazardous substances were enrolled in a medical surveillance program performed by or under the direct supervision of a qualified physician board certified in occupational medicine as required by Department of the Navy Environmental Restoration Program Manual (2006) as well as U.S. ACOE, Safety and Health Requirements Manual, EM 385-1-1.
- All CDM personnel assigned to work in any restricted area must be provided with a copy of this SHASP, agree to the terms in writing and sign the form in Attachment A, and attend a safety briefing before commencing work;
- Eating, drinking, and chewing gum or tobacco will only be permitted outside the work zone. Smoking is not permitted anywhere on the site;
- Before initiating any non-routine operation, personnel must consult the site HSO about health and safety requirements for that operation;
- Personnel will have access to the restroom facilities in Building 307; and
- Drinking water will be provided by the HSO and will be available throughout the day in the support zone.

5.4.2 Personal Protective Equipment and Clothing

Based on information available from the Navy, the groundwater monitoring will be performed using Level D PPE. CDM personnel and subcontractors will wear Level D PPE for all SA sampling efforts, unless working conditions (such as organic vapor analyzer [OVA] readings greater than 10 ppm, as described in Section 5.4.7) warrant an upgrade to Level C. Specific PPE is as follows:

Level D

- Steel-toed/shank leather boots (all conditions);
- Disposable Tyvek™ or breathable cloth coveralls (as needed);
- Leather work gloves (handling equipment in dry conditions);
- Polyvinyl chloride, nitrile, or neoprene gloves (handling equipment in wet conditions or conditions with the potential for exposure to contaminants);

- Hard hat (during drilling and sampling activities around heavy equipment and/or buildings);
- Safety glasses (during drilling and sampling activities); and
- Hearing protection (as appropriate).

Level C (Located in the field vehicle or stored in an easily accessible area away from any potential contaminants)

- Full face air-purifying respirator (APR), National Institute of Safety and Health/Mine Health and Safety Administration (NIOSH/MHSA)-approved with appropriate cartridges (e.g., combination organic/inorganic/dust);
- Polyethylene Tyvek™ suit;
- Nitrile, butyl rubber, or neoprene gloves;
- Steel-toed, chemically resistant boots;
- Latex inner disposable gloves (two pairs recommended);
- Hard hat; and
- Hearing protection (as appropriate).

5.4.3 Site Control

The migration of contaminants will be prevented or reduced by delineating zones at the site where prescribed operations occur. These zones may be contiguous or non-contiguous based on conditions and activities conducted at the site. Movement of personnel and equipment between zones and onto the site itself will be limited by access control points. By these means, contamination would be expected to be contained within relatively small areas on the site to minimize its potential spread. The contiguous zones used for site operations are:

- Zone 1 - Exclusion Zone;
- Zone 2 - Contamination Reduction Zone (CRZ); and
- Zone 3 - Support Zone.

The site HSO will be responsible for delineating these zones based on site conditions and activities. All site personnel and/or visitors entering the EZ/CRZ will be documented by the HSO on a daily basis in the field log book.

The exclusion zone is the zone where sampling is conducted. The outer boundary of the exclusion zone is the "hotline" and is established based on where the hazardous substances involved are located, where any spilled materials are located, and/or

where any soil discolorations are visible. The hotline should be well marked by the use of barrier tape and/or cones and can be adjusted as needed. The exclusion zone for this project will be an approximately 15-foot diameter circle around any area where sampling is occurring. The exclusion zone can be expanded or reduced by the HSO. All people entering the exclusion zone must wear the level of protection specified by the site HSO.

The CRZ provides a transition area between hazardous and clean and/or safe areas. The CRZ can serve as a decontamination area for equipment, supplies, and personnel. It provides additional assurance that the physical transfer of contaminating substances on people, equipment, or in the air is limited through a combination of decontamination, distance between exclusion and support zones, air dilution, zone restrictions, and work functions. The CRZ can also be used for packaging and preparing samples for shipment and as a temporary rest area. The CRZ will be located on one side of the exclusion zone and will extend for approximately 10 feet.

The support zone is considered a clean zone; therefore, potentially contaminated personal protective clothing, equipment, and samples will not be permitted. Normal work clothes are appropriate attire within this zone. The support zone can also serve as a command post, medical station, equipment and supply center and administrative center for field sampling activities.

The location of facilities in the support zone depends on a number of factors, including:

- Accessibility, topography, open space availability, or other limitations; and
- Wind direction. Preferably the support facilities should be located upwind of the exclusion zone; however, shifts in wind direction and other conditions may be such that an ideal location based on wind direction alone does not exist. In this case, a greater distance from the exclusion zone may be required.

The sampling area (exclusion zone) will be controlled to minimize the possibility of (1) exposure to any contaminants present and (2) their transport off-site by personnel or equipment. The possibility of exposure or translocation of substances will be reduced or eliminated in a number of ways, including the following:

- Setting up physical barriers (as necessary) to exclude unnecessary personnel from the general area. Delineate areas by flagging, warning tape, or equivalent. Only authorized personnel will be permitted beyond the support zone;
- Minimizing the number of personnel and equipment onsite consistent with effective operations;
- Establishing work zones within the site;

- Conducting operations in a manner to reduce the exposure of personnel and equipment and to eliminate the potential for airborne dispersion;
- Implementing appropriate decontamination procedures; and
- Ensuring that onsite personnel meet medical, respirator fit test, and training requirements.

5.4.4 Buddy System

The buddy system or two-man rule requires that at least two people be present during intrusive activities. No person will be permitted to work in an exclusion zone unless accompanied by another person who is willing and able to provide assistance in the event of an injury or illness.

5.4.5 Communications

Site personnel will work in teams of two or more people. Most communications between personnel will be verbal. All APRs will contain speaking diaphragms; however, if the diaphragms fail, the following standard hand signals should be used:

Hand gripping throat	Out of air, can't breath
Gripping partner's wrist or hand around waist.....	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	Yes, affirmative, OK, I understand
Thumbs down.....	No, negative

A cellular phone will be carried by field personnel at all times. If the cellular phone fails, Building 307 contains working phones that will be used in case of an emergency. The emergency alerting procedure will be a 5-second continuous sounding of the field vehicle's horn. The backup emergency signal will be using an air horn that will be accessible to each field crew member.

5.4.6 Air Monitoring

Air monitoring for organic vapors during intrusive field sampling will be conducted using a field-calibrated and maintained OVA. Direct reading air monitoring equipment (e.g., OVA) will be calibrated before and after each period of use in accordance with standard industrial hygiene practices and manufacturers' instructions, which will be kept onsite with air monitoring equipment. All employees taking hazardous chemical measurements will have read and be familiar with CDM's standard operating procedure Section 1-10 *Field Measurement of Organic Vapors* (Appendix B of Work Plan). The only field maintenance to be performed on the air monitors will be those procedures recommended by the manufacturer. All employees taking hazardous chemical measurements will have read and be familiar with CDM's standard operating procedure Section 1-10 *Field Measurement of Organic Vapors* (Appendix B of Work Plan).

Monitoring for organic vapors will be conducted continuously during drilling or sampling efforts. The breathing zone of the site workers will be checked when any organic vapors are detected during drilling or sampling.

Air monitoring (breathing zone) will be conducted continuously during entry into each work area and if any unusual odor is noted. In the event an action level (identified below) is exceeded or unidentified odors persist for more than two minutes in the breathing zone, field team members will upgrade respiratory protection and/or exit the area.

Monitoring equipment will be kept in a well-maintained condition and will be calibrated daily prior to the start of field operations according to manufacturer recommendations. Calibration records and information on the calibration gas used will be maintained on an equipment calibration log with a daily summary in the field logbook.

Action levels for air monitoring are as follows:

- OVA: 0 to 10 ppm sustained above background in the breathing zone for more than five minutes, Level D protection is used;
- OVA: 11 to 200 ppm sustained above background in the breathing zone for more than five minutes, Level C with full-face APR is required; and
- OVA: >200 ppm sustained above background in the breathing zone for more than five minutes, exit the area.

If the field team experiences any persistent unusual odors, nausea, headaches, or respiratory irritation, personnel will exit the area. The site HSO will assess the situation and determine if upgrading respiratory protection is sufficient or if further investigation is warranted prior to returning to work.

5.4.7 Heat Stress Prevention

Heat stress occurs when the body's physiological processes fail to maintain a normal body temperature because of excessive heat. Heat stress is a major concern while wearing impermeable protective garments that prevent evaporative body cooling. Appropriate heat stress prevention can include the following techniques:

- Advise workers to drink 16-ounces of water before beginning field work and continue to drink fluids throughout the work day;
- Acclimate workers to site work conditions by slowly increasing workloads;
- Wear loose clothing, appropriate to the weather and field tasks;
- In hot weather, conduct field activities in the early morning and evening;

- Allow appropriate rest period (i.e., at least 15 minutes each hour, depending on working and weather conditions); and
- Ensure that adequate shelter is available to protect personnel against heat.

Attachment B to this SHASP, Heat Stress Guidelines, contains more information regarding heat stress monitoring. Heat stress is a significant concern as daily temperatures are likely to exceed 75 degrees Fahrenheit (°F).

5.4.8 Spill Response

In the event that a spill occurs during the SA, the following procedures will be taken:

- The spill will have absorbent material placed over the area. Enough absorbent will be used to contain the entire spill. The absorbent material will then be placed in an appropriately labeled container using a shovel and disposed of properly;
- PPE to be used during the spill cleanup will be equal to the PPE being worn when the spill occurred, unless the site HSO determines that a PPE upgrade is necessary; and
- The spill will be reported to the RPM and the CDM project manager and noted in the field logbook.

The spill response equipment will be stored in the field vehicle. Spill response training has been conducted as part of the 40 hour hazardous waste operations and emergency response (HAZWOPER) training received by all CDM field personnel and refreshed annually. If it becomes necessary for the field vehicle to leave the site, the spill response equipment will be stored in the support zone (refer to Section 5.4.4).

5.5 Site Safety Practices

Historically, slips, trips and falls have been major causes of physical injuries. To prevent this type of hazard, tools, parts and other equipment should not be left lying around. Grease and oils found on the ground should be cleaned up as soon as possible. The simple knowledge of proper lifting techniques, bending the knees and lifting with muscles of the legs as discussed in Section 5.6, can eliminate many strained or injured backs.

There are a number of general practices that will be followed to ensure personnel safety during operations at the site. The following is a list of some of these practices:

- Do not run, except in emergencies;
- Do not operate moving equipment unless instruction in its use has been given and use authorized by the site HSO;

- Observe driving regulations within the site. These include wearing seat belts at all times when the vehicle is in motion and maintaining posted speeds or under 15 miles per hour;
- Get authorization from the site HSO before removing safety equipment or supplies from their normal location;
- Clean hand tools and special tools and keep them in good repair;
- Use the correct tool for the particular job in the proper manner;
- Carry materials and tools with concern for overloads and balance, and hold these items securely;
- Avoid movement with obscured vision;
- Practice good housekeeping at all times;
- Use solvents and/or volatile liquids for periodic cleaning authorized by the site HSO, and provide proper storage and disposal;
- Do not participate in "horseplay". Horseplay is defined as any frivolous behavior that increases the probability of an accident; and
- **DO NOT ENTER INTO CONFINED SPACES.**

5.6 Material Lifting

Many types of objects may be handled during the course of field activities. Care should be taken in handling heavy or bulky items, because they are the cause of a considerable number of accidents. There are certain fundamentals in the proper lifting of materials to avoid back injuries as listed below:

- The size, shape, and weight of the object to be lifted must be considered. A worker will not lift more than what one person can handle comfortably;
- The feet will be placed far enough apart for good balance and stability. The footing will be solid;
- The worker will get as close to the load as possible. The legs will be bent at the knees. If the load is too large or bulky and the worker cannot see around or over it, the worker will get assistance;
- The back will be kept as straight as possible;
- The object will be gripped firmly;
- To lift the object, the legs are straightened from their bend. Twisting motions will be avoided while lifting and/or carrying objects;

- A worker will never carry a load that cannot be seen over or around; and
- When placing an object down, the stance and position are identical to that for lifting. The legs are bent at the knees and the object lowered.

When two or more workers are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the persons carrying the load. When carrying the object, each worker, if possible, will face the direction in which the object is being carried. In handling bulky or heavy items, the following guidelines will be followed to avoid injury to the hands and fingers:

- A firm grip on the object is essential. The hands and object will be free of oil, grease, or water that might prevent a firm grip;
- The item will be inspected for metal slivers, jagged edges, burrs, and rough or slippery surfaces;
- Gloves will be used when necessary; and
- The fingers will be kept away from any points that may cause the fingers to be pinched or crushed, especially when setting the object down.

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Section 6

Health and Safety Training

CDM understands the importance of ensuring that employees are adequately trained to safely perform those tasks to which they are assigned. All employees who perform activities at hazardous or potentially hazardous waste sites participate in health and safety training programs designed to comply with the initial, refresher, and supervisory training requirements of 29 Code of Federal Regulations (CFR) 1910.120. At all times during the SA activities, there will be two personnel present that are trained in CPR and first aid, as well as, blood born pathogens.

6.1 Initial 40-Hour Health and Safety Training

29 CFR 1910.120 requires that all employees involved with activities at hazardous or potentially hazardous waste sites receive a minimum of 40 hours of off-site instruction prior to assignment. To ensure the quality and consistency of this training, training programs are carefully scrutinized as to content and actual field experience of the trainers.

Minimum course requirements include the following:

- Overview - 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response;
- Overview - 29 CFR 1910.1200, Hazard Communication;
- Health Hazard Recognition;
- Physical Hazard Recognition;
- Respiratory Protection - Selection, Use, and Maintenance;
- Personal Protective Equipment - Use and Limitations;
- Temperature Extremes;
- Site Control;
- Medical Surveillance;
- Site-specific Health and Safety Plans - Developments and Uses;
- Air Monitoring Equipment - Uses and Limitations;
- Emergency Plans and Procedures;
- Available Reference Materials;
- Effective Decontamination Procedures;

- Container Handling; and
- Confined Space Entry.

Courses may require the attendees to successfully complete a written examination at course completion.

6.2 Refresher Training

To supplement the initial training, periodic training sessions are conducted throughout the year at each of CDM's individual branch offices. These sessions, conducted by qualified CDM professionals, are designed to expand on and clarify the initial training. Additional topics may include accident prevention, seasonal physical hazards, trenching and shoring, lockout/tagout, block and bleed, hazardous waste transportation, and hazardous waste manifests. These sessions are designed to concisely present materials relevant to work being performed. Documentation of these sessions includes the completion of an attendance record and the completion of a quiz, which covers the materials that have been presented. Additionally, CDM has an internet-based version of the 8-hour refresher that is available to all CDM employees.

6.3 Supervisory Training

In addition to the initial and refresher training requirements, those individuals who supervise individuals performing activities at a hazardous or potentially hazardous waste site are required to have an additional 8 hours of training. Topics included in this training include corporate health and safety program, chemical and physical hazard recognition, spill containment, contingency plans, health hazard monitoring (i.e., subjects that help them perform activities in a safe and healthy manner).

6.4 Site-Specific Health and Safety Training

Site-specific health and safety training is presented to all employees as they are assigned to the site and periodically during the course of the project when there is a change in site activities. Specific topics covered include chemical and physical hazards associated with the task to be performed; necessary PPE required for the task; the type of environmental monitoring to be performed during the task; actions to be initiated based on environmental monitoring results; emergency and contingency plans; and task-specific topics, such as small spill containment. Attendance and materials covered are documented using the field Health and Safety Meeting Record in Exhibit 6-1.

No CDM employee or subcontractor will be put into a hazardous field situation without training, which includes an opportunity to practice job assignments in a non-hazardous situation. Prior to the initiation of field activities for the SA, all employees will attend a site-specific safety orientation given by the site HSO emphasizing the following:

- Names of personnel and alternates responsible for site health and safety;
- Site-specific health and safety hazards;
- Basic occupational health and safety;
- Appropriate PPE;
- General occupational health;
- Decontamination facilities and procedures;
- Work practices by which employees can minimize risks from hazards;
- Medical surveillance requirements, including recognition of symptoms and signs of exposure;
- Onsite communication;
- Evacuation routes;
- Route to the hospital;
- Emergency and fire response;
- Smoking restrictions;
- Locations of emergency equipment and list of emergency contacts;
- Site work areas; and
- The SHASP.

Topics covered in initial employee training are reinforced and emphasized in field orientation. It will include a tour of site facilities relevant to the field activities to be performed and the site safety equipment including the following (as appropriate):

- Fire extinguishers;
- Alarm devices;
- Designated work areas;
- First Aid kits; and
- Posted Emergency Contact list.

6.5 Hazard Communication

Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.1200 "Hazard Communication Standard" requires that all employees handling or using materials that may be hazardous be advised and informed as to the hazard potential associated with those materials.

The site HSO will discuss with the team members the following items:

- An overview of the hazard communication requirement;
- A review of the chemicals anticipated to be encountered during the course of project work;
- The location and availability of the written hazard communication program and an inventory of chemicals expected to be encountered;
- Methods and observation techniques that may be used to detect the presence or release of hazardous chemicals in the work area;
- Procedures to lessen or prevent exposure to hazardous workplace chemicals;
- Emergency procedures to follow if employees are exposed to hazardous chemicals; and
- Explanation of the proper use of PPE.

6.6 Daily Health and Safety Meetings

The site HSO will conduct the daily health and safety meetings for field workers. The site HSO will address safety concerns before the day's planned activities. The site HSO will discuss the meeting places in case of evacuation and rally points at this daily safety meeting, as well as other health and safety reminders regarding safe work practices discussed in this SHASP. These meetings will be documented in the field logbook. A brief meeting at the end of the day's work will also be attended by the field team if an emergency response situation has occurred.

6.7 Training Records

Initial employee, site-specific, and daily health and safety training will be documented. The site HSO is responsible for documenting all training activities and maintaining the files. To ensure that all site employees have read and fully understand the contents of this SHASP, a signature form is provided as Attachment A.

Exhibit 6-1 Field Health and Safety Meeting Record

CDM Programs Corporation Trainer: _____
Day: _____ Date: _____ Time: _____

-Field Health & Safety Meeting Record-

Site: _____

Review:

- Health & Safety Plan Location
- Weather Concerns
- Action Levels: __ 11-200 ppm sustained 5 min. in BZ=Level
- Buddy Teams
- Problems Previously Occurred
- Hospital Route/Nearest Phone
- Potential Problems

C _____ • Other: _____

Protective Clothing/Equipment: _____

Special Equipment: _____

Chemical Hazards: _____

Physical Hazards: _____

Emergency Actions: _____

Other Issues: _____

Check:

- H&S Monitoring Equipment/Calibration
- Fire Extinguisher Communications/Radio Check
- First Aid Kit/Eye Wash Station
- H&S Plan (each item) Respiratory Protection/Cartridges

	<u>Please Print - Name/Firm/Office</u>	<u>Signature</u>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____
9.	_____	_____
10.	_____	_____

Site Health & Safety Officer: _____

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Section 7

Hazard/Risk Assessment

The history of operations at AA3 and IRP Sites 1 and 2 poses the potential for hazardous and/or toxic chemicals to be present in the groundwater and represent a work environment that may involve exposure to recognized hazards and potential health hazards. A "recognized hazard" is a condition that is generally recognized as a hazard in the particular industry in which it occurs and is detectable by (a) means of the human senses or (b) accepted tests known in the industry to determine its existence. An example of a recognized hazard would be working in an unstable trench. A "potential health hazard" is generally considered to be exposure or potential exposure to a chemical, biological, pathogenic or radiological agent at or above 50 percent of its established exposure limit, including exposure to a mixture of chemicals. This criterion is a guideline for decision-making purposes and must not be considered or used as an upper limit for exposure.

A summary of the chemical, biological and physical hazards and mitigating health and safety measures is presented in Table 7-1, "Job Hazard Analysis" and as Activity hazard Analyses presented in Attachment C.

7.1 Chemical Hazards

Previous investigations performed at Former MCAS El Toro have identified the potential for organic and inorganic contaminants in the groundwater. Table 7-2 presents general health hazard information for the chemical contaminant categories that may be encountered during the sampling program. This table contains routes of entry, exposure limit ranges, and effects of acute exposure. Human exposure to these hazardous chemicals during the SA is considered low.

Chemical categories presented in Table 7-2 are identified based on past groundwater analysis performed at the area.

7.1.1 Skin/Eye Contact

One route of possible entry is through skin or eye contact. Acute exposure to these chemicals can produce skin or eye irritation. Table 7-1 lists recommended safety measures.

7.1.2 Inhalation

Another possible route of exposure is inhalation of volatile compounds, fumes, or airborne dust particles. Acute exposure to these chemicals can irritate and/or damage the pharynx and/or lungs, and allergic asthma may occur. Table 7-1 lists recommended safety measures.

7.2 Physical Hazards

The site HSO will screen the area for physical hazards prior to beginning work. Multiple physical hazards may be present at the area.

7.2.1 Heat Stress

For field personnel, heat stress is usually a result of protective clothing decreasing natural body ventilation, although it may occur at any time work is being performed at elevated temperatures. Thus, heat stress prevention will be practiced in accordance with the techniques in Section 5.4.7 and in Attachment B of this SHASP.

7.2.2 Slips, Trips, and Falls

Slips, trips and falls can be easily prevented by using common sense practices such as good housekeeping procedures, identifying tripping hazards and rectifying or avoiding them, and walking slowly with proper footwear on slippery surfaces.

7.2.3 Noise

When in operation, drilling and field sampling equipment can be noisy and can project potentially harmful levels of noise into the surrounding working area. To reduce the potential risk associated with noise, all field personnel will be required to wear acoustic earmuffs or earplugs when in the presence of equipment that is projecting excessive noise. To determine excess noise, equipment will be checked for excessive noise labels, if not present, manufacturer will be contacted to determine if hearing protection is suggested during operation.

7.3 Biological Hazards

The site HSO will also screen the area for biological hazards prior to beginning work. Care should be taken during field work activities to prevent contact with biological hazards.

7.3.1 Insects

Bees, wasps, yellow jackets, and black widow spiders present a potential hazard on this project. A victim suspected of being bitten by a black widow spider will receive medical attention. If a victim has been stung by an insect and is known to be allergic or shows signs of an allergic reaction, that victim will receive immediate medical attention.

Protection against insects, such as protective clothing (Level D) and insect repellents (where necessary) will be used. Personnel will receive training on working in conditions where insects will be present prior to field activities.

7.3.2 Vermin

Feral cats, skunks, rats, mice, squirrels and rabbits may be carriers of disease. Where vermin are identified in work areas, the site HSO shall be immediately notified. Bites will be immediately reported and medical care obtained.

Infections associated with rodent-borne disease are present in the southwestern United States. Infections may occur in humans associated with activities that bring humans into contact with rodents, rodent saliva, or rodent excreta. Activities that may bring humans into contact with the etiologic agents causing infections include the following situations:

- Working in areas of field crops;
- Disturbing rodent-infested areas;
- Visiting areas where rodent populations have increased; and
- Entry into potential rodent-infested areas.

Transmission of disease may occur through broken skin, contact with conjunctivae, ingestion of contaminated food or water, or inhalation of aerosols. Personal hygiene practices, such as frequent hand-washing, will help prevent rodent-borne diseases as well as using caution in areas likely to be occupied by vermin.

Workers will be advised that if a fever or respiratory illness develops within 45 days of the potential exposure, they should seek medical attention and inform the physician of potential Hantavirus exposure. All precautions will be made to ensure Hantavirus exposure is eliminated in the field. Rodent-borne diseases, including Hantavirus, result in severe respiratory distress and plague.

**Table 7-1
Job Hazard Analysis**

Type of Hazard	Potential Hazards	Recommended Safety Measures
<i>Chemical</i>	Skin/Eye	<ul style="list-style-type: none"> ▪ Wear appropriate protective equipment, as described in Section 5.4.2. ▪ Use personal hygiene measures such as frequent hand-washing after exposure to potentially toxic and/or pathogenic material.
	Inhalation	<ul style="list-style-type: none"> ▪ Wear appropriate protective equipment (respirator), as described in Section 5.4.2. ▪ Stand upwind of chemical release.
<i>Physical</i>	Heat Stress	<ul style="list-style-type: none"> ▪ Follow heat stress prevention procedures in Section 5.4.7. See Attachment B.
	Slips, Trips & Falls	<ul style="list-style-type: none"> ▪ Identify and remedy tripping hazards. ▪ Follow good housekeeping procedures. ▪ Wear proper footwear such as steel-toed leather boots, and walk slowly on slippery surfaces.
	Working near drill rig	<ul style="list-style-type: none"> ▪ Allow equipment to be operated by trained/experienced personnel only. ▪ Wear a hard hat.
	Noise	<ul style="list-style-type: none"> ▪ Wear earplugs or acoustic earmuffs.
<i>Biological</i>	Insects	<ul style="list-style-type: none"> ▪ Use insect repellent, where necessary. ▪ Wear protective clothing such as leather boots, long pants, hat and work gloves.
	Vermin	<ul style="list-style-type: none"> ▪ Use caution if working in areas of field crops or other rodent-infested areas. ▪ Personal hygiene practices such as frequent hand-washing.

Note:

See Table 7-2 for chemical health hazard information.
See Attachment C for detailed Activity Hazard Analyses.

**Table 7-2
Chemical Health Hazard Information**

Anticipated Contaminants	PEL/TLV*	IDLH*	Warning Concentration**	Principal Routes of Entry	Systems/Effects of Acute Exposure
Volatile Organic Compounds (e.g., benzene, ethyl benzene, toluene, total xylenes)	1-500 ppm	50-2000 ppm	1 ppm (5-min max)	Inhalation, skin/eye contact	Irritated eyes, nose, throat, weakness, dizziness, nausea, vomiting
Perchlorate	0.5 mg/m ³	50 mg/m ³	NA	Inhalation, skin/eye contact, ingestion.	Irritated eyes, nose, throat, weakness, dizziness, nausea, vomiting
Metals	0.01-5 mg/m ³	5-50 mg/m ³	Dust	Inhalation, skin/eye contact	Coughing, irritated nose, headache, metallic taste, chills, tight chest

Acronyms and Abbreviations:

ppm= parts per million
mg/m³ = milligrams per cubic meter
NA = not available
PEL= permissible exposure limit
TLV= threshold limit value
IDLH = immediately dangerous to life and health
* = range is presented for selected compounds within chemical category
** = warning concentration is lowest ue identified for selected compounds within chemical category

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Section 8 Decontamination

This section discusses decontamination techniques that will be performed for drilling and sampling activities.

8.1 Equipment Decontamination

Equipment decontamination procedures will be conducted according to CDM's Technical Standard Operating Procedures (SOPs). Specific equipment decontamination procedures are described in SOP 4-5, Equipment Decontamination at Non-Radioactive Sites (Appendix C of the Work Plan). All purge and decontamination water will be transferred to the onsite treatment plant. PPE will be rinsed and disposed of as trash. Tracking of the IDW disposition will be documented in the field logbook.

8.2 Personal Decontamination

After equipment is decontaminated and the decontamination area is clean, personnel will remove required protective clothing and wash hands, arms, and face with tap water and anti-microbial detergent. Hands and face will be washed prior to any eating or drinking. Plastic sheeting from the decontamination area will be treated as a solid, non-hazardous waste and will be disposed of as such.

Personal decontamination procedures in the case of an injured or ill person are discussed in Section 9.2.

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Section 9

Emergency Action Plan Procedures

If field personnel observe a potential or actual emergency condition, such as a chemical spill or fire, they will notify the personnel listed in Table 9-1. In the case of an emergency such as a fire at an off-site location, the appropriate agencies (i.e., the fire department) will be notified. During the morning health and safety briefing, the emergency action plan will be discussed and demonstrated, so that all members of the team are aware of proper procedures.

Upon entering the site and prior to sampling activity, field personnel will identify the location of the nearest base phone (even though a cellular phone will be on site) and the proposed safe meeting place in case of a site evacuation. A Safe Zone will be established south of the site across North 5th Street that contains emergency equipment and PPE. The Safe Zone is shown in Figure 9-1. In case of emergencies all CDM workers and subcontractors will meet on the concrete runway system, southeast of Building 5.

The emergency alerting procedure will be a 5-second continuous sounding of the field vehicle's horn. An air horn will be used as a backup emergency alerting device. All posted safety and health requirements onsite will be strictly followed. If unexpected hazards or conditions such as noxious fumes are encountered, field personnel will evacuate immediately and meet upwind of the site at the meeting place designated prior to sampling. The proper authorities listed in Table 9-1 will be contacted.

9.1 Emergency Medical Facility

The medical facility used for emergencies for field work conducted at MCAS El Toro is:

Major and minor
exposures and injuries:

Irvine Regional Hospital & Medical
Center
16200 Sand Canyon Ave.
Irvine, California 92718
General Number: (949) 753-2000
Emergency 911

The hospital route to this facility appears in Figure 9-2.

Directions to Hospital from Former MCAS El Toro: Exit Former MCAS El Toro using the new gate at Marine Way. Travel on Marine Way to Sand Canyon Avenue. Turn left on Sand Canyon Avenue and travel approximately 1½ miles until you reach the Irvine Regional Hospital & Medical Center on the left side of the road.

9.2 Medical Emergencies

In the event of an accident requiring first aid, the site HSO will be responsible for coordinating the first aid and/or requesting aid from a medical service (Table 9-1). If the person requiring attention is capable of being moved without further injury, the site HSO may transport the injured party to obtain medical assistance. Site support vehicles may be used to transport injured or ill personnel. Directions and maps showing the routes to the medical facility will be located in all vehicles. This SHASP should also be brought to the hospital. As aforementioned, the site HSO will have CPR and first aid training.

Depending on the seriousness of the injury, treatment may be given at the site by trained response personnel. Emergency first aid equipment, such as a first aid kit and a portable eyewash station (which meets or exceeds the minimum current ANSI Z-358.1 standard for emergency eyewash and shower equipment), will be maintained and kept onsite at all times during site work. For more serious injuries, additional assistance may be required at the site, or the victim may have to be treated at a medical facility.

There is the possibility that decontamination may aggravate or cause more serious health effects. The procedures that will be followed in the case of a medical emergency are included in this section. If prompt, life-saving first aid and/or medical treatment is required, decontamination procedures should be postponed. Site personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

Life-saving care should be instituted immediately without considering decontamination. The outside garments can be removed (depending on the weather) if they do not cause delays, interfere with treatment, or aggravate the problem. If the other contaminated garments cannot be safely removed, the individual should be wrapped in plastic, rubber, or blankets to help prevent contaminating the inside of ambulance and/or medical personnel. Outside garments will then be removed at the medical facility. No attempt should be made to wash or rinse the victim. One exception would be if it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause further or severe injury or loss of life. For minor medical problems or injuries, the normal decontamination procedure should be followed.

Exposure to chemicals can be divided into two categories:

- Injuries from direct contact such as acid burns or inhalation of toxic chemicals; and
- Potential injury due to gross contamination on clothing or equipment.

If a contaminant is inhaled, treatment can only be conducted by qualified physicians. If the contaminant is on the skin or in the eyes, immediate measures must be taken to counteract the substance's effect.

When protective clothing is grossly contaminated, contaminants may be transferred to treatment personnel or the wearer and cause injuries. Unless severe medical problems have occurred simultaneously with splashes, the protective clothing should be washed off as rapidly as possible and carefully removed. Workers showing symptoms of acute exposure should be transported, immediately, following appropriate decontamination, to the nearest medical facility.

If the injured person can be moved and if he/she requires decontamination, he/she will be taken to the decontamination area where contaminated clothing can be removed and first aid administered, while awaiting transportation to the local emergency medical facility. Off-site medical assistance will be obtained, if the person cannot be moved (based on the nature of the injury).

Heat-related illnesses range from heat fatigue to heat stroke, the most serious condition. Heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing may have to be cut off. Less serious forms of heat stress require prompt attention or they may lead to a heat stroke. Decontamination should be minimized unless the victim is obviously contaminated and treatment begun immediately. Section 5.4.7 and Attachment B presents a discussion of recommended heat stress prevention procedures.

**Table 9-1
Emergency Contacts**

Resource	Provider/Title	Telephone No.
Contacts		
Fire Department		911
Ambulance Service		911
Hospital (Irvine Regional Hospital)		(949) 753-2000 General
Poison Control Center		1-800-222-1222
Police		(949) 724-7000
CDM Federal Programs Corporation		
Larry Davidson	Program Manager	office (858) 627-1542
Jacob Dunk	Project Manager	office (858) 627-1557
Dave Lange	Field Team Leader/HSO	office (858) 627-1549
Chuck Myers	CHSM	office (703) 968-0900 cell (571) 216-7004
Dr. Ken Chase	Occupational Physician	office (800) 777-9642
On-site Navy Contact		
Scott Kehe	Bldg. 307	(949) 726-2506
Navy Contacts		
Louie Cardinale	NAVFAC Southwest TA	(619) 532-0979

Notes:

- CHSM = corporate health and safety manager
- HSO = health and safety officer
- NAVFAC = Naval Facilities Engineering Command
- TA = technical advisor

SENSITIVE RECORD

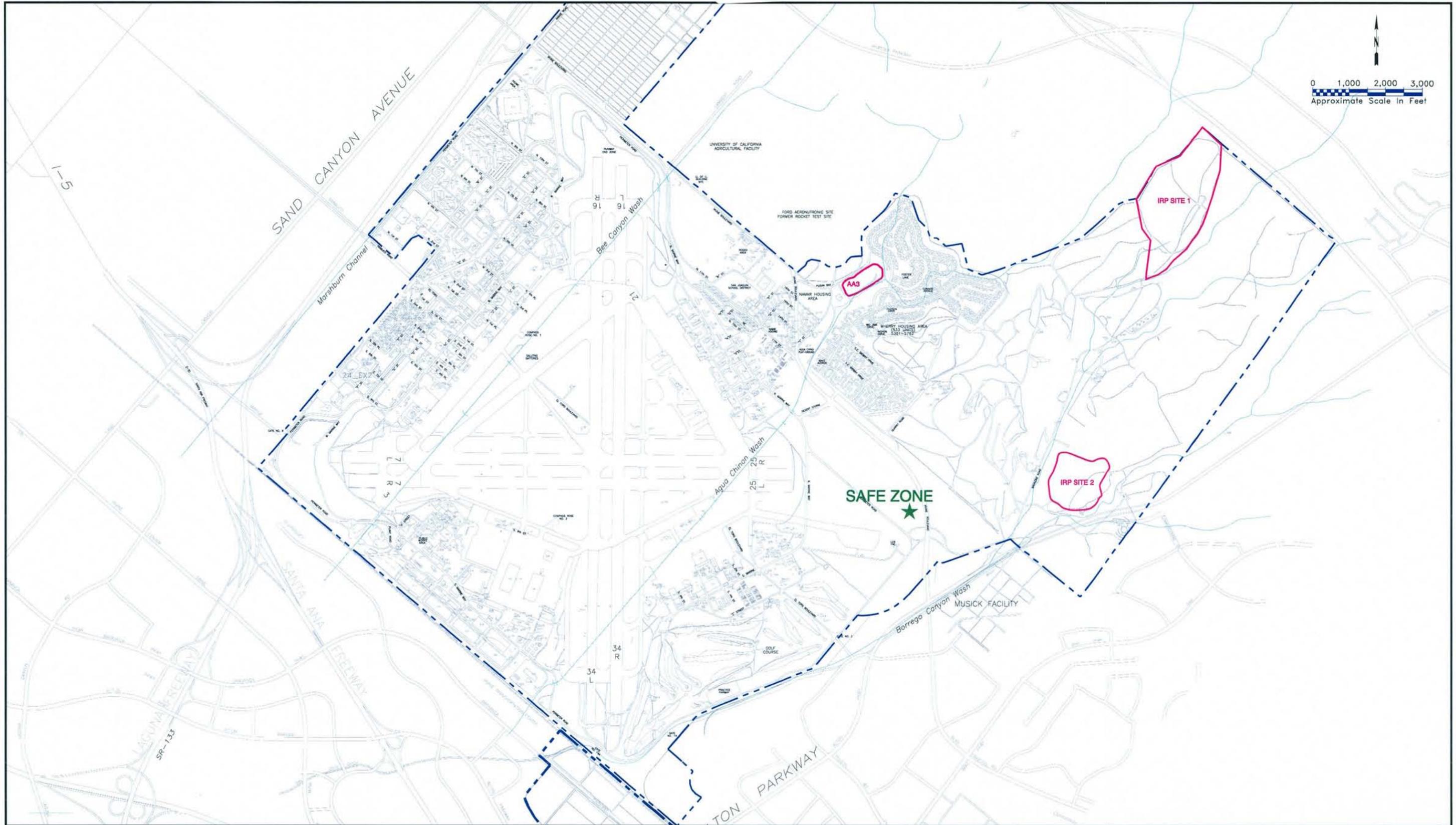
PORTIONS OF THIS RECORD ARE CONSIDERED SENSITIVE
AND ARE NOT AVAILABLE FOR PUBLIC VIEWING

FIGURES 9-1 AND 9-2

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



FORMER MCAS EL TORO IRVINE, CALIFORNIA	
CDM	DATE: 02/2007
	FN: 003_SHASP
	PROJECT NO.: 6228-003
MODIFIED BY: <i>J. Brown</i>	

SAFE ZONE

Groundwater Monitoring Program
Former MCAS El Toro, California

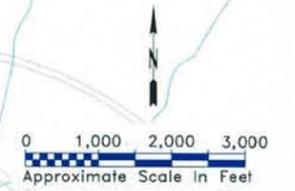
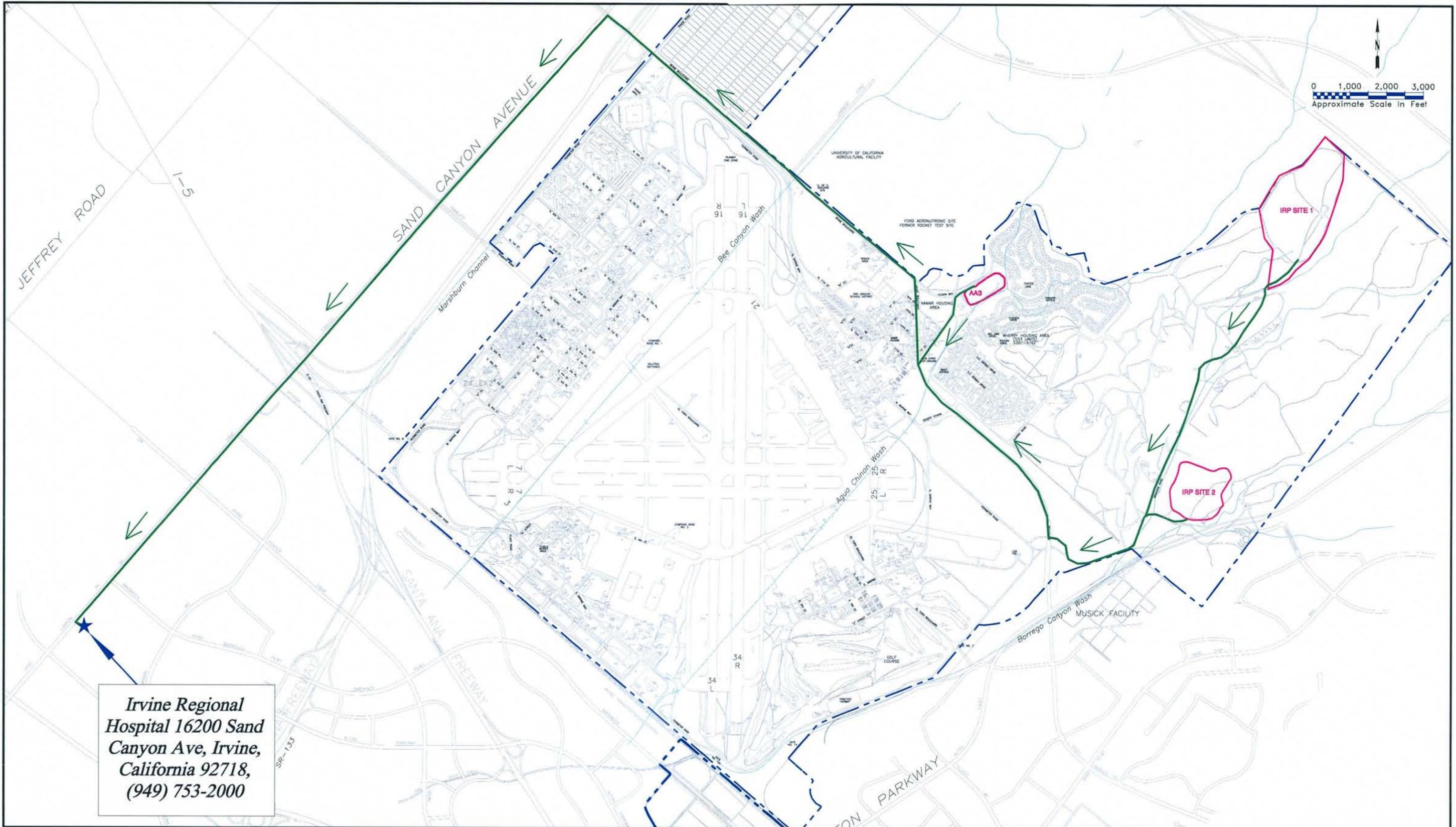
FIGURE

9-1

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**Irvine Regional
Hospital 16200 Sand
Canyon Ave, Irvine,
California 92718,
(949) 753-2000**

FORMER MCAS EL TORO IRVINE, CALIFORNIA	
CDM	DATE: 02/2007
	FN: 003_SHASP
MODIFIED BY: <i>J. Brown</i>	PROJECT NO.: 6228-003

HOSPITAL ROUTE MAP

Groundwater Monitoring Program
Former MCAS El Toro, California

FIGURE
9-2

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Section 10

Exposure/Injury Reporting

10.1 Purpose

The purpose of the exposure/injury reporting system is twofold: (1) to learn from past mistakes in order to maintain an exposure/injury-free work environment and (2) to document incidents as required by OSHA. The reporting system consists of monthly surveys and exposure/incident reports. All incidents involving injury, illness, exposure, vehicle, or equipment damage will be thoroughly investigated by the CHSM, including incidents that might not cause injury, illness, or property damage but had the potential to do so ("near miss incidents").

10.2 Accident Reporting and Investigation

Personnel are required to notify the CHSM of reportable exposures and injuries. Individuals will discuss all potential exposures with the CHSM and/or site HSO to ascertain if the exposure is reportable. If the exposure is deemed reportable, the employees will fill out the Employee Injury/Illness Incident Report (Exhibit 10-1) and submit it to the CHSM. All injuries will be reported.

In general, an exposure is reportable under these conditions:

- If the employee was exposed to vapors or aerosols of chemical compounds in excess of known health standard as indicated by instrument readings;
- If skin or eye contact occurred with a liquid or solid containing chemical compounds, either by a direct splash or by failure of protective gear;
- If any exposure to biohazardous agents occurred; and
- If the employee exhibits any symptoms of exposure, such as rash, headache, etc.

An Injury/Illness Report Form will serve as the basis for the written documentation and investigation of all accidents resulting in employees receiving more than first aid. All such accidents will be verbally communicated to the CHSM or site HSO as soon as medical services are secured. These individuals will verbally notify the CHSM within 24 hours of the accident.

The investigation will be thorough and performed by the injured employee's immediate supervisor. The results of the investigation will be documented using the report form and will be signed by the investigator. The form will then be sent to the appropriate section or local manager, who following a review is also required to sign the form before forwarding it to the site HSO. Following the site HSO's review and signature, a copy of the form will be made for the office/project file with the original forwarded to the CHSM.

10.3 Follow-Up

If the injury/illness resulted from the uncontrolled release of hazardous material, the CHSM will be notified immediately, so that discussions with the occupational physician can occur to determine if additional biological monitoring should be prescribed.

As soon as practical, following the initial medical treatment, the injured employee will be scheduled into the clinic that administers the annual examinations for the injured employee's office. This procedure is necessary to ensure that the employee receives quality medical treatment during any type of recovery period.

The CHSM and the site HSO will follow up with the PM to ensure that corrective action, if identified in the Injury/Illness Report Form, has been implemented.

10.4 Occupational Injuries and Illnesses

The CHSM maintains a log of all occupational injuries and illnesses in accordance with OSHA requirements. The log is maintained using OSHA Form 200. The RPM will also be notified of all accidents/injuries.

Exhibit 10-1
CDM Federal Programs Corporation
Injury/Illness Report

Case # _____ OSHA Recordable? Yes No
 Region _____ Address _____
 Project # _____ Accident or Diagnosis Date _____
 Injury or Illness • Injury • Illness
 Property • Yes • No
 Damage? _____
 Vehicle Involved? • Yes • No
 Employee Status: • Subcontractor • CDM
 Name of Subcontractor Firm _____
 Address and Phone _____
 Name of Injured, or involved employee: _____
 First _____ Initial _____ Last _____
 SSN _____ Sex _____ Age _____
 Employee Number _____
 Witnesses to the Accident or Injury _____
 Employee's usual occupation _____
 Occupation at time of accident _____

Employment Category	Length of Employment	Time in Occupation
• Regular Full Time	• In training • years	• In training • years
• Regular Part Time	• < 6 months • years	• < 6 months • years
• Temporary	• mos - 1 yr • years	• mos - 1 yr • years
• Non-employee	• years • years	• years • years

 Time of Accident/Injury/Illness _____
 Specific location of Accident _____
 Date/day of Accident _____
 Supervisor _____
 Case #'s of others injured or involved in the same Accident _____

Injury/Illness Severity	OSHA Illness Code
• First Aid only	• Occupational skin diseases or disorders
• Medical treatment	• Dust diseases of the lungs
• Lost workdays - restricted activity	• Respiratory conditions due to toxic agents
• Lost workdays - away from work	• Poisoning
• Fatality Date: _____	• Disorders due to physical agents
• Total number of lost days _____	• Disorders associated with repeated trauma
	• All other occupational illnesses

 Phase of employee's workday at time of injury
 • Performing work duties
 • During meals
 • During rest periods
 • Entering or leaving workplace
 • Other _____
 General type of task being performed at injury or illness _____

 Specific activity being performed at time of injury or illness _____

 Employee was working: • Alone • With a crew or fellow worker • Other • Crew size _____
 Supervision at time of accident
 • Directly supervised • Indirectly supervised • Not supervised • Supervision not feasible
 Name, address, phone number of Attending Physician _____

 Name and address of Hospital _____

Exhibit 10-1 (continued)
CDM Federal Programs Corporation
Injury/Illness Report

Check all applicable in each section.

(1) Body Part affected:

- | | | | | |
|-----------|-------------|-----------------------|------------------|------------|
| • Abdomen | • Digestive | • Foot | • Leg | • Shoulder |
| • Ankle | • Ear | • Hand | • Lungs | • Skull |
| • Arm | • Elbow | • Head | • Multiple | • Thigh |
| • Back | • Eye | • Heart | • Musc. Skel | • Toe |
| • Brain | • Face | • Hips | • Neck | • Wrist |
| • Chest | • Finger | • Kidneys, Intestines | • Nervous System | • Other |
| | | • Knee | • Scalp | • Unknown |

(2) Injury Type:

- | | | | | |
|-------------------|----------------------|------------------|------------------|-----------------|
| • Amputation | • Infectious Disease | • Dislocation | • Heat Stroke | • Poisoning |
| • Asphyxia | • Contusion | • Electric Shock | • Hernia | • Radiation |
| • Burn - chemical | • Crush/Bruise | • Fracture | • Inflammation | • Scratch |
| • Burn - heat | • Cut/Puncture | • Freezing | • Multiple | • Sprain/Strain |
| • Concussion | • Dermatitis | • Hearing Loss | • Occ. Disease | • Other |
| | | | • Pneumoconiosis | • Unknown |

(3) Injury Source:

- | | | | | |
|------------------------|-----------------------------|--------------------------|--------------------------|-------------------------|
| • Air pressure | • Clothing | • Glass | • Noise | • Scrap/Debris |
| • Animals | • Coal/Petroleum | • Hand/Power Tools | • Paper | • Silica |
| • Animal products | • Cold | • Heat | • Particles | • Soaps |
| • Body motion | • Drugs & Infectious agents | • Hoists | • Plastics | • Steam |
| • Boilers | • Electricity | • Ladders | • Power trans. apparatus | • Textiles |
| • Boxes/Containers | • Fire/Smoke | • Liquids | • Pumps | • Vehicles/Fork lifts |
| • Buildings/Structures | • Food products | • Machines | • Radiating Substances | • Wood Working Surfaces |
| • Ceramics | • Furniture | • Molten metal | | • Other |
| • Chemicals | | • Minerals - metallic | | • Unknown |
| | | • Minerals - nonmetallic | | |

(4) Accident Type Code:

- | | | | | |
|------------------|----------------------|-------------------|------------------------|-----------------|
| • Struck against | • Fall on same level | • Bodily reaction | • Temperature extremes | • Motor vehicle |
| • Struck by | • Caught in between | • Overexertion | • Radiations, caustics | • Other |
| • Fall from | • Rub, abraded | • Electrocutation | • Public transport | • Unknown |

(5) Hazardous Conditions:

- | | | | | |
|-----------------|------------------------|------------------------|--------------------|-----------|
| • Defects | • Environment hazards | • Inadequately guarded | • Work Environment | • None |
| • Dress/Apparel | • Hazardous procedures | • Public Hazard | • Other | • Unknown |

(6) Accident Part Code

- | | | | | |
|----------------------|-----------------------|---------------------------------|---------------------|---------|
| • Parts of boilers | • Parts of conveyors | • Parts of hand tools (powered) | • Parts of Machines | • Other |
| • Parts of buildings | • Parts of hand tools | • Parts of Hoists | • Parts of Vehicles | • None |

Exhibit 10-1 (continued)
CDM Federal Programs Corporation
Injury/Illness Report

Description of
Accident: _____

Check for each factor that applies to this incident

EQUIPMENT - Was a hazardous condition a contributing factor?

- Defect in equipment/tools
- Hazardous condition not recognized
- Hazardous condition not reported
- Employee not informed/Job procedure not specified
- No equipment inspection procedure
- Inspection procedure failed to detect hazard
- Correct equipment/tools not used
- Correct equipment/tools not available
- Employee not informed of correct equipment
- Substitute equipment
- Equipment design contributed to operator stress/error
- Design/quality of tool contributed to hazardous condition
- Other/Unknown _____

EQUIPMENT - Was the location/ position of equipment, materials, or employee a contributing factor?

- Location/ position contributed to a hazardous condition
- Hazardous condition not recognized
- Hazardous condition not reported
- Employee not informed of correct job procedure for hazard
- Employee did not belong in area
- Hazardous condition not visible to employee
- Insufficient workspace
- Poor environmental control
- Uncontrolled release of a hazardous material
- Other/Unknown _____

PEOPLE - Was the job procedure(s) a contributing factor?

- Aggravation of a pre-existing condition
- No written/known procedure
- Job procedure inadequate
- Employee not trained on proper job procedure
- Employee deviated from proper job procedure
- Employee not physically/mentally capable of performing job
- Job procedure too difficult
- Job procedure encourages deviation
- Other/Unknown _____

PERSONAL PROTECTIVE EQUIPMENT (PPE)

- PPE not specified for task
 - PPE unavailable
 - Employee not advised of PPE
 - Employee not properly trained in PPE
 - PPE used incorrectly
 - PPE inadequate
 - Emergency equipment not specified (shower, eyewash, etc.)
 - Emergency equipment not available
 - Emergency equipment not used
 - Emergency equipment malfunctioned
 - Other/Unknown _____
-

Exhibit 10-1 (continued)
CDM Federal Programs Corporation
Injury/Illness Report

MANAGEMENT - Was a management defect a contributing factor?

- Supervisor failed to detect/anticipate/report hazardous condition
- Supervisor failed to detect/correct deviations from job procedure
- No supervisor review of hazards and job procedures
- Supervisor responsibility not defined/understood
- Supervisor not trained in accident prevention
- Failure to initiate corrective action for known hazard
- Other/Unknown _____

OCCUPATIONAL HEALTH - Was a chemical or physical agent a contributing factor?

Physical Agent:

- Noise, Vibration
- Temperature extremes
- Ionizing radiation - X, gamma, beta, or alpha radiation
- Non-ionizing radiation - microwave, laser, ultraviolet, or radio frequency
- Ergonomic - repetitive motion trauma, inappropriate lighting, glare, incorrect or insufficient tooling, benches, seating

Chemical Agent:

- Solvents Solvent Name _____
- Acid, Base Acid or Base Name _____
- Particulates Particulate Name _____
- Other Toxic Chemicals Chemical Name _____

Biological Agent:

- Microorganism Microorganism _____
- Insect Insect Name _____
- Animal Animal Species _____
- Allergens Allergen Name _____

Medical Problem: _____

CORRECTIVE ACTION
REQUIRED:

Signatures

Immediate Supervisor	_____	Date	_____
H&S Coordinator	_____	Date	_____
Branch/Section Manager	_____	Date	_____
H&S Manager	_____	Date	_____

Section 11

References

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Attachment A
Signature Form

Attachment B
Heat Stress Guidelines

1.0 HEAT STRESS GUIDELINES

1.1 INTRODUCTION

A majority of CDM project activities are performed in outdoor locations and, as such, employees occasionally perform these activities in elevated temperature extremes. In light of this, it's important that all employees understand the signs and symptoms of potential injuries associated with working in temperature extremes.

1.2 HEAT STRESS

Heat stress occurs when the body's physiological processes fail to maintain a normal body temperature because of excessive heat. The body reacts to heat stress in a number of different ways. The reactions range from mild, such as fatigue, irritability, anxiety, and decreased concentration, to severe, such as death. Heat related disorders are generally classified into four basic categories: heat rash, heat cramps, heat exhaustion, and heat stroke. The descriptions, symptoms, and treatment for these disorders are described as follows.

Heat Rash

- **Description:** Heat rash is caused by continuous exposure to heat and humid air and is generally aggravated by coarse clothing. This condition decreases the ability to tolerate heat. Heat rash is the mildest of heat related disorders.
- **Symptoms:** Mild red rash which is generally more prominent in areas of the body in contact with personal protective equipment.
- **Treatment:** Decrease the amount of time in personal protective equipment and use powder to help absorb moisture.

Heat Cramps

- **Description:** Heat cramps are caused by perspiration that is not off-set with adequate fluid intake. This condition is the first sign of a situation that can lead to heat stroke.
- **Symptoms:** Acute, painful spasms occurring in the voluntary muscles (e.g., abdomen and extremities).
- **Treatment:** Remove victim to a cool area and decontaminate, and loosen clothing. Have victim sip cool water or electrolyte replenishing solution as tolerated until the symptoms subside. Total water consumption should be 1-2 gallons per day. Consult with a physician.

Heat Exhaustion

- **Description:** Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. This condition is more severe than heat cramps.

- Symptoms: Pale, clammy, moist skin with profuse perspiration and extreme weakness. Body temperature is generally normal and the pulse is weak and rapid. Breathing is shallow. The victim may show signs of dizziness and may vomit.
- Treatment: Remove the victim to a cool, air conditioned atmosphere. Decontaminate victim, loosen clothing and require that the victim lay in a flat position with the feet slightly elevated. Have the victim sip cool water or electrolyte replenishing solution as tolerated until the symptoms subside. Seek medical attention, particularly in severe situations. It is recommended that personnel experiencing heat exhaustion be evaluated by a doctor prior to returning to work.

Heat Stroke

- Description: Heat stroke is an acute and dangerous situation. It can happen in a very short time period. The victim's temperature control system shuts down completely, resulting in a rise in body core temperature to levels that can cause brain damage and can be fatal if not treated promptly and effectively.
- Symptoms: Red, hot, dry skin, with no perspiring. Rapid respiration, high pulse rate, and extremely high body temperature (an oral temperature at or above 104°F) are other symptoms.
- Treatment: Cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death can result. Decontaminate the victim, remove PPE and take the victim to a nearby shady or air conditioned location, remove as much personal clothing as decency permits, cool by sponging with cool water and fanning, and place cool packs in the axilla and forehead. Get immediate medical attention at the nearest emergency medical treatment facility.

1.2.1 Preventive Measures

There are a number of steps that can be taken to minimize and/or eliminate the potential for heat stress disorders when working in hot atmospheres. Some of these are as follows:

- Acclimate employees to working conditions by slowly increasing workloads over extended periods of time. Do not begin site work activities with the most demanding physical expenditures.
- Where possible, conduct strenuous activities during cooler portions of the day, such as early morning or early evening.
- Provide and encourage all employees to drink lots of tempered water during the course of the work shift and discourage the use of alcohol during nonworking hours. It's essential that fluids lost due to perspiration get replenished.
- During hot periods, use administrative controls to limit exposure.
- Provide cooling devices when appropriate. Mobile showers and/or hose down

facilities, powered air purifying respirators, and ice vests have all proven effective in reducing heat stress potential.

1.2.2 Heat Stress Monitoring

For strenuous field activities that are part of on-going site work activities in hot weather, the following procedures are used to monitor the body's physiological response to heat. These procedures are implemented when employees are required to wear impervious clothing in atmospheres exceeding 70°F.

- **Monitor Heart Rate:** Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The measurement at the beginning of the rest period should not exceed 110 beats/minute. If the heart rate is in excess, the next work period should be shortened by 33 percent, with the length of the rest period remaining the same. If the heart rate is still in excess at the beginning of the net rest period, the following work cycle should be shortened by 33 percent. This procedure continues until the rate is maintained below 110 beats/minute.
- **Monitor Body Temperature:** Body temperature is measured orally or by ear with a clinical thermometer as early as possible in the resting period. Temperatures should not exceed 99.6°F. If it does, the next work period should be shortened by 33 percent. If the oral temperature at the end of the next work period still exceeds 99.6°F, the following work cycle is shortened by another 33 percent. This procedure continues until the body temperature is maintained below 99.6°F.

The Wet-Bulb Globe Temperature (WBGT) Index is a method of monitoring environmental factors that most nearly correlate to an individual's physiological response to heat. This method uses a black globe thermometer, a natural wet-bulb thermometer, and a dry-bulb thermometer. From measurements with these instruments, the WBGT can be calculated. The WBGT is then compared with work load categories with the result being the establishment of recommended work - rest regimens. Examples of permissible heat exposure threshold limit values are described in the following table.

Examples of Permissible Heat Exposure Threshold Limit Values (TLV)
 (Values are given in °C and (°F) WBGT)

Work - Rest Regimen	Work Load		
	Light	Moderate	Heavy
Continuous Work	30.0 (86)	26.7 (80)	25.0 (77)
75% work - 25% rest, each hour	30.6 (87)	28.0 (82)	25.9 (78)
50% work -50% rest, each hour	31.4 (89)	29.4 (85)	27.9 (82)
25% work -75% rest, each hour	32.2 (90)	31.1 (88)	30.0 (86)

Notes:

As workload increases, the heat stress impact on an unacclimatized worker is exacerbated. For unacclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5EC.

Attachment C

Activity Hazard Analyses

ACTIVITY HAZARD ANALYSIS FOR ACCESSING WELL LOCATIONS

[1] AHA No. CDM-045

5/02

Instructions for filling out AHA

Enter information on the AHA form as described below. Bracketed numbers refer to the numbered sections of the form.

- [1] Enter a unique identifying number for each AHA on every page.
- [2] Describe the work location.
- [3] Enter the task title.
- [4] Describe as many phases for completing the work as needed to clearly break down the steps, hazards and hazard controls. (See Example)
- [5] List the Craft or technical discipline for each work group needed to conduct each phase of the task.
- [6] List the steps needed to complete each phase of the task.
- [7] List the work group (craft or discipline) that will perform each step.
- [8] List the hazards involved with each step.
- [9] List the controls for each hazard in the following priority order:
 1. Engineered controls
 2. Operational work practices
 3. Administrative documents
 4. Personal Protective Equipment
 5. Special personal qualifications for workers
- [10] List documents that will be attached to the AHA for use in the field (e.g., RWP, LOTO, Hotwork Permits)
- [11] List reference documents that should be available on site but do not need to be in the supervisors hands to conduct job briefings or control work.
- [12] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA.
- [13] Repeat steps 6 through 9 to describe any changes needed in the AHA based on changes in work or hazards encountered.
- [14] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA change.

ACTIVITY HAZARD ANALYSIS FOR ACCESSING WELL LOCATIONS

[1] AHA No. CDM-045

5/02

[2] Work Location: AA3 and IRP Sites 1 and 2 Former MCAS El Toro			
[3] Task Title: Accessing Well Locations			
[4] Work Phase:		[5] List Work Groups Needed for Each Phase	
A. Inspection of Truck and Trailer		A. CDM	
B. Accessing Monitoring Wells for Sampling		B. CDM	
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. Inspection of Truck and Trailer	All	Truck and/or Trailer in Poor Condition	Perform visual inspection of the vehicle before operating. Trucks and/or trailers needing repair shall be taken out of service until the repair has been made. Contact supervisor immediately to give notification of the problem and to expedite the repair.
		Poor Housekeeping	Trucks and trailers shall be kept neat and orderly. All items within the trucks and trailers shall be secured to prevent movement during use.

Any employee observing a condition deemed unsafe or hazardous has STOP WORK AUTHORITY.

ACTIVITY HAZARD ANALYSIS FOR SAMPLING BOTTLE PREPARATION AND PRESERVATION
[1] AHA No. CDM-045 **5/02**

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
B. Accessing Monitoring Wells	All	Truck and Trailer Stuck in Soft or Uneven Surfaces	<p>Avoid driving off of paved entrée areas.</p> <p>Visually inspect any questionable areas before exiting paved or graveled roadways.</p>
		Contact with Well and/or Bumper Posts	<p>Use side view mirrors to avoid contact with well or well bumper posts.</p> <p>If working in pairs, the passenger will serve as a spotter to prevent contact with wells or bumper posts.</p>
		Untrained Truck Operator	<p>Employee(s) must have a valid drivers license before operating a company vehicle.</p> <p>Employee(s) must have experience in pulling a sampling trailer before being allowed to drive without another trained employee.</p>
		Truck Malfunctioning	<p>Trucks needing repair shall be taken out of service until the repair has been made.</p> <p>Contact supervisor immediately to give notification of the problem and to expedite the repair.</p>
		Inappropriate Driving or Horseplay	<p>Employees shall maintain professionalism at all times.</p> <p>Any employee witnessed driving in an inappropriate or careless manner will be disciplined immediately.</p>

ACTIVITY HAZARD ANALYSIS FOR SAMPLING BOTTLE PREPARATION AND PRESERVATION
[1] AHA No. CDM-045 **5/02**

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
B. Accessing Monitoring Wells (continued)	All	Emergency Conditions	<p>Employees performing tasks that are hazardous in nature shall use the "buddy system".</p> <p>Employees performing tasks in the field alone shall have a means of communication (radio or cell phone).</p> <p>Plan of the day meetings shall determine the locations of each employee performing field activities alone.</p>
		Inclement Weather	<p>Employees shall have radio contact to hear public announcements of approaching storms.</p> <p>Employees are prohibited from performing outside activities during lightning storms or periods that are under severe thunderstorm or tornado warnings.</p> <p>Employee shall remain in vehicle and away from towers or trees in the event of a lightning storm.</p> <p>In the event of tornado, the employee shall take cover in the safest area available (preferably a ditch, sewer, or any area that will provide safe shelter from high winds).</p>

ACTIVITY HAZARD ANALYSIS FOR SAMPLING BOTTLE PREPARATION AND PRESERVATION
[1] AHA No. CDM-045 **5/02**

[10] Attachments:			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
Comments:			
[11] References:			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
[12] Subcontractor Approvals	a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health		
2	Site Supervisor		

ACTIVITY HAZARD ANALYSIS FOR SAMPLING BOTTLE PREPARATION AND PRESERVATION
[1] AHA No. CDM-045 **5/02**

[13] Change Summary			
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)

[14] Subcontractor Approvals		a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health			
2	Site Supervisor			

ACTIVITY HAZARD ANALYSIS FOR SAMPLE BOTTLE PREPARATION

[1] AHA No. CDM-038

5/02

Instructions for filling out AHA

Enter information on the AHA form as described below. Bracketed numbers refer to the numbered sections of the form.

- [1] Enter a unique identifying number for each AHA on every page.
- [2] Describe the work location.
- [3] Enter the task title.
- [4] Describe as many phases for completing the work as needed to clearly break down the steps, hazards and hazard controls. (See Example)
- [5] List the Craft or technical discipline for each work group needed to conduct each phase of the task.
- [6] List the steps needed to complete each phase of the task..
- [7] List the work group (craft or discipline) that will perform each step.
- [8] List the hazards involved with each step.
- [9] List the controls for each hazard in the following priority order:
 1. Engineered controls
 2. Operational work practices
 3. Administrative documents
 4. Personal Protective Equipment
 5. Special personal qualifications for workers
- [10] List documents that will be attached to the AHA for use in the field (e.g., RWP, LOTO, Hotwork Permits)
- [11] List reference documents that should be available on site but do not need to be in the supervisors hands to conduct job briefings or control work.
- [12] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA.
- [13] Repeat steps 6 through 9 to describe any changes needed in the AHA based on changes in work or hazards encountered.
- [14] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA change.

ACTIVITY HAZARD ANALYSIS FOR SAMPLE BOTTLE PREPARATION

[1] AHA No. CDM-038

5/02

[2] Work Location: AA3 and IRP Sites 1 and 2 Former MCAS El Toro			
[3] Task Title: Sample Bottle Preparation			
[4] Work Phase:		[5] List Work Groups Needed for Each Phase	
A. Sampling Bottle Preparation		A. CDM	
B.		B.	
C.		C.	
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. Bottle Preparation	All	Back Injury Due to Improper Lifting Practices	Avoid bending at the waist. Use proper lifting techniques (lift with the legs, not with the back), size up the load, use teamwork, never twist or turn when lifting. Avoid lifting more than two sampling bottle boxes at one time. Use dolly to move boxes if necessary to avoid back strain.
		Employee Vision Impaired Due to Carrying Excessive Load	Avoid carrying more than two sampling bottle boxes at one time. Use dolly to move boxes if necessary to avoid tripping or falling due to impaired line of sight.

Any employee observing a condition deemed unsafe or hazardous has STOP WORK AUTHORITY.

ACTIVITY HAZARD ANALYSIS FOR SAMPLING BOTTLE PREPARATION AND PRESERVATION
[1] AHA No. CDM-038 **5/02**

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. Bottle Preparation (continued)	All	Cuts to the Hand From Box Cutter, Knife or Paper Cut While Opening Sample Bottle Boxes	<p>Employee shall remain alert while cutting boxes open with box cutter or knife.</p> <p>Cuts shall be made away from the body.</p> <p>Leather palm gloves shall be worn if there is a likelihood of cuts from paper or box cutter/knife used to open bottle boxes.</p>
		Employee Cut by Broken Bottle	<p>Bottles shall be inspected before handling.</p> <p>Avoid contact with broken bottles. Use dust pan and broom to clean up broken glass.</p> <p>Use cut resistant gloves if necessary to physically handle broken glass.</p> <p>Use plastic bottles if appropriate.</p>
		Inhalation of Fumes From Preservation Solution	Bottles shall be filled at the acid fume exhaust hood to prevent inhalation.

ACTIVITY HAZARD ANALYSIS FOR SAMPLING BOTTLE PREPARATION AND PRESERVATION
[1] AHA No. CDM-038 **5/02**

[10] Attachments: NONE			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
Comments:			
[11] References: NONE			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
[12] Subcontractor Approvals			
	a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health		
2	Site Supervisor		

ACTIVITY HAZARD ANALYSIS FOR SAMPLING BOTTLE PREPARATION AND PRESERVATION
[1] AHA No. CDM-038 **5/02**

[13] Change Summary			
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)

[14] Subcontractor Approvals		a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health			
2	Site Supervisor			

ACTIVITY HAZARD ANALYSIS FOR WASTE HANDLING AND DISPOSAL

[1] AHA No. CDM-050

5/02

Instructions for filling out AHA

Enter information on the AHA form as described below. Bracketed numbers refer to the numbered sections of the form.

- [1] Enter a unique identifying number for each AHA on every page.
- [2] Describe the work location.
- [3] Enter the task title.
- [4] Describe as many phases for completing the work as needed to clearly break down the steps, hazards and hazard controls. (See Example)
- [5] List the Craft or technical discipline for each work group needed to conduct each phase of the task.
- [6] List the steps needed to complete each phase of the task..
- [7] List the work group (craft or discipline) that will perform each step.
- [8] List the hazards involved with each step.
- [9] List the controls for each hazard in the following priority order:
 - 1. Engineered controls
 - 2. Operational work practices
 - 3. Administrative documents
 - 4. Personal Protective Equipment
 - 5. Special personal qualifications for workers
- [10] List documents that will be attached to the AHA for use in the field (e.g., RWP, LOTO, Hotwork Permits)
- [11] List reference documents that should be available on site but do not need to be in the supervisors hands to conduct job briefings or control work.
- [12] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA.
- [13] Repeat steps 6 through 9 to describe any changes needed in the AHA based on changes in work or hazards encountered.
- [14] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA change.

ACTIVITY HAZARD ANALYSIS FOR WASTE HANDLING AND DISPOSAL

[1] AHA No. CDM-050

5/02

[2] Work Location: AA3 and IRP Sites 1 and 2 Former MCAS El Toro			
[3] Task Title: Waste Handling and Disposal			
[4] Work Phase:		[5] List Work Groups Needed for Each Phase	
A. Disposal of Personal Protective Equipment (PPE)		A. CDM and Subcontractors	
B. Disposal of Soil Cuttings		B. CDM and Subcontractors	
C. Disposal of Decontamination Water		C. CDM and Subcontractors	
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A, Disposal of PPE	All	Personal Injury Due to Pressurized Drum	Comply with CDM Activity Hazard Analysis (AHA) CDM-008, <i>Opening Containerized Waste</i> and CDM Environmental Management Program Procedure CDM-031, <i>Sampling Containerized Waste</i> .
		Hand Injury Due to Pinch Points and/or Abrasive Surfaces	Visually inspect waste drum and other receptacles before handling. Leather gloves shall be worn to protect hands from pinch points, abrasive surfaces, and other physical hazards.
		Back Injury Due to Improper Lifting or Twisting While Handling Drums	Avoid bending at the waist. Use proper lifting techniques (lift with the legs, not with the back), size up the load, use teamwork, never twist or turn when lifting.

ACTIVITY HAZARD ANALYSIS FOR WASTE HANDLING AND DISPOSAL

[1] AHA No. CDM-050

5/02

B, Disposal of Soil Cuttings	All	Personal Injury Due to Pressurized Drum	Comply with CDM Activity Hazard Analysis (AHA) CDM-008, <i>Opening Containerized Waste</i> and CDM Environmental Management Program Procedure CDM-031, <i>Sampling Containerized Waste</i> .
B, Disposal of Soil Cuttings (continued)	All	Hand Injury Due to Pinch Points and/or Abrasive Surfaces	Visually inspect waste drum and other receptacles before handling. Leather gloves shall be worn to protect hands from pinch points, abrasive surfaces, and other physical hazards.
		Back Injury Due to Improper Lifting or Twisting While Handling Drums	Avoid bending at the waist. Use proper lifting techniques (lift with the legs, not with the back), size up the load, use teamwork, never twist or turn when lifting.

Any employee observing a condition deemed unsafe or hazardous has STOP WORK AUTHORITY.

ACTIVITY HAZARD ANALYSIS FOR WASTE HANDLING AND DISPOSAL

[1] AHA No. CDM-050

5/02

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
C. Disposal of Decontamination Water	All	Truck Failure	<p>Perform visual inspection to the vehicle before operating.</p> <p>Ensure brakes are working properly before backing toward the C-612 Treatment Facility.</p> <p>If the truck or trailer is in need of repair, report to supervision immediately.</p>
		Back Strain or Spain During Attachment/Detachment of Hoses	<p>Use proper lifting techniques. Lift with you legs, not with you back. Avoid bending and twisting</p>
		Splash and Pressure Hazards While Purge Water is Being Transferred	<p>Safety glasses with side shield shall be worn at all times within the C-612 facility.</p> <p>Inspect hose connections to ensure proper attachment.</p> <p>Transfer pumps shall be turned off before hoses are uncoupled.</p> <p>Employees shall inspect the transfer hoses for signs of pressure before uncoupling.</p>

ACTIVITY HAZARD ANALYSIS FOR WASTE HANDLING AND DISPOSAL

[1] AHA No. CDM-050

5/02

[10] Attachments: NONE			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
Comments:			
[11] References: NONE			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
[12] Subcontractor Approvals			
	a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health		
2	Site Supervisor		

ACTIVITY HAZARD ANALYSIS FOR WASTE HANDLING AND DISPOSAL

[1] AHA No. CDM-050

5/02

[13] Change Summary			
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)

[14] Subcontractor Approvals		a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health			
2	Site Supervisor			

ACTIVITY HAZARD ANALYSIS FOR WELL SAMPLING

[1] AHA No. CDM-044

5/02

Instructions for filling out AHA

Enter information on the AHA form as described below. Bracketed numbers refer to the numbered sections of the form.

- [1] Enter a unique identifying number for each AHA on every page.
- [2] Describe the work location.
- [3] Enter the task title.
- [4] Describe as many phases for completing the work as needed to clearly break down the steps, hazards and hazard controls. (See Example)
- [5] List the Craft or technical discipline for each work group needed to conduct each phase of the task.
- [6] List the steps needed to complete each phase of the task..
- [7] List the work group (craft or discipline) that will perform each step.
- [8] List the hazards involved with each step.
- [9] List the controls for each hazard in the following priority order:
 1. Engineered controls
 2. Operational work practices
 3. Administrative documents
 4. Personal Protective Equipment
 5. Special personal qualifications for workers
- [10] List documents that will be attached to the AHA for use in the field (e.g., RWP, LOTO, Hotwork Permits)
- [11] List reference documents that should be available on site but do not need to be in the supervisors hands to conduct job briefings or control work.
- [12] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA.
- [13] Repeat steps 6 through 9 to describe any changes needed in the AHA based on changes in work or hazards encountered.
- [14] Site Environmental Safety and Health Representative and Site supervisor complete this section to agree that the work can be safely performed as described in the AHA change.

ACTIVITY HAZARD ANALYSIS FOR WELL SAMPLING

[1] AHA No. CDM-044

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[2] Work Location: AA3 and IRP Sites 1 and 2 Former MCAS El Toro			
[3] Task Title: Well Sampling			
[4] Work Phase:		[5] List Work Groups Needed for Each Phase	
A. Accessing Above Ground Wells and Well Vaults		A. GEO	
B. Sampling Above Ground Well		B. GEO	
C. Sampling Well at Well Vault		C. GEO	
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. Accessing Above Ground Wells and Well Vaults	All	Driving Truck and Trailer	<p>Comply with AHA CDM-042, <i>Driving Company Truck and Trailer.</i></p> <p>Employee(s) must have a valid drivers license before operating a company vehicle.</p> <p>Employee(s) must have experience in pulling a sampling trailer before being allowed to drive without another trained employee.</p> <p>Perform visual inspection of the truck and trailer before operating.</p> <p>Trucks and/or trailers needing repair shall be taken out of service until the repair has been made.</p> <p>Contact supervisor immediately to give notification of the problem and to expedite the repair.</p>

Any employee observing a condition deemed unsafe or hazardous has STOP WORK AUTHORITY.

ACTIVITY HAZARD ANALYSIS FOR WELL SAMPLING

[1] AHA No. CDM-044

5/02

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. Accessing Above Ground Wells and Well Vaults (continued)	All	Unfavorable Road Conditions	<p>Employees shall reduce speed during periods of precipitation, snow, sleet, etc.</p> <p>Headlights shall be used to make the company vehicle more visible to other motorist during unfavorable conditions.</p>
		Vehicle Collision	<p>All employees shall wear seat belt s while operating vehicles.</p> <p>Employees shall practice defensive driving techniques.</p>
		Vehicle Malfunction	<p>Employee shall visually inspect company vehicles before use.</p> <p>Any vehicle found to me in need of maintenance, that would impair drivability of that vehicle, shall be tagged out until the necessary repairs can be made and reported immediately to the supervisor.</p>
B. Sampling Above Ground Well	All	Pinch Points	<p>Use caution when removing well caps.</p> <p>Wear leather palm gloves if pinch points are identified that can injury the employees' hands.</p>
		Struck By Trailer Door	<p>All opened access doors shall be secured at all times.</p>
		Possible Vapors From Well	<p>Open well cap from the upwind side.</p> <p>Contact supervision or ES&H representative if any unfamiliar or unusual odors are detectable.</p> <p>Periodic industrial hygiene monitoring will be performed to ensure employee safety and health.</p>

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[1] AHA No. CDM-044

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[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
B. Sampling Above Ground Well (continued)	All	Stinging Insects and Ticks	<p>Treat well cap and well shaft as insect containing.</p> <p>Observe for insects before proceeding.</p> <p>Use insect repellent and insect killer if required.</p> <p>Tape pant legs and apply permethrin on shoes and pant legs to provide protection from ticks.</p> <p>Visually inspect clothing after accessing each well location.</p> <p>Employees allergic to insect stings shall be identified and necessary actions taken to treat in the event of a sting.</p>
		Use of Nitrogen Tank	<p>Cylinder shall be secure and free from movement.</p> <p>Keep heat sources away from cylinder at all times.</p> <p>The protective cylinder cap shall be secured to the top of the cylinder during trailer movement.</p>
		Use of Gasoline-Powered Air Compressor	<p>The air compressor shall be fastened or secured to prevent movement.</p> <p>Smoking is prohibited while operating the compressor or during refueling.</p> <p>A fire extinguisher shall be available in case of emergency.</p>
		Working With and Filling Acid Preserved Bottles	<p>Latex gloves shall be worn while filling acid preserved bottles with water samples.</p>
		Poisonous Plants	<p>Avoid contact with poisonous plants. Contact Safety Advocate or ES&H to have plants removed or killed by grounds personnel.</p>

ACTIVITY HAZARD ANALYSIS FOR WELL SAMPLING

[1] AHA No. CDM-044

5/02

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
C. Sampling Well at Well Vault	All	Fall Hazard at Opened Well Vault	<p>Avoid standing near opened well vault if not entering.</p> <p>Do not carry equipment down steps. Place equipment outside the vault and then retrieve once entry has been made.</p>
		Hand Injured by Pinch Points or Abrasive Surfaces Associated With the Opening of Vault Doors	<p>Vault doors shall be thoroughly inspected to determine pinch points and to locate any sharp edges that need to be eliminated or guarded.</p> <p>Employees handling materials that could cause cuts or abrasions to hands shall wear leather-palm gloves.</p>
		Foot Injury Due to Pinch Points	<p>Steel-toed safety shoes shall be worn by employee(s) performing tasks associated with this activity hazard analysis.</p>
		Use of Nitrogen Tank	<p>Cylinder shall be secure and free from movement.</p> <p>Keep heat sources away from cylinder at all times.</p> <p>The protective cylinder cap shall be secured to the top of the cylinder during trailer movement.</p>
		Use of Gasoline-Powered Air Compressor	<p>The air compressor shall be fastened or secured to prevent movement.</p> <p>Smoking is prohibited while operating the compressor or during refueling.</p> <p>A fire extinguisher shall be available in case of emergency.</p>

ACTIVITY HAZARD ANALYSIS FOR WELL SAMPLING

[1] AHA No. CDM-044

5/02

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
C. Sampling Well at Well Vault (continued)	All	Back or Other Bodily Injury Caused by Improper Bending, Twisting or Stretching While Opening Vault Doors	Use proper lifting techniques (lift with the legs, not with the back), size up the load, use teamwork, never twist or turn when lifting.
		Struck By Trailer Door	All opened access doors shall be secured at all times.
		Employee Stung By Flying Insect or Bitten By Spider	<p>Be prepared and alert for flying insects that may be using the vaults as shelter.</p> <p>Utilize insect spray for stinging insects and spider if necessary.</p> <p>Inspect vault interior for poisonous spiders before and after entry into vault.</p>
		Poisonous Plants	Avoid contact with poisonous plants. Contact Safety Advocate or ES&H to have plants removed or killed by grounds personnel.
		Employee Struck By Vault Door	Ensure well vault door is secured with the safety latch before entering the vault.
		Tripping Hazards	Visually inspect well vault sites for any objects that could cause employees to stumble or fall into vaults.
		Working With and Filling Acid Preserved Bottles	Latex gloves shall be worn while filling acid preserved bottles with water samples.

ACTIVITY HAZARD ANALYSIS FOR WELL SAMPLING

[1] AHA No. CDM-044

5/02

[10] Attachments:			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
Comments:			
[11] References:			
Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
[12] Subcontractor Approvals	a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health		
2	Site Supervisor		

ACTIVITY HAZARD ANALYSIS FOR WELL SAMPLING

[1] AHA No. CDM-044

5/02

[13] Change Summary			
[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)

[14] Subcontractor Approvals		a. Print Name	b. Signature	c. Date
1	Environment, Safety, and Health			
2	Site Supervisor			

Appendix C
Standard Operating Procedures

Appendix C

Table of Contents

The following standard operating procedures can be found in Appendix C:

- SOP 1-2, Sample Custody;
- SOP 1-10, Field Measurement of Organic Vapors;
- SOP 2-1, Packaging and Shipping of Environmental Samples;
- SOP 2-2, Guide to Handling of Investigation-Derived Waste;
- SOP 4-1, Field Logbook Content and Control;
- SOP 4-2, Photographic Documentation of Field Activities;
- SOP 4-5, Field Equipment Decontamination at Nonradioactive Sites;
- SOP 5-1, Control of Measurement and Test Equipment; and
- Low-Stress (Low Flow) / Minimal Drawdown Ground-water Sample Collection.

Sample Custody

SOP 1-2
Revision: 4
Date: March 1, 2004
Page 1 of 7

Prepared: David O. Johnson

Technical Review: Shelley Thibeault

QA Review: Laura Splichal

Approved: Michael C. Mally 2/24/04

Issued: [Signature] 2/18/04
Signature/Date

Signature/Date

1.0 Objective

Due to the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are introduced as evidence in legal proceedings. To maintain and document sample possession, sample custody procedures are followed. All paperwork associated with the sample custody procedures will be retained in CDM Federal Programs Corporation (CDM) files unless the client requests that it be transferred to them for use in legal proceedings or at the completion of the contract.

Note: Sample custody documentation requirements vary with the specific EPA region or client. This SOP is intended to present basic sample custody requirements, along with common options. Specific sample custody requirements should be presented in the project-specific quality assurance (QA) project plan or project-specific modification or clarification form (see Section U-1).

2.0 Background

2.1 Definitions

Sample - A sample is material to be analyzed that is contained in single or multiple containers representing a unique sample identification number.

Sample Custody - A sample is under custody if:

1. It is in your possession
2. It is in your view, after being in your possession
3. It was in your possession and you locked it up
4. It is in a designated secure area

Chain-of-Custody Record - A chain-of-custody record is a form used to document the transfer of custody of samples from one individual to another.

Custody Seal - A custody seal is a tape-like seal that is part of the chain-of-custody process and is used to detect tampering with samples after they have been packed for shipping.

Sample Label - A sample label is an adhesive label placed on sample containers to designate a sample identification number and other sampling information.

Sample Tag - A sample tag is attached with string to a sample container to designate a sample identification number and other sampling information. Tags may be used when it is difficult to physically place adhesive labels on the container (e.g., in the case of small air sampling tubes).

3.0 Responsibilities

Sampler – The sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

Field Team Leader – The field team leader (FTL) is responsible for ensuring that strict chain-of-custody procedures are maintained during all sampling events. The FTL is also responsible for coordinating with the subcontractor laboratory to ensure that adequate information is recorded on custody records. The FTL determines whether proper custody procedures were followed during the fieldwork and decides if additional samples are required.

Field Sample Custodian – The field sample custodian, when designated by the FTL, is responsible for accepting custody of samples from the sampler(s) and properly packing and shipping the samples to the laboratory assigned to do the analyses. A field sample custodian is typically designated only for large and complex field efforts.

4.0 Required Supplies

- Chain-of-custody records (applicable client or CDM forms)
- Sample labels or tags
- Custody seals
- Clear tape

5.0 Procedures

5.1 Chain-of-Custody Record

This procedure establishes a method for maintaining custody of samples through use of a chain-of-custody record. This procedure will be followed for all samples collected or split samples accepted.

Field Custody

1. Collect only the number of samples needed to represent the media being sampled. To the extent possible, determine the quantity and types of samples and sample locations prior to the actual fieldwork. As few people as possible should handle samples.
2. Complete sample labels or tags for each sample using waterproof ink.
3. Maintain personal custody of the samples (in your possession) at all times until custody is transferred for sample shipment or directly to the analytical laboratory.

Transfer of Custody and Shipment

1. Complete a chain-of-custody record for all samples (see Figure 1 for an example of a chain-of-custody record. Similar forms may be used when requested by the client). When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the sample custodian in the appropriate laboratory.
 - The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via common carrier (e.g., Federal Express), the

Sample Custody

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date/time will not be the same for both signatures. Common carriers are not required to sign the chain-of-custody record.

- In all cases, it must be readily apparent that the person who received custody is the same person who relinquished custody to the next custodian.
- If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record.

Note: If a field sample custodian has been designated, he/she may initiate the chain-of-custody record, sign, and date as the relinquisher. The individual sampler(s) must sign in the appropriate block, but does (do) not need to sign and date as a relinquisher (refer to Figure 1).

2. Package samples properly for shipment and dispatch to the appropriate laboratory for analysis. Each shipment must be accompanied by a separate chain-of-custody record. If a shipment consists of multiple coolers, samples in the coolers may be recorded on a single chain-of-custody record.
3. The original record will accompany the shipment, and the copies will be retained by the FTL and, if applicable, distributed to the appropriate sample coordinators. Freight bills will also be retained by the FTL as part of the permanent documentation. The shipping number from the freight bill shall be recorded on the applicable chain-of-custody record.

Procedure for Completing CDM Example Chain-of-Custody Record

The following procedure is to be used to fill out the CDM chain-of-custody record. The record provided herein (Figure 1) is an example chain-of-custody record. If another type of custody record (i.e., provided by the EPA contract laboratory program or a subcontract laboratory) is used to track the custody of samples, the custody record should be filled out in its entirety.

1. Record project number.
2. Record FTL for the project (if a field sample custodian has been designated, also record this name in the "Remarks" box).
3. Record the name and address of the laboratory to which samples are being shipped.
4. Enter the project name/location or code number.
5. Record overnight courier's airbill number.
6. Record sample location number.
7. Record sample number.
8. Note preservatives added to the sample.
9. Note media type (matrix) of the sample.
10. Note sample type (grab or composite).
11. Enter date of sample collection.
12. Enter time of sample collection in military time.

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 Revision: 4
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Figure 1
Example CDM Chain-of-Custody Record

CDM

125 Maiden Lane, 5th Floor
 New York, NY 10038
 (212) 785-9123
 Fax: (212) 785-6114

**CHAIN OF CUSTODY
 RECORD**

PROJECT ID.		FIELD TEAM LEADER		LABORATORY AND ADDRESS				DATE SHIPPED	
PROJECT NAME/LOCATION				LAB CONTRACT:				AIRBILL NO.	
MEDIA TYPE		PRESERVATIVES		SAMPLE TYPE		ANALYSES (List no. of containers submitted)			
1. Surface Water		1. HCl, pH <2		G - Grab					
2. Groundwater		2. HNO ₃ , pH <2		C - Composite					
3. Leachate		3. NaOH, pH >12							
4. Field CC		4. H ₂ SO ₄ , pH <2							
5. Soil/Sediment		5. Zinc Acetate, pH >9							
6. Oil		6. Ice Only							
7. Waste		7. Not Preserved							
8. Other _____		8. Other _____							
SAMPLE LOCATION NO.	LABORATORY SAMPLE NUMBER	PRESERVATIVES ADDED	MEDIA TYPE	SAMPLE TYPE	DATE	TIME SAMPLED	REMARKS (Note if NCS/MSD)		
1.									
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
SAMPLER SIGNATURES:									
RELINQUISHED BY: (NAME)	DATE/TIME	RECEIVED BY: (NAME)	DATE/TIME	RELINQUISHED BY: (NAME)	DATE/TIME	RECEIVED BY: (NAME)	DATE/TIME	RELINQUISHED BY: (NAME)	DATE/TIME
RELINQUISHED BY: (NAME)	DATE/TIME	RECEIVED BY: (NAME)	DATE/TIME	RELINQUISHED BY: (NAME)	DATE/TIME	RECEIVED BY: (NAME)	DATE/TIME	RELINQUISHED BY: (NAME)	DATE/TIME
COMMENTS:									

DISTRIBUTION: White and yellow copies (secondary sample shipment) to laboratory; yellow copy retained by laboratory; Pink copy retained by samplers.

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Note: If requested by the client, different chain-of-custody records may be used. Copies of the template for this record may be obtained from the Chantilly Graphics Department.

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Revision: 4

Date: March 1, 2004

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13. When required by the client, enter the names or initials of the samplers next to the sample location number of the sample they collected.
14. List parameters for analysis and the number of containers submitted for each analysis.
15. Enter matrix spike/matrix spike duplicate (MS/MSD) if sample is for **laboratory** quality control or other remarks (e.g., sample depth).
16. Sign the chain-of-custody record(s) in the space provided. All samplers must sign each record.
17. If sample tags are used, record the sample tag number in the "Remarks" column.
18. The originator checks information entered in Items 1 through 16 and then signs the top left "Relinquished by" box, prints his/her name, and enters the current date and time (military).
19. Send the top two copies (usually white and yellow) with the samples to the laboratory; retain the third copy (usually pink) for the project files. Retain additional copies for the project file or distribute as required to the appropriate sample coordinators.
20. The laboratory sample custodian receiving the sample shipment checks the sample label information against the chain-of-custody record. Sample condition is checked and anything unusual is noted under "Remarks" on the chain-of-custody record. The laboratory custodian receiving custody signs in the adjacent "Received by" box and keeps the copy. The white copy is returned to CDM.

5.2 Sample Labels and Tags

Unless the client directs otherwise, sample labels or tags will be used for all samples collected or accepted for CDM projects.

1. Complete one label or tag with the information required by the client for each sample container collected. A typical label or tag would be completed as follows (see Figure 2 for example of sample tag; labels are completed with the equivalent information):
 - Record the project code (i.e., project or task number).
 - Enter the station number (sample number) if applicable.
 - Record the date to indicate the month, day, and year of sample collection.
 - Enter the time (military) of sample collection.
 - Place a check to indicate composite or grab sample.
 - Record the station (sample) location.
 - Sign in the space provided.
 - Place a check next to "yes" or "no" to indicate if a preservative was added.
 - Place a check under "Analyses" next to the parameters for which the sample is to be analyzed. If the desired analysis is not listed, write it in the empty slot. **Note:** Do not write in the box for "laboratory sample number."
 - Place or write additional relevant information under "Remarks."
2. Place adhesive labels directly on the sample containers. Place clear tape over the label to protect from moisture.
3. Securely attach sample tags to the sample bottle. On 2.27 liter (80 oz.) amber bottles, the tag string may be looped through the ring style handle and tied. On all other containers, it is

Sample Custody

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 Revision: 4
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**Figure 2
 Example Sample Tag**



Designate	Grab	Preservative: Yes <input type="checkbox"/> No <input type="checkbox"/>	
	Comp.		
Time	ANALYSES		BOD
			Anions
			Solids (TS) (TSS) (SS)
			COD, TOC, Nutrients
			Phenolics
			Mercury
			Metals
Month/Day/Year			Cyanide
			Oil and Grease
			Organics GC/MS
Station No.			Priority Pollutants
			Volatile Organics
		Pesticides	
		Mutagenicity	
Project Code	Bacteriology		
	Remarks:		
Tag No. Lab Sample No.			
3-3023215			

Note: Equivalent sample labels or tags may be used.

Sample Custody

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recommended that the string be looped around the neck of the bottle, then twisted and re-looped around the neck until the slack in the string is removed.

4. Double-check that the information recorded on the sample tag is consistent with the information recorded on the chain-of-custody record.

5.3 Custody Seals

Two custody seals must be placed on opposite corners of all shipping containers (e.g., cooler) prior to shipment. The seals should be signed and dated by the shipper.

Custody seals may also be placed on individual sample bottles. Check with the client or refer to EPA regional guidelines for direction.

5.4 Sample Shipping

The CDM standard operating procedure listed below defines the requirements for packaging and shipping environmental samples.

- CDM Federal SOP 2-1, Packaging and Shipping Environmental Samples

6.0 Restrictions/Limitations

Check with the EPA region or client for specific guidelines. If no specific guidelines are identified, this procedure should be followed.

For EPA Contract Laboratory Program (CLP) sampling events, combined chain-of-custody/traffic report forms or other EPA-specific records may be used. Refer to regional guidelines for completing these forms.

The EPA FORMS II Lite™ software may be used to customize sample labels and custody records when directed by the client or the CDM project manager.

7.0 References

U.S. Environmental Protection Agency, *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/600/R-98/018, February 1998, Section B3.

U.S. Environmental Protection Agency, *National Enforcement Investigations Center, Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p.85.

U.S. Environmental Protection Agency, *Contract Laboratory Program (CLP), Guidance for Field Samplers*, EPA-540-R-00-003, Draft Final, June 2001, Section 3.2.

U.S. Environmental Protection Agency, *FORMS II Lite™ User's Guide*, March 2001.

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, May 1996, Section 3.3.

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plan*, EM 200-1-3, February 2001, Appendix F.

Field Measurement of Organic Vapors

SOP 1-10
Revision: 3
Date: March 1, 2004
Page 1 of 3

Prepared: Tammy Phillips

Technical Review: Peggy Bloisa

QA Review: Rich Opem

Approved: Michael C. Mally 2/24/04
Signature Date

Issued: [Signature] 2/10/04
Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to define the techniques and the requirements for the measurement of organic vapors in the field.

2.0 Background

2.1 Definitions

Flame Ionization Detector - A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the flame ionization of organic vapors.

Photoionization Detector - A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the photoionization of organic vapors.

2.2 Discussion

The measurement of organic vapors is a required step during numerous field activities. The primary purpose of such measurements is health and safety monitoring to determine if the breathing zone in a work area is acceptable or if personal protective equipment such as a respirator or a supplied air device is necessary for field personnel. In addition to health and safety monitoring, organic vapor measurement is also used in conjunction with sampling activities, including subsurface soil sampling and groundwater sampling, where measurements are useful for establishing approximate contaminant levels or ranges.

The two types of instruments most commonly used to measure organic vapors are photoionization detectors (PIDs) and flame ionization detectors (FIDs). Both instruments first ionize the gaseous compound and then measure the response, which is proportional to the concentration. The PID ionizes the gas using an ultraviolet lamp. The photons emitted by the ultraviolet lamp are absorbed by the gas molecules, producing a positively charged ion and an electron. The ionization potential (in electron volts) of the organic compounds to be measured must be less than the energy carried by the photons; therefore, the ionization potential of the known or suspected compounds should be checked against the energy of the ultraviolet lamp to verify that the energy provided by the lamp is greater. Additionally, manufacturer's manuals should be consulted to obtain the appropriate correction factors for known or suspected contaminants. The FID ionizes the gas by burning in a hydrogen/air flame. The FID allows measurement of a wide variety of compounds but in general its sensitivity is not as high as the PID.

2.3 Associated Procedures

- CDM Federal SOP 1-4, Subsurface Soil Sampling
- CDM Federal SOP 1-5, Groundwater Sampling Using Bailers
- CDM Federal SOP 1-6, Water Level Measurement
- CDM Federal SOP 3-1, Geoprobe Soil Sampling Survey
- CDM Federal SOP 3-5, Lithologic Logging
- CDM Federal SOP 4-3, Well Development and Purging

3.0 Responsibilities

Site Manager - The site manager is responsible for ensuring that field activities are conducted in accordance with the procedure and any other SOPs pertaining to the specific activity.

Field Team Leader - The field team leader is responsible for ensuring that field personnel conduct field activities in accordance with this and other relevant procedures.

4.0 Required Equipment

- Site-specific plans
- Field logbook
- Waterproof black ink pen
- Personal protective clothing and equipment
- Photoionization detector or flame ionization detector
- 0.5 liter (16-ounce) or "Mason" type glass jar
- Hydrogen Canister (if using FID for a period of more than 1 day)

5.0 Procedures

5.1 Direct Reading Measurement

1. Connect the measurement probe to the instrument and make necessary operational checks (e.g., battery check, etc.) as outlined in the manufacturer's manual.
2. Calibrate the instrument following the applicable manufacturer's manual
3. Make sure the instrument is reading zero and all function and range switches are set appropriately.
4. Insert the end of the probe directly into the atmosphere to be measured (e.g., breathing zone, monitoring well casing, split spoon, etc.) and read the organic vapor concentration in parts per million (ppm) from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.
5. Immediately document the reading in the field logbook or on the appropriate field form.

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5.2 Headspace Measurement

1. Connect the measurement probe to the instrument and make necessary operational checks (e.g., battery check, etc.) as outlined in the manufacturer's manual.
2. Calibrate the instrument following the appropriate manufacturer's manual.
3. Make sure the instrument is reading zero and all function and range switches are set appropriately.
4. Fill a clean glass jar approximately half-full of the sample to be measured. Quickly cover the top of the jar with one or two sheets of clean aluminum foil and apply cap to seal the jar.
5. Allow headspace to develop for approximately 10 minutes. It is generally preferable to shake the sealed jar for 10 to 15 seconds at the beginning and end of headspace development. **Note:** When the ambient temperature is below 0°C (32°F), the headspace development and subsequent measurement should occur within a heated vehicle or building.
6. Remove the jar cap and quickly puncture the foil and insert the instrument probe to a point approximately one-half of the headspace depth.
7. Read the organic vapor concentration in ppm from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.
8. Immediately record the reading in the field logbook or on the appropriate field form.

6.0 Restrictions/Limitations

The two methods outlined above are the most commonly used for field measurement of organic vapors but do not apply to all circumstances. Consult project- or program-specific procedures and guidelines for deviations. Both the PID and FID provide quantitative measurement of organic vapors, but generally neither instrument is compound-specific. The typical reading range of the PID is 0 to 2,000 ppm, and the typical reading range of the FID is 0 to 1,000 ppm. The FID will measure methane while the PID will not. **Note:** The presence of methane will cause erratic PID measurements. In methane rich environments, toxic organic vapors should be monitored with an FID. If desired, a charcoal filter can be placed temporarily on the FID inlet probe, which will trap all organic vapors except methane. The filtered (methane only) reading can be subtracted from unfiltered (total organic vapors) to provide an estimate of non-methane organic vapors. The reading accuracy of both instruments can be affected by ambient temperature, barometric pressure, humidity, lithology, etc.

7.0 References

Martin Marietta Energy Systems, Inc., *Environmental Surveillance Procedures Quality Control Program*, ESH/Sub/87-21706/1, 1988.

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QA Review: Douglas J. Updike Approved: Michael C. Mally 2/24/04

Issued: [Signature] 2/18/04
Signature/Date

Signature/Date

1.0 Packaging and Shipping of All Samples

This standard operating procedure (SOP) applies to the packaging and shipping of all environmental samples. If the sample is preserved or radioactive, the following sections may also be applicable.

- Section 2.0 - Packaging and Shipping Samples Preserved with Methanol
- Section 3.0 - Packaging and Shipping Samples Preserved with Sodium Hydroxide
- Section 4.0 - Packaging and Shipping Samples Preserved with Hydrochloric Acid
- Section 5.0 - Packaging and Shipping Samples Preserved with Nitric Acid
- Section 6.0 - Packaging and Shipping Samples Preserved with Sulfuric Acid
- Section 7.0 - Packaging and Shipping Limited-Quantity Radioactive Samples

1.1 Objective

The objective of this SOP is to outline the requirements for the packaging and shipment of environmental samples. Additionally, Sections 2.0 through 7.0 outline requirements for the packaging and shipping of regulated environmental samples under the Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations for shipment by air and applies only to domestic shipments. This SOP does not cover the requirements for packaging and shipment of equipment (including data loggers and self-contained breathing apparatus [SCBAs] or bulk chemicals that are regulated under the DOT, IATA, and ICAO.

1.2 Background

1.2.1 Definitions

Environmental Sample - An aliquot of air, water, plant material, sediment, or soil that represents the contaminant levels on a site. Samples of potential contaminant sources, like tanks, lagoons, or non-aqueous phase liquids are normally not "environmental" for this purpose. This procedure applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Custody Seal - A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/or the container (i.e., cooler) before offsite shipment. Custody seals are used to demonstrate that sample integrity has not been compromised during transportation from the field to the analytical laboratory.

Inside Container - The container, normally made of glass or plastic, that actually contacts the shipped material. Its purpose is to keep the sample from mixing with the ambient environment.

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Outside Container – The container, normally made of metal or plastic, that the transporter contacts. Its purpose is to protect the inside container.

Secondary Containment – The outside container provides secondary containment if the inside container breaks (i.e., plastic overpackaging if liquid sample is collected in glass).

Excepted Quantity – Excepted quantities are limits to the mass or volume of a hazardous material in the inside and outside containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Limited Quantity – Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance Testing – Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper – A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

1.2.2 Discussion

Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both CDM and the individual employee at risk of serious fines. The analytical holding times for the samples must not be exceeded. The samples should be packed in time to be shipped for overnight delivery. Make arrangements with the laboratory before sending samples for weekend delivery.

1.2.3 Associated Procedure

- CDM Federal SOP 1-2, Sample Custody

1.3 Required Equipment

- Coolers with return address of the appropriate CDM office
- Heavy-duty plastic garbage bags
- Plastic zip-type bags, small and large
- Clear tape
- Nylon reinforced strapping tape
- Duct tape
- Vermiculite (or an equivalent nonflammable material that is inert and absorbent)*
- Bubble wrap (optional)
- Ice
- Custody seals
- Completed chain-of-custody record or contract laboratory program (CLP) custody records, if applicable
- Completed bill of lading
- "This End Up" and directional arrow labels

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- * Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

1.4 Packaging Environmental Samples

The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager should be observed.
2. Select a sturdy cooler in good repair. Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler. Line the cooler with a large heavy-duty plastic garbage bag.
3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly (SOP 1-2, Sample Custody).
4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, or separating them so that they do not contact each other, will reduce the risk of breakage. Bottles may be wrapped in bubble wrap. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite or equivalent. Note: Trip blanks must be included in coolers containing VOA samples.
5. Place 2 to 4 inches of vermiculite (or equivalent) into a cooler that has been lined with a garbage bag, and then place the bottles and cans in the bag with sufficient space to allow for the addition of packing material between the bottles and cans. It is preferable to place glass sample bottles and jars into the cooler vertically. Glass containers are less likely to break when packed vertically rather than horizontally.
6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record. The chain-of-custody with the cooler should reflect only those samples within the cooler.
7. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° Celsius (C) if the analytical method requires cooling. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.
8. Place the completed chain-of-custody record or the CLP traffic report form (if applicable) for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid and close the cooler.

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9. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times. Attach a completed chain-of-custody seal across the opening of the cooler on opposite sides. The custody seals should be affixed to the cooler with half of the seal on the strapping tape so that the cooler cannot be opened without breaking the seal. Complete two more wraps around with fiber tape and place clear tape over the custody seals.
10. The shipping container lid must be marked "THIS END UP" and arrow labels that indicate the proper upward position of the container should be affixed to the cooler. A label containing the name and address of the shipper (CDM) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the lid of the shipping container.

2.0 Packaging and Shipping Samples Preserved with Methanol

2.1 Containers

- The maximum volume of methanol in a sample container is limited to 30 ml.
- The sample container must not be full of methanol.

2.2 Responsibility

It is the responsibility of the qualified shipper to:

- Ensure that the samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

2.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packing may consist of glass or plastic jars
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 3 flammable liquid labels
- Orientation labels
- Consignor/consignee labels

2.4 Packaging Samples Preserved with Methanol

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.

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- At a minimum the label must contain:
 - Project name
 - Project number
 - Date and time of sample collection
 - Sample location
 - Sample identification number
 - Collector's initials
 - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of methanol per shipping container must not exceed 500 ml.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Methanol Mixture
UN1230
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Flammable Liquid label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

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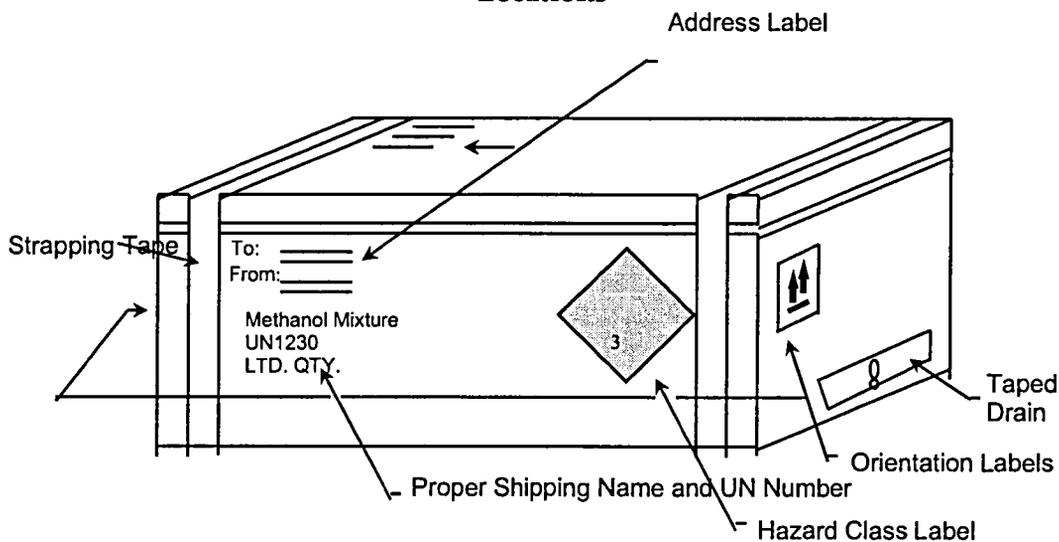
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Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

Figure 1 - Example of Cooler Label/Marking Locations



3.0 Packaging and Shipping Samples Preserved with Sodium Hydroxide

3.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sodium Hydroxide Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
				40 ml	125 ml	250 ml	500 ml	1 L
NaOH	30%	pH >12	Conc. 0.08%		.25	0.5	1	2

5 drops = 1 ml

3.2 Responsibility

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

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3.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Inner packings may consist of glass or plastic jars no larger than 1 pint
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

3.4 Packaging Samples Preserved with Sodium Hydroxide

Samples containing NaOH as a preservative that exceed the excepted concentration of 0.08 percent (2 ml of a 30 percent NaOH solution per liter) may be shipped as a limited quantity per packing instruction Y819 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
 - Project name
 - Project number
 - Date and time of sample collection
 - Sample location
 - Sample identification number
 - Collector's initials
 - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- The total volume of sample in each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.

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- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sodium Hydroxide Solution
UN1824
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples meeting the exception concentration of 0.08 percent NaOH by weight may be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

4.0 Packaging and Shipping Samples Preserved with Hydrochloric Acid

4.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

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Excepted Quantities of Hydrochloric Acid Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container		
		pH	Conc.	40 ml	125 ml	250 ml
HCl	2N	<1.96	0.04%	.2	.5	1

5 drops = 1 ml

4.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

4.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packing may consist of glass or plastic jars no larger than 1 pint.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

4.4 Packaging Samples Preserved with Hydrochloric Acid

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
 - Project name
 - Project number
 - Date and time of sample collection
 - Sample location
 - Sample identification number
 - Collector's initials
 - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (No more than 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)

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- Total volume of sample inside each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Hydrochloric Acid Solution
UN1789
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples containing less than the exception concentration of 0.04 percent HCl by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.

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- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

5.0 Packaging and Shipping Samples Preserved with Nitric Acid

5.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Nitric Acid Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
HNO ₃	6N	<1.62	0.15%		2	4	5	8

5 drops = 1 ml

5.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

5.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

5.4 Packaging Samples Preserved with Nitric Acid

Samples containing HNO₃ as a preservative that exceed the excepted concentration of 0.15 percent HNO₃ will be shipped as a limited quantity per packing instruction Y807 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
 - Project name

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- Project number
- Date and time of sample collection
- Sample location
- Sample identification number
- Collector's initials
- Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Nitric Acid Solution (with less than 20 percent)
UN2031
Ltd. Qty.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

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Note: Samples meeting the exception concentration of 0.15 percent HNO₃ by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

6.0 Packaging and Shipping Samples Preserved with Sulfuric Acid

6.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sulfuric Acid Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
H ₂ SO ₄	37N	<1.15	0.35%	.1	.25	0.5	1	2

5 drops = 1 ml

6.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

6.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

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6.4 Packaging of Samples Preserved with Sulfuric Acid

Samples containing H_2SO_4 as a preservative that exceed the excepted concentration of 0.35 percent will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
 - Project name
 - Project number
 - Date and time of sample collection
 - Sample location
 - Sample identification number
 - Collector's initials
 - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each glass container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sulfuric Acid Solution
UN2796
LTD. QTY.

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- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples containing less than the exception concentration of 0.35 percent H₂SO₄ by weight will be shipped as non-regulated or non-hazardous in accordance with the procedure described in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

7.0 Packaging and Shipping Limited-Quantity Radioactive Samples

7.1 Containers

The inner packaging containers that may be used for these shipments include:

- Any size sample container

7.2 Description/Responsibilities

- The qualified shipper will determine that the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT.
- The qualified shipper will ship all samples that meet the Class 7 definition of radioactive materials and meet the activity requirements specified in Table 7 of 49 CFR 173.425, as Radioactive Materials in Limited Quantity. The qualified shipper will verify that all packages and their contents meet the requirements of 49 CFR 173.421, *Limited Quantities of Radioactive Materials*.
- The packaging used for shipping will meet the general requirements for packaging and packages specified in 49 CFR 173.24 and the general design requirements provided in 173.410. These standards state that a package must be capable of withstanding the effects of any acceleration, vibration, or vibration resonance that may arise under normal condition of transport without any deterioration in the effectiveness of the closing devices on the various

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receptacles or in the integrity of the package as a whole and without loosening or unintentionally releasing the nuts, bolts, or other securing devices even after repeated use.

- If the shipment is from a DOE facility, radiological screenings will be completed on all samples taken. The qualified shipper will review the results of each screening (alpha, beta, and gamma speciation). Samples will not be shipped offsite until the radiological screening has been performed.
- The total activity for each package will not exceed the relevant limits listed in Table 7 of 49 CFR 173.425. The A_2 value of the material will be calculated based on all radionuclides found during previous investigations (if any) in the area from which the samples are derived. The A_2 values to be used will be the most restrictive of all potential radionuclides as listed in 49 CFR 173.435.
- The radiation level at any point on the external surface of the package bearing the sample(s) will not exceed 0.005 mSv/hour (0.5 mrem/hour). These will be verified by dose and activity monitoring prior to shipment of the package.
- The removable radioactive surface contamination on the external surface of the package will not exceed the limits specified in 49 CFR 173.443(a). CDM will apply the DOE-established free release criteria for removable surface contamination of less than 20 dpm/100 cm² (alpha) and 1,000 dpm/100 cm² (beta/gamma). It should be noted that these values are more conservative than the DOT requirements for removable surface contamination.
- The qualified shipper will verify that the outside of the inner packaging is marked "Radioactive."
- The qualified shipper will verify that the excepted packages prepared for shipment under the provisions of 49 CFR 173.421 have a notice enclosed, or shown on the outside of the package, that reads, "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."

7.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Survey documentation/radiation screening results (if shipping from DOE or radiological sites)
- Orientation labels
- Excepted quantities label
- Consignor/consignee labels

7.4 Packaging of Limited-Quantity Radioactive Samples

The following steps are to be followed when packaging limited-quantity sample shipments.

- The cooler is to be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
 - Project name
 - Project number

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- Date and time of sample collection
- Sample location
- Sample identification number
- Collector's initials
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place sufficient amount of vermiculite, or approved packaging material, in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- If required, place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tying or taping.
- Place a label marked Radioactive on the outside of the sealed bag.
- Enclose a notice that includes the name of the consignor or consignee and the following statement: "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."
- Note that both DOT and IATA apply different limits to the quantity in the inside packing and in the outside packing.
- The maximum weight of the package shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- If a cooler is used, wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix package orientation labels on two opposite sides of the cooler/package.
- Affix a completed Excepted Quantities label to the side of the cooler/package.
- Secure any marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of the cooler labeling/marketing is shown in Figure 2.

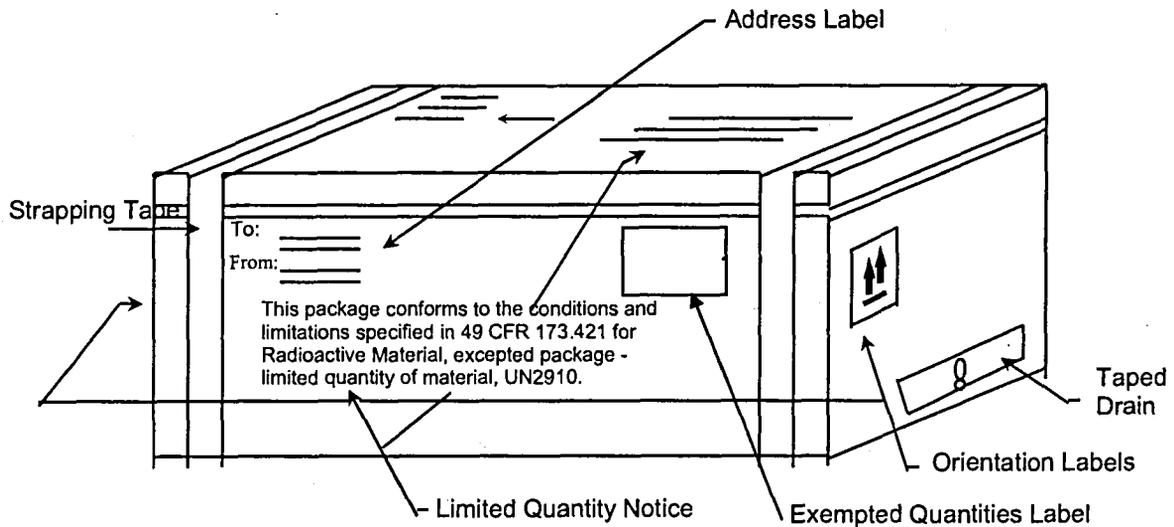
Note: No marking or labeling can be obscured by strapping or duct tape.

- Complete the Shipment Quality Assurance Checklist (Appendix B).

Note: Except as provided in 49 CFR 173.426, the package will not contain more than 15 grams of ²³⁵U.

Note: A declaration of dangerous goods is not required.

Figure 2 - Radioactive Material – Limited-Quantity Cooler Marking Example



8.0 References

U.S. Environmental Protection Agency, *Sampler's Guide to the Contract Laboratory Program*, EPA/540/P-90/006, December 1990.

U.S. Environmental Protection Agency, Region IV, *Standard Operating Procedures and Quality Assurance Manual*, February 1991.

U.S. Environmental Protection Agency Rule, 40 CFR 136.

**Appendix A
Dangerous Goods and Hazardous Materials Inspection Checklist
for Shipping Limited-Quantity**

Sample Packaging

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The VOA vials are wrapped in bubble wrap and placed inside a zip-type bag.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The VOA vials are placed into a polyethylene bottle, filled with vermiculite, and tightly sealed.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The drain plug is taped inside and outside to ensure control of interior contents.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The samples have been placed inside garbage bags with sufficient bags of ice to preserve samples at 4°C.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The cooler weighs less than the 66-pound limit for limited-quantity shipment.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The garbage bag has been sealed with tape (or tied) to prevent movement during shipment.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The chain-of-custody has been secured to the interior of the cooler lid.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The cooler lid and sides have been taped to ensure a seal.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The custody seals have been placed on both the front and back hinges of the cooler, using waterproof tape.

Air Waybill Completion

Yes	No	N/A	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Section 1 has the shipper's name, company, and address; the account number, date, internal billing reference number; and the telephone number where the shipper can be reached.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Section 2 has the recipient's name and company along with a telephone number where they can be reached.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Section 3 has the Bill Sender box checked.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Section 4 has the Standard Overnight box checked.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Section 5 has the Deliver Weekday box checked.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Section 6 has the number of packages and their weights filled out. Was the total of all packages and their weights figured up and added at the bottom of Section 6?
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Under the Transport Details box, the Cargo Aircraft Only box is obliterated, leaving only the Passenger and Cargo Aircraft box.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Under the Shipment Type , the Radioactive box is obliterated, leaving only the Non-Radioactive box.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Under the Nature and Quantity of Dangerous Goods box, the Proper Shipping Name, Class or Division, UN or ID No., Packing Group, Subsidiary Risk, Quantity and Type of Packing, Packing Instructions, and Authorization have been filled out for the type of chemical being sent.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The Name, Place and Date, Signature, and Emergency Telephone Number appears at the bottom of the FedEx Airbill.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The statement "In accordance with IATA/ICAO" appears in the Additional Handling Information box.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The Emergency Contact Information at the bottom of the FedEx Airbill is truly someone who can respond any time of the day or night.

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<i>Proper Shipping Name</i>	<i>Class or Division</i>	<i>UN or ID No.</i>	<i>Packing Group</i>	<i>Sub Risk</i>	<i>Quantity</i>	<i>Packing Instruction</i>	<i>Authorization</i>
Hydrochloric Acid Solution	8	UN1789	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Nitric Acid Solution (with less than 20%)	8	UN2031	II		1 plastic box × 0.5 L	Y807	Ltd. Qty.
Sodium Hydroxide Solution	8	UN1824	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Sulfuric Acid Solution	8	UN2796	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Methanol	3	UN1230	II		1 plastic box × 1 L	Y305	Ltd. Qty.

Sample Cooler Labeling

Yes No N/A

- The proper shipping name, UN number, and Ltd. Qty. appears on the shipping container.
- The corresponding hazard labels are affixed on the shipping container; the labels are not obscured by tape.
- The name and address of the shipper and receiver appear on the top and side of the shipping container.
- The air waybill is attached to the top of the shipping container.
- Up Arrows** have been attached to opposite sides of the shipping container.
- Packaging tape does not obscure markings or labeling.

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**Appendix B
Shipment Quality Assurance Checklist**

Date: _____ Shipper: _____ Destination: _____

Item(s) Description: _____

Radionuclide(s): _____

Radiological Survey Results: surface _____ mrem/hr 1 meter _____

Instrument Used: Mfgr: _____ Model: _____

S/N: _____ Cal Date: _____

Limited-Quantity or Instrument and Article

- | Yes | No | |
|-----|-----|--|
| ___ | ___ | 1. Strong tight package (package that will not leak material during conditions normally incidental to transportation). |
| ___ | ___ | 2. Radiation levels at any point on the external surface of package less than or equal to 0.5 mrem/hr. |
| ___ | ___ | 3. Removable surface contamination less than 20 dpm/100 cm ² (alpha) and 1,000 dpm/100 cm ² (beta/gamma). |
| ___ | ___ | 4. Outside inner package bears the marking "Radioactive." |
| ___ | ___ | 5. Package contains less than 15 grams of ²³⁵ U (check yes if ²³⁵ U not present). |
| ___ | ___ | 6. Notice enclosed in or on the package that includes the consignor or consignee and the statement, "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910." |
| ___ | ___ | 7. Activity less than that specified in 49 CFR 173.425. Permissible package limit:
Package Quantity: |
| ___ | ___ | 8. On all air shipments, the statement Radioactive Material, excepted package-limited quantity of material shall be noted on the air waybill. |

Qualified Shipper: _____ Signature: _____

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Prepared: Tim Eggert

Technical Review: Sharon Budney

QA Review: Jeniffer Oxford

Approved: Michael C. Mally 2/24/04

Issued: [Signature] 2/18/04
Signature/Date

Signature/Date

1.0 Objective

This standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW). The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed prior to field activities
- Remove wastes that pose an immediate threat to human health or the environment
- Proper handling of onsite wastes that do not require offsite disposal or extended above-ground containerization
- Complying with federal, state, and facility applicable or relevant and appropriate requirements (ARARs)
- Careful planning and coordination of IDW management options
- Minimizing the quantity of IDW

2.0 Background

2.1 Definitions

Hazardous Waste - Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes (IDWs) - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, liquid, or gaseous, or multiphase materials that may be classified as hazardous or non-hazardous.

Mixed-Waste - Any material that has been classified as hazardous and radioactive.

Radioactive Wastes - Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/or disposal. These facilities must be permitted by the U.S. Environmental Protection Agency (EPA) and appropriate state agencies.

2.2 Discussion

Field investigation activities result in the generation of waste materials that may be characterized as hazardous or radioactive waste. IDWs may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues from testing of treatment technologies and pump and treat systems; personal protective equipment (PPE); solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and

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equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material.

Note: The client's representatives may not be aware of all potential contaminants. The management of IDW must comply with applicable regulatory requirements.

3.0 Responsibilities

Site Manager - The site manager is responsible for ensuring that all IDW procedures are conducted in accordance with this SOP. The site manager is also responsible for ensuring that handling of IDW is in accordance with site-specific requirements.

Project Manager - The project manager is responsible for identifying site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements.

Field Crew Members - Field crew members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the project manager's attention.

4.0 Required Equipment

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required should consider: containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be onsite and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (drums, tanks, etc.) will depend on site- or client-specific requirements and the ultimate disposition of the IDW. Typical IDW containment devices can include:

- Plastic sheeting (polyethylene) with a minimum thickness of 20 millimeters
- Department of Transportation (DOT) approved steel containers
- Bulk storage tanks comprised of polyethylene or steel

Containment of IDW should be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device should be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking should be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported offsite are:

- Labels and markings that contain the following information: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents (drill cuttings, purge water, PPE, etc.).
- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.
- Containers that are 5 gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents.

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- Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the drum color.
- Labels will be secured in a manner to ensure the label remains affixed to the container.

Labeling or marking requirements for IDW expected to be transported offsite must be in accordance with the requirements of 49 CFR 172.

4.3 IDW Container Movement

Staging areas for IDW containers should be predetermined and in accordance with site-specific and/or client requirements. Arrangements should be made prior to field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation offsite onto a public roadway is prohibited unless 49 CFR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW should be staged pending chemical analysis or further onsite treatment. Staging areas and bulk storage procedures are to be determined according to site-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided as appropriate.

5.0 Procedures

The three general options for managing IDW are (1) collection and onsite disposal, (2) collection for offsite disposal, and (3) collection and interim management. Attachment 1 summarizes media-specific information on generation processes and management options. The option selected should take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW onsite
- Compliance with regulatory requirements
- IDW minimization and consistency with the IDW remedy and the site remedy

In all cases the client should approve the plans for IDW. Formal plans for the management of IDW must be prepared as part of a work plan or separate document.

5.1 Onsite Disposal

5.1.1 Soil/Sludge/Sediment

The options for handling soil/sludge/sediment IDW are as follows:

1. Return to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).
2. Spread around boring, pit, or source within the area of contamination (AOC) as long as returning the media to these areas will not increase site risks (e.g., direct contact with surficial contamination).

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3. Consolidate in a pit within the AOC as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).
4. Send to onsite TSDF - may require analytical analysis prior to treatment/disposal.

Note: These options may require client and/or regulatory approval.

5.1.2 Aqueous Liquids

The options for handling aqueous liquid IDW are as follows:

1. Discharge to surface water, only when IDW is not contaminated.
2. Discharge to ground surface close to the well, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background upgradient wells is not a community concern or associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.
3. Discharge to sanitary sewer.
4. Send to onsite TSDF - may require analysis prior to treatment/disposal.

Note: These options may require analytical results to obtain client and/or regulatory approval.

5.1.3 Disposable PPE

The options for handling disposable PPE are as follows:

1. Double-bag contents in non-transparent trash bags and place in onsite industrial dumpster, only if PPE is not contaminated.
2. Containerize, label, and send to onsite TSDF - may require analysis prior to treatment/disposal.

5.2 Offsite Disposal

Before sending to an offsite TSDF, analysis may be required. Also, manifests are required. Arrangements must be made with the client responsible for the site; it is CDM's policy not to sign manifests. The TSDF and transporter must be permitted for the respective wastes.

5.2.1 Soil/Sludge/Sediment

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., drummed, covered in a waste pile) or returned to its source until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.2 Aqueous Liquids

When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., mobile tanks or drums) until final disposal. The management option selected should take into account the

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potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.3 Disposable PPE

When the final site remedy requires offsite treatment disposal, the IDW may be containerized and stored. The management option selected should take into account potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.3 Interim Measures

All interim measures must be approved by the client and regulatory agencies.

1. Storing IDW onsite until the final action may be practical in the following situations:
 - A. Returning wastes (especially sludges and soils) to their onsite source area would require re-excavation for disposal in the final remediation alternative.
 - B. Interim storage in containers may be necessary to provide adequate protection to human health and the environment.
 - C. Offsite disposal options may trigger land disposal regulations under the Resource Conservation and Recovery Act (RCRA). Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.
 - D. Interim storage may be necessary to provide time for sampling and analysis.
2. Segregate and containerize all waste for future treatment and/or disposal.
 - A. Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.
 - B. Containment options for aqueous liquids may include mobile tanks or drums.
 - C. Containment options for PPE may include drums or roll-off boxes.

6.0 Restrictions/Limitations

Site Managers Should Determine the Most Appropriate Disposal Option for Aqueous Liquids on a Site-Specific Basis. Parameters to consider, especially when determining the level of protection, include the volume of IDW, the contaminants present in the groundwater, the presence of contaminants in the soil at the site, whether the groundwater or surface water is a drinking water supply, and whether the groundwater plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components.

Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. **Under No Circumstances Should These Types of Materials Be Brought Back to the Office or Warehouse.**

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7.0 References

Environmental Resource Center. 1992. *Hazardous Waste Management Compliance Handbook*, Van Nostrand Reinhold.

Institute of Hazardous Materials Management. 1992. *Handbook on Hazardous Materials Management*, 4th Ed.

U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

U. S. Environmental Protection Agency. August 1990. *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees*, EPA/530-SW-90-057.

U. S. Environmental Protection Agency. May 1991. *Management of Investigation-Derived Wastes During Site Inspections*, EPA/540/G-91/009.

U. S. Environmental Protection Agency. January 1992. *Guide to Management of Investigation-Derived Wastes*, 9345.3-03FS.

U. S. Environmental Protection Agency, Region IV. May 1996 and 1997. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, revisions.

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**Attachment 1
IDW Management Options**

<i>Type of IDW</i>	<i>Generation Processes</i>	<i>Management Options</i>
Soil	<ul style="list-style-type: none"> ■ Well/Test pit installations ■ Borehole drilling ■ Soil sampling 	<p>Onsite Disposal</p> <ul style="list-style-type: none"> ■ Return to boring, pit, or source immediately after generation ■ Spread around boring, pit, or source within the AOC ■ Consolidate in a pit (within the AOC) ■ Send to onsite TSDF <p>Offsite Disposal</p> <ul style="list-style-type: none"> ■ Client to send to offsite TSDF <p>Interim Management</p> <ul style="list-style-type: none"> ■ Store for future treatment and/or disposal
Sludge/Sediment	<ul style="list-style-type: none"> ■ Sludge pit/sediment sampling 	<p>Onsite Disposal</p> <ul style="list-style-type: none"> ■ Return to boring, pit, or source immediately after generation ■ Send to onsite TSDF <p>Offsite Disposal</p> <ul style="list-style-type: none"> ■ Client to send to offsite TSDF <p>Interim Management</p> <ul style="list-style-type: none"> ■ Store for future treatment and/or disposal
Aqueous Liquids (groundwater, surface water, drilling fluids, wastewaters)	<ul style="list-style-type: none"> ■ Well installation/development ■ Well purging during sampling ■ Groundwater discharge during pump tests ■ Surface water sampling ■ Wastewater sampling 	<p>Onsite Disposal</p> <ul style="list-style-type: none"> ■ Pour onto ground close to well (nonhazardous waste) ■ Discharge to sewer ■ Send to onsite TSDF <p>Offsite Disposal</p> <ul style="list-style-type: none"> ■ Client to send to offsite commercial treatment unit ■ Client to send to publicly owned treatment works (POTW) <p>Interim Management</p> <ul style="list-style-type: none"> ■ Store for future treatment and/or disposal
Decontamination Fluids	<ul style="list-style-type: none"> ■ Decontamination of PPE and equipment 	<p>Onsite Disposal</p> <ul style="list-style-type: none"> ■ Send to onsite TSDF ■ Evaporate (for small amounts of low contamination organic fluids) ■ Discharge to ground surface <p>Offsite Disposal</p> <ul style="list-style-type: none"> ■ Client to send to offsite TSDF ■ Discharge to sewer <p>Interim Management</p> <ul style="list-style-type: none"> ■ Store for future treatment and/or disposal
Disposable PPE and Sampling Equipment	<ul style="list-style-type: none"> ■ Sampling procedures or other onsite activities 	<p>Onsite Disposal</p> <ul style="list-style-type: none"> ■ Place in onsite industrial dumpster ■ Send to onsite TSDF <p>Offsite Disposal</p> <ul style="list-style-type: none"> ■ Client to send to offsite TSDF <p>Interim Management</p> <ul style="list-style-type: none"> ■ Store for future treatment and/or disposal

Adapted from U.S. Environmental Protection Agency, Guide to Management of Investigation-Derived Wastes, 9345-03FS, January 1992.

Field Logbook Content and Control

SOP 4-1

Revision: 5

Date: March 1, 2004

Page 1 of 4

Prepared: Del Baird

Technical Review: Sharon Budney

QA Review: Douglas J. Updike

Approved: Michael C. Mally 2/24/04
Signature/Date

Issued: [Signature] 2/10/04
Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to set CDM Federal (CDM) criteria for content entry and form of field logbooks. Field logbooks are an essential tool to document field activities for historical and legal purposes.

2.0 Background

2.1 Definitions

Biota - The flora and fauna of a region.

Magnetic Declination Corrections - Compass adjustments to correct for the angle between magnetic north and geographical meridians.

2.2 Discussion

Information recorded in field logbooks includes field team names, observations, data, calculations, date/time, weather, and description of the data collection activity, methods, instruments, and results. Additionally, the logbook may contain deviations from plans and descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

3.0 Responsibilities

Field Team Leader (FTL) - The FTL is responsible for ensuring that the format and content of data entries are in accordance with this procedure.

Site Personnel - All CDM employees who make entries in field logbooks during onsite activities are required to read this procedure prior to engaging in this activity. The FTL will assign field logbooks to site personnel who will be responsible for their care and maintenance. Site personnel will return field logbooks to the records file at the end of the assignment.

4.0 Required Equipment

- Site-specific plans
- Field notebook
- Indelible black or blue ink pen
- Ruler or similar scale

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5.0 Procedures

5.1 Preparation

In addition to this SOP, site personnel responsible for maintaining logbooks must be familiar with all procedures applicable to the field activity being performed. These procedures should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation. These procedures should be located at the field office.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. Prior to use in the field, each logbook will be marked with a specific document control number issued by the document control administrator, if required by the contract quality implementation plan (QIP). Not all contracts require document control numbers. The following information shall be recorded on the cover of the logbook:

- Field logbook document control number.
- Activity (if the logbook is to be activity-specific) and location.
- Name of CDM contact and phone number(s).
- Start date.
- In specific cases, special logbooks may be required (e.g., waterproof paper for stormwater monitoring).

The first few (approximately five) pages of the logbook will be reserved for a table of contents (TOC). Mark the first page with the heading and enter the following:

Table of Contents

Date/Description	Page
(Start Date)/Reserved for TOC	1-5

The remaining pages of the table of contents will be designated as such with "TOC" written on the top center of each page.

5.2 Operation

Requirements that must be followed when using a logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by an activity-specific plan, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Indicate any deletion by a single line through the material to be deleted. Initial and date each deletion. Take care to not obliterate what was written previously.
- Do not remove any pages from the book.

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Specific requirements for field logbook entries include:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- Multiple authors must sign out the logbook by inserting the following:
Above notes authored by:
 - (Sign name)
 - (Print name)
 - (Date)
- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
 - Date and time
 - Name of individual making entry
 - Names of field team and other persons onsite
 - Description of activity being conducted including station or location (i.e., well, boring, sampling location number) if appropriate
 - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data
 - Level of personal protection to be used
 - Serial numbers of instruments
 - Required calibration information
 - Serial/tracking numbers on documentation (e.g., carrier air bills)

Entries into the field logbook shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In these cases, the logbook must reference the automatic data record or form.

At each station where a sample is collected or an observation or measurement made, a detailed description of the location of the station is required. Use a compass (include a reference to magnetic declination corrections), scale, or nearby survey markers, as appropriate. A sketch of station location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator. It is preferred that maps and sketches be oriented so that north is toward the top of the page. Maps, sketches, figures, or data that will not fit on a logbook page should be referenced and attached to the logbook to prevent separation.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personal protection equipment.

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5.3 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, completed pages shall be periodically photocopied (weekly, at a minimum) and forwarded to the field or project office. Other field records shall be photocopied and submitted regularly and as promptly as possible to the office. When possible, electronic media such as disks and tapes should be copied and forwarded to the project office.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook shall be submitted to the records file.

6.0 Restrictions/Limitations

Field logbooks constitute the official record of onsite technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by CDM personnel and their subcontractors. They are documents that may be used in court to indicate dates, personnel, procedures, and techniques employed during site activities. Entries made in these logbooks should be factual, clear, precise, and non-subjective. Field logbooks, and entries within, are not to be used for personal use.

7.0 References

Sandia National Laboratories, *Procedure for Preparing Sampling and Analysis Plan, Site-Specific Sampling Plan, and Field Operating Procedures*, QA-02-03, Albuquerque Environmental Program Department 3220, Albuquerque, New Mexico, 1991.

Sandia National Laboratories, Division 7723, *Field Operation Procedure for Field Logbook Content and Control*, Environmental Restoration Department, Albuquerque, New Mexico, 1992.

Photographic Documentation of Field Activities

SOP 4-2
Revision: 6
Date: March 1, 2004
Page 1 of 6

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1.0 Objective

The purpose of this standard operating procedure (SOP) is to provide standard guidelines and methods for photographic documentation, which include still and digital photography and videotape recordings of field activities and site features (geologic formations, core sections, lithologic samples, water samples, general site layout, etc.). This document shall provide guidelines designed for use by a professional or amateur photographer. This SOP is intended for circumstances when formal photographic documentation is required. Based on project requirements, it may not be applicable for all photographic activities.

2.0 Background

2.1 Definitions

Photographer - A photographer is the camera operator (professional or amateur) of still photography, including digital photography, or videotape recording whose primary function with regard to this SOP is to produce documentary or data-oriented visual media.

Identifier Component - Identifier components are visual components used within a photograph such as visual slates, reference markers, and pointers.

Standard Reference Marker - A standard reference marker is a reference marker that is used to indicate a feature size in the photograph and is a standard length of measure, such as a ruler, meter stick, etc. In limited instances, if a ruled marker is not available or its use is not feasible, it can be a common object of known size placed within the visual field and used for scale.

Slates - Slates are blank white index cards or paper used to present information pertaining to the subject/procedure being photographed. Letters and numbers on the slate will be bold and written with black, indelible marking pens.

Arrows and Pointers - Arrows and pointers are markers/pointers used to indicate and/or draw attention to a special feature within the photograph.

Contrasting Backgrounds - Contrasting backgrounds are backdrops used to lay soil samples, cores, or other objects on for clearer viewing and to delineate features.

Data Recording Camera Back - A data recording camera back is a camera attachment or built-in feature that will record, at the very least, frame numbers and dates directly on the film.

2.2 Discussion

Photographs and videotape recordings made during field investigations are used as an aid in documenting and describing site features, sample collection activities, equipment used, and possible

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lithologic interpretation. This SOP is designed to illustrate the format and desired placement of identifier components, such as visual slates, standard reference markers, and pointers. These items shall become an integral part of the "visual media" that, for the purpose of this document, shall encompass still photographs, digital photographs, and videotape recordings (or video footage). The use of a photographic logbook and standardized entry procedures are also outlined. These procedures and guidelines will minimize potential ambiguities that may arise when viewing the visual media and ensure the representative nature of the photographic documentation.

2.3 Associated Procedures

- CDM Federal SOP 4-1, Field Logbook Content and Control

3.0 Responsibilities

Field Team Leader (FTL) – The FTL is responsible for ensuring that the format and content of photographic documentation are in accordance with this procedure. The FTL is responsible for directing the photographer to specific situations, site features, or operations that the photographer will be responsible for documenting.

Photographer – The photographer shall seek direction from the FTL and regularly discuss the visual documentation requirements and schedule. The photographer is responsible for maintaining a logbook per Sections 5.1, 5.2.4, and 5.3.1 of this SOP.

4.0 Required Equipment

The following is a general list of equipment that may be used:

- 35mm camera or disposable single use camera (35mm or panoramic use)
- Digital camera
- Extra batteries for 35mm camera
- Video camera
- Logbook
- Indelible black or blue ink pen
- Standard reference markers
- Slates
- Arrows or pointers
- Contrasting backgrounds
- Medium speed, or multi purpose fine-grain, color, 35 mm negative film or slide film (project dependent)
- Data recording camera back (if available)
- Storage medium for digital camera

5.0 Procedures

5.1 Documentation

A commercially available, bound logbook will be used to log and document photographic activities. Review the CDM Federal SOP 4-1, Field Logbook Content and Control and prepare all supplies needed for logbook entries.

Note: A separate photographic logbook is not required. A portion of the field logbook may be designated as the photographic log and documentation section.

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5.1.1 Field - Health and Safety Considerations

There are no hazards that an individual will be exposed to specific to photographic documentation. However, site-specific hazards may arise depending on location or operation. Personal protective equipment used in this operation will be site-specific and dictated through requirements set by the site safety officer, site health and safety plan, and/or prescribed by the CDM Federal Corporate Health and Safety Program. The photographer should contact the site safety officer for health and safety orientation prior to commencing field activities. The site health and safety plan must be read prior to entry to the site, and all individuals must sign the appropriate acknowledgement that this has been done.

The photographer should be aware of any potential physical hazards while photographing the subject (e.g., traffic, low overhead hazard, edge of excavation).

5.2 Operation

5.2.1 General Photographic Activities in the Field

The following sections provide general guidelines that should be followed to visually document field activities and site features using still/digital cameras and video equipment. Listed below are general suggestions that the photographer should consider when performing activities under this SOP:

- The photographer should be prepared to make a variety of shots, from close-up to wide-angle. Many shots will be repetitive in nature or format especially close-up site feature photographs. Consideration should therefore be given to designing a system or technique that will provide a reliable repetition of performance.
- All still film photographs should be made using a medium speed, or multi purpose fine-grain, color negative film in the 35 mm format unless otherwise directed by the FTL.
- It is suggested that Kodak brand "Ektapress Gold Deluxe" film or equivalent be used as the standard film for the still photography requirements of the field activities. This film is stable at room temperature after exposure and will better survive the time lag between exposure and processing. It is suggested that film speed ASA 100 should be used for outdoor photographs in bright sunlight, ASA 200 film should be used in cloudy conditions, and ASA 400 film should be used indoors or for very low-light outdoor photographs.
- No preference of videotape brand or digital storage medium is specified and is left to the discretion of the photographer.
- The lighting for sample and feature photography should be oriented toward a flat condition with little or no shadow. If the ambient lighting conditions are inadequate, the photographer should be prepared to augment the light (perhaps with reflectors or electronic flash) to maintain the desired visual effect.
- Digital cameras have multiple photographic quality settings. A camera that obtains a higher resolution (quality) has a higher number of pixels and will store a fewer number of photographs per digital storage medium.

5.2.2 General Guidelines for Still Photography

Slate Information

When directed by the FTL, each new roll of film or digital storage medium shall contain on the first usable frame (for film) a slate with consecutively assigned control numbers (a consecutive, unique number that is assigned by the photographer as in sample numbers).

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Caption Information

All still photographs will have a full caption permanently attached to the back or permanently attached to a photo log sheet. The caption should contain the following information (digital photographs should have a caption added after the photographs are downloaded):

- Film roll control number (if required) and photograph sequence number
- Date and time
- Description of activity/item shown (e.g., name of facility/site, specific project name, project no.)
- Direction (if applicable)
- Photographer

When directed by the FTL, a standard reference marker should be used in all documentary visual media. While the standard reference marker will be predominantly used in close-up feature documentation, inclusion in all scenes should be considered.

Digital media should be downloaded at least once each day.

Close-Up and Feature Photography

When directed by the FTL, close-up photographs should include a standard reference marker of appropriate size as an indication of the feature size and contain a slate marked with the site name and any identifying label, such as a well number or core depth, that clearly communicates to the viewer the specific feature being photographed.

Feature samples, core pieces, and other lithologic media should be photographed as soon as possible after they have been removed from their in situ locations. This enables a more accurate record of their initial condition and color. When directed by the FTL, include a standard reference color strip (color chart such as Munsell Soil Color Chart or that available from Eastman Kodak Co.) within the scene. This is to be included for the benefit of the viewer of the photographic document and serves as a reference aid to the viewer for formal lithologic observations and interpretations.

Site Photography

Site photography, in general, will consist predominantly of medium and wide-angle shots. A standard reference marker should be placed adjacent to the feature or, when this is not possible, within the same focal plane.

While it is encouraged that a standard reference marker and caption/slate be included in the scene, it is understood that situations will arise that preclude their inclusion within the scene. This will be especially true of wide-angle shots. In such a case, the film/tape control number shall be entered in the photographic logbook along with the frame number and all other information pertinent to the scene.

Panoramic

In situations where a wide-angle lens does not provide sufficient subject detail, a single-use disposable panoramic camera is recommended. If this type of camera is not available, a panoramic series of two or three photos would be appropriate. Panoramas can provide greater detail while covering a wide subject, such as an overall shot of a site.

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To shoot a panoramic series using a standard 35 mm or digital camera, the following procedure is recommended.

- Use a stable surface or tripod to support the camera
- Allow a 20 to 30 percent overlap while maintaining a uniform horizon
- Complete two to three photos per series

5.2.3 General Photographic Documentation Using Video Cameras

As a reminder, it is not within the scope of this document to set appropriate guidelines for presentation or "show" videotape recording. The following guidelines are set for documentary videotape recordings only and should be implemented at the discretion of the FTL.

Documentary videotape recordings of field activities may include an audio slate for all scenes. At the beginning of each video session, an announcer will recite the following information: date, time (in military units), photographer, site ID number, and site location. This oral account may include any additional information clarifying the subject matter being recorded.

A standard reference marker may be used when taking close-up shots of site features with a video camera. The scene may also include a caption/slate. It should be placed adjacent and parallel to the feature being photographed.

It is recommended that a standard reference marker and caption/slate be included in all scenes. The caption information is vital to the value of the documentary visual media and should be included. If it is not included within the scene, it should be placed before the scene.

Original videotape recordings will not be edited. This will maintain the integrity of the information contained on the videotape. If editing is desired, a working copy of the original videotape recording can be made.

A label should be placed on the videotape with the appropriate identifying information (i.e., project name, project number, date, location, etc.).

5.2.4 Photographic Documentation

Photographic activities must be documented in a photographic logbook or in a section of the field logbook. The photographer will be responsible for making proper entries.

In addition to following the technical standards for logbook entry as referenced in CDM Federal SOP 4-1, the following information should be maintained in the appropriate logbook:

- Photographer name.
- If required, an entry shall be made for each new roll/tape control number assigned.
- Sequential tracking number for each photograph taken (for digital cameras, the camera-generated number may be used).
- Date and time (military time).
- Location.
- A description of the activity/item photographed.

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- If needed, a description of the general setup, including approximate distance between the camera and the subject, may be recorded in the logbook.
- Record as much other information as possible to assist in the identification of the photographic document.

5.3 Post Operation

All film will be sent for development and printing to a photographic laboratory (to be determined by the photographer). The photographer will be responsible for arranging transport of the film from the field to the photographic laboratory. The photographer shall also be responsible for arranging delivery of the negatives and photographs, digital storage medium, or videotape to the project management representative.

5.3.1 Documentation

At the end of each day's photographic session, the photographer(s) will ensure that the appropriate logbook has been completely filled out and maintained as outlined in CDM Federal SOP 4-1.

5.3.2 Archive Procedures

1. Photographs and the associated set of uncut negatives, digital media, and original unedited documentary videotape recordings will be submitted to the project files and handled according to contract records requirements. The FTL will ensure their proper distribution.
2. Completed pages of the appropriate logbook will be copied weekly and submitted to the project files.

6.0 Restrictions/Limitations

This document is designed to provide a set of guidelines for the field amateur or professional photographer to ensure that an effective and standardized program of visual documentation is maintained.

It is not within the scope of this document to provide instruction in photographic procedures, nor is it within the scope of this document to set guidelines for presentation or "show" photography.

The procedures outlined herein are general by nature. The FTL is responsible for specific operational activity or procedure. Questions concerning specific procedures or requirements should be directed to the FTL.

Note: Some sites do not permit photographic documentation. Check with the site contact for any restrictions.

7.0 References

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3, February 2001, Appendix F.

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Athens, Georgia, November 2001.

U.S. Environmental Protection Agency, National Enforcement Investigations Center, *Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p. 85.

Field Equipment Decontamination at Nonradioactive Sites

SOP 4-5
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Date: December 31, 2004

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Technical Review: Tim Turner

QA Review: Doug Updike

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Issued: [Signature] 12/22/04
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1.0 Objective

The objective of this standard operating procedure (SOP) is to describe the general procedures required for decontamination of field equipment at nonradioactive sites. This SOP serves as a guide and is applicable at most sites; however, it should be noted that site-specific conditions (i.e., type of contamination, type of media sampled) and the governing agency (i.e., EPA, DOE, USACE) may require modifications to the decontamination procedures provided in this SOP.

2.0 Background

2.1 Definitions

Acid Rinse - A solution of 10 percent nitric or hydrochloric acid made from reagent grade acid and analyte-free water.

Analyte-Free Water - Tap water that has been treated so that the water contains no detectable heavy metals or other inorganic compounds. Analyte-free water should be stored only in clean glass, stainless steel, or plastic containers that can be closed when not in use.

Clean - Free of visible contamination and when decontamination has been completed in accordance with this SOP.

Cross Contamination - The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or noncontaminated samples or areas.

Decontamination - The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross contamination of samples or exposure of personnel.

Organic-Free/Analyte-Free Water - Tap water that has been treated so that the water meets the analyte-free water criteria and contains no detectable organic compounds. Organic-free/analyte-free water should be stored only in clean glass, Teflon™, or stainless steel containers that can be closed when not in use.

Potable Water - Tap water may be obtained from any municipal system. Chemical analysis of the water source may be required before it is used.

Soap - Low-sudsing, nonphosphate detergent such as Liquinox™.

Solvent Rinse - Pesticide grade, or better, isopropanol, acetone, or methanol.

2.2 Discussion

Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants offsite.

3.0 Responsibilities

Field Team Leader - The field team leader (FTL) ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this procedure. The FTL may also be required to collect and document rinsate samples to provide quantitative verification that these procedures have been correctly implemented.

4.0 Required Equipment

- Stiff-bristle scrub brushes
- Plastic buckets and troughs
- Soap
- Nalgene or Teflon sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting
- Disposable wipes, rags, or paper towels
- Potable water*
- Analyte-free water
- Organic-free/analyte-free water
- Gloves, safety glasses, and other protective clothing as specified in the site-specific health and safety plan
- High-pressure pump with soap dispenser or steam-spray unit (for large equipment only)
- Appropriate decontamination solutions pesticide grade or better and traceable to a source (e.g., 10 percent and/or 1 percent nitric acid [HNO₃], acetone, methanol, isopropanol, hexane)
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums or tanks (as required)
- Pallets for drums or tanks holding decontamination water (as required)

* Potable water may be required to be tested for contaminants before use. Check field plan for requirements.

5.0 Procedures

All reusable equipment (nondedicated) used to collect, handle, or measure samples will be decontaminated before coming into contact with any sample. Decontamination of equipment will occur either at a central decontamination station or at portable decontamination stations set up at the sampling location, drill site, or monitoring well location. The centrally located decontamination station will include an appropriately sized bermed and lined area on which equipment decontamination will occur and shall be equipped with a collection system and storage vessels. In certain circumstances, berming is not required when small quantities of water are being generated and for some short duration field activities (i.e., pre-remedial sampling). Equipment should be transported to the decontamination station in a manner to prevent cross contamination of equipment and/or area. Precautions taken may include enclosing augers in plastic wrap while being transported on a flatbed truck.

The decontamination area will be constructed so that contaminated water is either collected directly into appropriate containers (5-gallon buckets or steel wash tubs) or within the berms of the decontamination area that then drains into a collection system. Water from the collection system will be transferred into 55-gallon drums or portable tanks for storage. Typically, decontamination water will be staged until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined. The exact procedure for decontamination waste disposal should be discussed in the field plan. Also, solvent and acid rinse fluids may need to be segregated from other investigation-derived wastes.

All items that will come into contact with potentially contaminated media will be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they will be covered either with clean plastic or aluminum foil depending on the size of the item. All decontamination procedures for the equipment being used are as follows:

General Guidelines

- Potable, analyte-free, and organic-free/analyte-free water should be free of all contaminants of concern. Following the field plan, analytical data from the water source may be required.

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- Sampling equipment that has come into contact with oil and grease will be cleaned with methanol or other approved alternative to remove the oily material. This may be followed by a hexane rinse and then another methanol rinse. Regulatory or client requirements regarding solvent use will be stated in the field plan.
- All solvents and acids will be pesticide grade or better and traceable to a source. The corresponding lot numbers will be recorded in the appropriate logbook. Solvents and acids are potentially hazardous materials and must be handled, stored, and transported accordingly. Solvents should never be used in a closed building. See the site-specific health and safety plan and/or the chemical's Material Safety Data Sheet (MSDS) for specific information regarding the safe use of the chemical.
- Decontaminated equipment will be allowed to air dry before being used.
- Documentation for all cleaning will be recorded in the appropriate logbook.
- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment will be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment includes drilling rigs and backhoes. Follow these steps when decontaminating this equipment:

- Establish a bermed decontamination area that is large enough to fully contain the equipment to be cleaned. If available, an existing wash pad or appropriate paved and bermed area may be used; otherwise, use one or more layers of heavy plastic sheeting to cover the ground surface and berms. All decontamination pads should be upwind of the area under investigation.
- With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated soils using a hot water high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage.
- Use brushes, soap, and potable water to remove dirt whenever necessary.
- Remove equipment from the decontamination pad and allow it to air dry before returning it to the work site.
- Record the equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal as detailed in the field plan. Liquids and solids must be drummed separately.

5.2 Downhole Equipment Decontamination

Downhole equipment includes hollow-stem augers, drill pipes, rods, stems, etc. Follow these steps when decontaminating this equipment:

- Set up a centralized decontamination area, if possible. This area should be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.
- Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air-drying. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed. All decontamination pads should be upwind of any areas under investigation.
- Place the object to be cleaned on aluminum foil or plastic-covered wooden sawhorses or other supports. The objects to be cleaned should be at least 2 feet above the ground to avoid splashback when decontaminating.

- Using soap and potable water in the hot water high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.
- If using soapy water, rinse the equipment using clean, potable water. If using hot water, the rinse step is not necessary if the hot water does not contain a detergent. If the hot water contains a detergent, this final clean water rinse is required.
- Using a suitable sprayer, rinse the equipment thoroughly with analyte-free water.
- Remove the equipment from the decontamination area and place in a clean area upwind to air dry.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 Sampling Equipment Decontamination

Sampling equipment is defined as equipment that comes into direct contact with the sample media. Such equipment includes split spoon samplers, well casing and screens, and spatulas or bowls used to homogenize samples. Follow these steps when decontaminating this equipment:

- Set up a decontamination line on plastic sheeting. The decontamination line should progress from "dirty" to "clean." A clean area shall be established upwind of the decontamination wash/rinse activities to dry the equipment. At a minimum, clean plastic sheeting must be used to cover the ground, table, or other surfaces that the decontaminated equipment is placed for drying.
- Disassemble any items that may trap contaminants internally. Do not reassemble the items until decontamination and air drying are complete.
- Wash the items with potable water and soap using a stiff brush as necessary to remove particulate matter and surface films. The items may be steam cleaned using soap and hot water as an alternative to brushing. Note that polyvinyl chloride or plastic items should not be steam cleaned. Items that have come into contact with concentrated and/or oily contaminants may need to be rinsed with a solvent such as hexane and allowed to air dry prior to this washing step.
- Thoroughly rinse the items with potable water.
- If sampling for metals, thoroughly rinse the items with an acid solution (e.g., 10 percent nitric acid) followed by a rinse using analyte-free water. If sampling for organic compounds, thoroughly rinse the items with solvent (e.g., isopropanol) followed by a rinse using analyte-free water. The specific chemicals used for the acid rinse and solvent rinse phases should be specified in the work plan. The acid rinsate and solvent rinsate must each be containerized separately. Acids and solvents are potentially hazardous materials and care must be exercised when using these chemicals to prevent adverse health affects (e.g., skin burns, irritation to the eyes and respiratory system, etc.). Appropriate personal protective equipment must be worn when using these chemicals. These chemicals (including spent rinsate) must be managed and stored appropriately. Special measures such as proper labels, paperwork, notification, etc. may be required when transporting or shipping these chemicals.
- Rinse the items thoroughly using organic-free/analyte-free water.
- Allow the items to air dry completely.

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- After drying, reassemble the parts as necessary and wrap the items in clean plastic wrap or in aluminum foil.
- Record equipment type, date, time, and method of decontamination in the appropriate logbook.
- After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable personal protective equipment. Place the contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately. Refer to site-specific plans for labeling and waste management requirements.

5.4 Pump Decontamination

Follow the manufacturer's recommendation for specified pump decontamination procedures. At a minimum, follow these steps when decontaminating pumps:

- Set up the decontamination area and separate "clean" storage area using plastic sheeting to cover the ground, tables, and other surfaces. Set up four containers: the first container shall contain dilute (nonfoaming) soapy water, the second container shall contain potable water, the third container shall be empty to receive wastewater, and the fourth container shall contain analyte-free water.
- The pump should be set up in the same configuration as for sampling. Submerge the pump intake (or the pump, if submersible) and all downhole-wetted parts (tubing, piping, foot valve) in the soapy water of the first container. Place the discharge outlet in the wastewater container above the level of the wastewater. Pump soapy water through the pump assembly until it discharges to the waste container. Scrub the outside of the pump and other wetted parts with a metal brush.
- Move the pump assembly to the potable water container while leaving discharge outlet in the waste container. All downhole-wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
- Move the pump intake to the analyte-free water container. Pump the water through the pump assembly. Pump the volume of water through the pump specified in the field plan. Usually, three pump-and-line-assembly volumes will be required.
- Decontaminate the discharge outlet by hand, following the steps outlined in Section 5.3.
- Remove the decontaminated pump assembly to the clean area and allow it to air dry upwind of the decontamination area. Intake and outlet orifices should be covered with aluminum foil to prevent the entry of airborne contaminants and particles.
- Record the equipment type, serial number, date, time, and method of decontamination in the appropriate logbook.

5.5 Instrument Probe Decontamination

Instrument probes used for field measurements such as pH meters, conductivity meters, etc. will be decontaminated between samples and after use with analyte-free, or better, water.

5.6 Waste Disposal

Refer to site-specific plans for waste disposal requirements. The following are guidelines for disposing of wastes:

- All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of as investigation-derived waste.
- Small quantities of decontamination solutions may be allowed to evaporate to dryness.

- If large quantities of used decontamination solutions will be generated, each type of waste should be contained in separate containers.
- Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste.
- Waste liquids should be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

6.0 Restrictions/Limitations

Nitric acid and polar solvent rinses are necessary only when sampling for metals or organics respectively. These steps should not be used, unless required, because of the potential for acid burns and ignitability hazards.

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow. Check with your EPA region, state, and client for approved decontamination solvents.

7.0 References

American Society for Testing and Materials. 2002. *Standard Practice for Decontamination of Field Equipment at Nonradioactive Waste Sites*, ASTM D5088-02. January 10.

Department of Energy. Hazardous Waste Remedial Actions Program. 1996. *Standard Operating Procedures for Site Characterization*, DOE/HWP-100/R1. September.

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U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

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Control of Measurement and Test Equipment

SOP 5-1

Revision: 7

Date: December 31, 2004

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Approved: Michael C. Mally 12/21/04

Issued: *George J. Smith* 12/24/04
Signature/Date

Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish the baseline requirements, procedures, and responsibilities inherent to the control and use of all measurement and test equipment (M&TE). Contractual obligations may require more specific or stringent requirements that must also be implemented.

2.0 Background

2.1 Definitions

Traceability - The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

2.2 Discussion

M&TE may be government furnished (GF), rented or leased from an outside vendor, or purchased. It is essential that measurements and tests resulting from the use of this equipment be of the highest accountability and integrity. To facilitate that, the equipment shall be used in full understanding and compliance with the instructions and specifications included in the manufacturer's operations and maintenance and calibration procedures and in accordance with any other related project-specific requirements.

2.3 Associated Procedures

- CDM Federal (CDM) Technical SOP 4-1
- CDM Quality Procedures (QPs) 2.1 and 2.3
- Manufacturer's operating and maintenance and calibration procedures

3.0 Responsibilities

All staff with responsibility for the direct control and/or use of M&TE are responsible for being knowledgeable of and understanding and implementing the requirements contained herein as well as any other related project-specific requirements.

The project manager (PM) or designee (equipment coordinator, quality assurance coordinator, field team leader, etc.) is responsible for initiating and tracking the requirements contained herein.

4.0 Required Equipment

- Determine and implement M&TE related project-specific requirements
- The maintenance and calibration procedures must be followed when using M&TE
- Obtain the maintenance and calibration procedures if they are missing or incomplete
- Attach or include the maintenance and calibration procedures with the M&TE
- Prepare and record maintenance and calibration in an Equipment Log or a Field Log as appropriate (Figure 1)
- Maintain M&TE records
- Label M&TE requiring routine or scheduled calibration (when required)
- Perform maintenance and calibration using the appropriate procedure and calibration standards
- Identify and take action on nonconforming M&TE

5.0 Procedures

5.1 Determine if Other Related Project-Specific Requirements Apply

For All M&TE:

The PM or designee shall determine if M&TE related project-specific requirements apply. If M&TE related project-specific requirements apply, obtain a copy of them and review and implement as appropriate.

5.2 Obtain the Operating and Maintenance and Calibration Documents

For GF M&TE that is to be procured:

Requisitioner - Specify that the maintenance and calibration procedures be included.

For GF M&TE that is acquired as a result of a property transfer:

Receiver - Inspect the M&TE to determine whether maintenance and calibration procedures are included with the item. If missing or incomplete, order the appropriate documentation from the manufacturer.

For M&TE that is to be rented or leased from an outside vendor:

Requisitioner - Specify that the maintenance and calibration procedures, the latest calibration record, and the calibration standards certification be included. If this information is not delivered with the M&TE, ask Procurement to request it from the vendor.

5.3 Prepare and Record Maintenance and Calibration Records

For all M&TE:

PM or Designee - Record all maintenance and calibration events in a Field Log unless other project-specific requirements apply.

For GF M&TE only (does not apply to rented or leased M&TE):

If an Equipment Log is a project specific requirement, perform the following:

Receiver - Notify the PM or designee for the overall property control of the equipment of the receipt of an item of M&TE.

PM or Designee - Prepare a sequentially page numbered Equipment Log for the item using the maintenance and calibration form (or equivalent) from the CDM *Property Control Manual* (Figure 1).

PM or Designee and User - Record all maintenance and calibration events in an Equipment Log.

5.4 Label M&TE Requiring Calibration

For GF M&TE only (does not apply to rented or leased M&TE):

If calibration labeling is a project specific requirement, perform the following:

PM or Designee - Read the maintenance and calibration procedures to determine the frequency of calibration required.

PM or Designee - If an M&TE item requires calibration before use, affix a label to the item stating "Calibrate Before Use."

PM or Designee - If an M&TE item requires calibration at other scheduled intervals, e.g., monthly, annually, etc., affix a label listing the date of the last calibration, the date the item is next due for a calibration, the initials of the person who performed the calibration, and a space for the initials of the person who will perform the next calibration.

5.5 Operating, Maintaining or Calibrating an M&TE Item

For all M&TE:

PM or Designee and User - Operate, maintain, and calibrate M&TE in accordance with the maintenance and calibration procedures. Record maintenance and calibration actions in the Equipment Log or Field Log.

Control of Measurement and Test Equipment

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Figure 1



A subsidiary of Camp Dresser & McKee Inc.

Maintenance and Calibration

Date: _____	Time: _____ (AM/PM)	Equipment Description: _____
Employee Name: _____		Equipment ID No.: _____
Contract/Project: _____		Equipment Serial No.: _____
Activity: _____		
Maintenance		
Maintenance Performed: _____ _____		
Comments: _____ _____		
Signature: _____	Date: _____	
Calibration/Field Check		
Calibration Standard: _____	Concentration of Standard: _____	
Lot No. of Calibration Standard: _____	Expiration Date of Calibration Standard: _____	
Pre-Calibration Reading: _____	Post-Calibration Reading: _____	
Additional Readings: _____	Additional Readings: _____	
Additional Readings: _____	Additional Readings: _____	
Pre-Field Check Reading: _____	Post-Field Check Reading: _____	
Adjustment(s): _____ _____		
Calibration: <input type="checkbox"/> Passed <input type="checkbox"/> Failed		
Comments: _____ _____		
Signature: _____	Date: _____	

5.6 Shipment

For GF M&TE:

Shipper - Inspect the item to ensure that the maintenance and calibration procedures are attached to the shipping case, or included, and that a copy of the most recent Equipment Log entry page (if required) is included with the shipment. If the maintenance and calibration procedures and/or the current Equipment Log page (if required) is missing or incomplete, do not ship the item. Immediately contact the PM or designee and request a replacement.

For M&TE that is rented or leased from an outside vendor:

Shipper - Inspect the item to ensure that the maintenance and calibration procedures and latest calibration and standards certification records are included prior to shipment. If any documentation is missing or incomplete, do not ship the item. Immediately contact Procurement and request that they obtain the documentation from the vendor.

5.7 Records Maintenance

For GF M&TE:

PM or Designee - Create a file upon the initial receipt of an item of M&TE or calibration standard. Organize the files by contract origin and by M&TE item and calibration standard. Store all files in a cabinet, file drawer, or other appropriate storage media at the pertinent warehouse or office location.

PM or Designee - Maintain all original documents in the equipment file except for the packing slip and Field Log.

Receiver - Forward the original packing slip to Procurement and a photocopy to the PM or designee.

PM or Designee - File the photocopy of the packing slip in the M&TE file.

PM or Designee and User - Record all maintenance and calibration in an Equipment Log or Field Log (as appropriate.) File the completed Equipment Logs in the M&TE records. Forward completed Field Logs to the PM for inclusion in the project files.

For M&TE rented or leased from an outside vendor:

Receiver - Forward the packing slip to Procurement.

User - Forward the completed Field Log to the PM for inclusion in the project files.

User - Retain the most current maintenance and calibration record and calibration standards certifications with the M&TE item and forward previous versions to the PM for inclusion in the project files.

5.8 Traceability of Calibration Standards

For all items of M&TE:

PM or Designee and User - When ordering calibration standards, request nationally recognized standards as specified or required. Request commercially available standards when not otherwise specified or required. Or, request standards in accordance with other related project-specific requirements.

PM or Designee and User - Require certifications for standards that clearly state the traceability.

PM or Designee and User - Note standards that are perishable and consume or dispose of them on or before the expiration date.

PM or Designee - Require Material Safety Data Sheet to be provided with standards.

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5.9 M&TE That Fails Calibration

For any M&TE item that cannot be calibrated or adjusted to perform accurately:

PM or Designee - Immediately discontinue use and segregate the item from other equipment. Notify the appropriate PM and take appropriate action in accordance with the CDM QP 2.3 for nonconforming items.

PM or Designee - Review the current and previous maintenance and calibration records to determine if the validity of current or previous measurement and test results could have been affected and notify the appropriate PM(s) of the results of the review.

6.0 Restrictions/Limitations

On an item-by-item basis, exemptions from the requirements of this SOP may be granted by the HDQ health and safety manager and/or HDQ quality assurance director. All exemptions shall be documented by the grantor and included in the equipment records as appropriate.

7.0 References

CDM Federal Programs Corporation *Property Control Manual*. 2002. March.

**STANDARD OPERATING PROCEDURE FOR
LOW-STRESS (Low Flow) / MINIMAL DRAWDOWN
GROUND-WATER SAMPLE COLLECTION**

INTRODUCTION

The collection of "representative" water samples from wells is neither straightforward nor easily accomplished. Ground-water sample collection can be a source of variability through differences in sample personnel and their individual sampling procedures, the equipment used, and ambient temporal variability in subsurface and environmental conditions. Many site inspections and remedial investigations require the sampling at ground-water monitoring wells within a defined criterion of data confidence or data quality, which necessitates that the personnel collecting the samples are trained and aware of proper sample-collection procedures.

The purpose of this standard operating procedure (SOP) is to provide a method which minimize the amount of impact the purging process has on the ground water chemistry during sample collection and to minimize the volume of water that is being purged and disposed. This will take place by placing the pump intake within the screen interval and by keeping the drawdown at a minimal level (0.33 feet) (Puls and Barcelona, 1996) until the water quality parameters have stabilized and sample collection is complete. The flow rate at which the pump will be operating will be depended upon both hydraulic conductivity of the aquifer and the drawdown with the goal of minimizing the drawdown. The flow rate from the pump during purging and sampling will be at a rate that will not compromise the integrity of the analyte that is being sampled. This sampling procedure may or may not provide a discrete ground water sample at the location of the pump intake. The flow of ground-water to the pump intake will be dependent on the distribution of the hydraulic conductivity (K) of the aquifer within the screen interval. In order to minimize the drawdown in the monitoring well a low-flow rate must be utilized. Low-flow refers to the velocity with which water enters the pump intake from the surrounding formation in the

immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface, which can be affected by flow regulators or restrictions (Puls and Barcelona, 1996). This SOP was developed by the Superfund/RCRA Ground Water Forum and draws from an USEPA's Ground Water Issue Paper, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedure, by Robert W. Puls and Michael J. Barcelona. Also, available USEPA Regional SOPs regarding Low-Stress (Low Flow) Purging and Sampling were used for this SOP.

SCOPE AND APPLICATION

This SOP should be used primarily at monitoring wells which have a screen or an open interval with a length of ten feet or less and can accept a sampling device which minimizes the disturbance to the aquifer or the water column in the well casing. The screen or open interval should have been optimally located to intercept an existing contaminant plume(s) or along flowpaths of potential contaminant releases. Knowledge of the contaminant distribution within the screen interval is highly recommended and is essential for the success of this sampling procedure. The ground-water samples which are collected using this procedure are acceptable for the analyses of ground-water contaminants which may be found at Superfund and RCRA contamination sites. The analytes may be volatile, semi-volatile organic compounds, pesticides, PCBs, metals and other inorganic compounds. The screened interval should be located within the contaminant plume(s) and the pump intake should be placed at or near the known source of the contamination within the screened interval. It is critical to place the pump intake in the exact location or depth for each sampling event. This argues for the use of dedicated, permanently installed sampling devices whenever possible. If this is not possible then the placement of the pump intake should be positioned with a calibrated sampling pump hose sounded with a weighted-tape or using a pre-measured hose. The pump intake should not be placed near the bottom of the screened interval to avoid disturbing any sediment that may have settled at the bottom of the well.

Water-quality indicator parameters and water levels must be measured during purging, prior to sample collection. Stabilization of the water quality parameters as well as

monitoring water levels are a prerequisite to sample collection. The water-quality indicator parameters which are recommended include the following: specific electrical conductance, dissolved oxygen, turbidity, oxidation-reduction potential, pH, and temperature. The latter two parameters are useful data, but are generally insensitive as purging parameters. Oxidation-reduction potential may not always be appropriate stabilization parameter, and will depend on site-specific conditions. However, readings should be recorded because of its value as a double check for oxidation conditions, and for fate and transport issues. Also, when samples are collected for metals, semi-volatile organic compounds, and pesticides every effort must be made to reduce turbidity to 10 NTUs or less (not just the stabilization of turbidity) prior to the collection of the water sample. In addition to the measurement of the above parameters, depth to water must be measured during purging (U.S. Environmental Protection Agency, 1995).

Proper well construction, development and maintenance are essential for any ground-water sampling procedure. Prior to conducting the field work, information on the construction of the well and well development should be obtained and that information factored into the site specific sampling procedure. The attached Sampling Checklist is an example of the type of information that is useful.

Stabilization of the water-quality indicator parameters is the criterion for sample collection. But if stabilization is not occurring and the procedure has been strictly followed, then sample collection can take place once three (minimum) to six (maximum) casing volumes have been removed (Schuller et al., 1981 and U.S. Environmental Protection Agency., 1986; Wilde et al., 1998; Gibs and Imbrigiotta., 1990). The specific information on what took place during purging must be recorded in the field notebook or in the ground-water sampling log.

This SOP is not to be used where non-aqueous phase liquids (immiscible fluids) are present in the monitoring well.

EQUIPMENT

- Depth-to-water measuring device - An electronic water-level indicator or steel tape and chalk, with marked intervals of

0.01 foot. Interface probe for determination of liquid products (NAPL) presence, if needed.

- Steel tape and weight - Used for measuring total depth of well. Lead weight should not be used.
- Sampling pump - Submersible or bladder pumps with adjustable rate controls are preferred. Pumps are to be constructed of inert materials, such as stainless steel and teflon®. Pump types that are acceptable include gear and helical driven, centrifugal (low-flow type) and air-activated piston. Adjustable rate, peristaltic pump can be used when the depth to water is 20 feet or less.
- Tubing - Teflon® or Teflon® lined polyethylene tubing is preferred when sampling for organic compounds. Polyethylene tubing can be used when sampling inorganics.
- Power Source - If a combustion type (gasoline or diesel-driven) generator is used, it must be placed downwind of the sampling area.
- Flow measurement supplies - flow meter, graduated cylinder and a stop watch.
- Multi-Parameter meter with flow-through-cell - This can be one instrument or more contained in a flow-through cell. The water-quality indicator parameters which must be monitored are pH, ORP/EH, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Turbidity readings must be collected before the flow cell because of the potential for sediment buildup which can bias the turbidity measurements. Calibration fluids for all instruments should be NIST-traceable and there should be enough for daily calibration through-out the sampling event. The inlet of the flow cell must be located near the bottom of the flow cell and the outlet near the top. The size of the flow cell should be kept to a minimum and a closed cell is preferred. The flow cell must not contain any air or gas bubbles when monitoring for the water-quality indicator parameters.
- Decontamination Supplies - Including a reliable and documented source of distilled water and any solvents (if used). Pressure sprayers, buckets or decontamination tubes for pumps, brushes and non-phosphate soap will also be needed.
- Sample bottles, sample preservation supplies, sample tags or labels and chain of custody forms.
- Approved Field Sampling and Quality Assurance Project Plan.
- Well construction data, field and water quality data from the previous sampling event.
- Well keys and map of well locations.

- Field notebook, ground-water sampling logs and calculator. A suggested field data sheet (ground-water sampling record or ground-water sampling log) are provided in the attachment.
- Filtration equipment, if needed. An in-line disposable filter is recommended.
- Polyethylene sheeting which will be placed on ground around the well head.
- Personal protective equipment specified in the site Health and Safety Plan.
- Air monitoring equipment as specified in the Site Health and Safety Plan.
- Tool box - All needed tools for all site equipment used.
- A 55-gallon drum or container to contain the purged water.

Materials of construction of the sampling equipment (bladders, pumps, tubing, and other equipment that comes in contact with the sample) should be limited to stainless steel, Teflon®, glass and other inert material. This will reduce the chance of the sampling materials to alter the ground-water where concentrations of the site contaminants are expected to be near the detection limits. The sample tubing diameter thickness should be maximized and the tubing length should be minimized so that the loss of contaminants into and through the tubing walls may be reduced and the rate of stabilization of ground-water parameters is maximized. The tendency of organics to sorb into and out of material makes the appropriate selection of sample tubing material critical for trace analyses (Pohlmann and Alduino, 1992; Parker and Ranney, 1998).

PURGING AND SAMPLING PROCEDURES

The following describes the purging and sampling procedures for the Low-Stress (Low Flow)/ Minimal Drawdown method for the collection of ground-water samples. These procedures also describe steps for dedicated and non-dedicated systems.

Pre-Sampling Activities (Non-dedicated and dedicated system)

1. Sampling locations must begin at the monitoring well with the least contamination, generally up-gradient or furthest from the site or suspected source. Then proceed systematically to the monitoring wells with the most contaminated ground water.

2. Check and record the condition of the monitoring well for damage or evidence of tampering. Lay out polyethylene sheeting around the well to minimize the likelihood of contamination of sampling/purging equipment from the soil. Place monitoring, purging and sampling equipment on the sheeting.
3. Unlock well head. Record location, time, date and appropriate information in a field logbook or on the ground-water sampling log (See attached ground-water sampling record and ground-water sampling log as examples).
4. Remove inner casing cap.
5. Monitor the headspace of the monitoring well at the rim of the casing for volatile organic compounds (VOC) with a Photo-ionization detector (PID) or Flame ionization detector (FID), and record in the logbook. If the existing monitoring well has a history of positive readings of the headspace, then the sampling must be conducted in accordance with the Health and Safety Plan.
6. Measure the depth to water (water level must be measured to nearest 0.01 feet) relative to a reference measuring point on the well casing with an electronic water level indicator or steel tape and record in logbook or ground-water sampling log. If no reference point is found, measure relative to the top of the inner casing, then mark that reference point and note that location in the field logbook. Record information on depth to ground water in the field logbook or ground water sampling log. Measure the depth to water a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.
7. Check the available well information or field information for the total depth of the monitoring well. Use the information from the depth of water in step six and the total depth of the monitoring well to calculate the volume of the water in the monitoring well or the volume of one casing. Record information in field logbook or ground-water sampling log.

Purging and Sampling Activities

8A. Non-dedicated system - Place the pump and support equipment at the wellhead and slowly lower the pump and tubing down into the monitoring well until the location of the pump intake is set

at a pre-determined location within the screen interval. The placement of the pump intake should be positioned with a calibrated sampling pump hose, sounded with a weighted-tape, or using a pre-measured hose. Refer to the available monitoring well information to determine the depth and length of the screen interval. Measure the depth of the pump intake while lowering the pump into location. Record pump location in field logbook or groundwater sampling log.

8B. Dedicated system - Pump has already been installed, refer to the available monitoring well information and record the depth of the pump intake in the field logbook or ground-water sampling log.

9. Non-dedicated system and dedicated system - Measure the water level (water level must be measured to nearest 0.01 feet) and record information on the ground-water sampling log, leave water level indicator probe in the monitoring well.

10. Non-dedicated and dedicated system - Connect the discharge line from the pump to a flow-through cell. A "T" connection is needed prior to the flow cell to allow for the collection of water for the turbidity measurements. The discharge line from the flow-through cell must be directed to a container to contain the purge water during the purging and sampling of the monitoring well.

11. Non-dedicated and dedicated system - Start pumping the well at a low flow rate (0.2 to 0.5 liter per minute) and slowly increase the speed. Check water level. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet (Puls and Barcelona, 1996). If drawdown is greater than 0.33 feet lower the flow rate. 0.33 feet is a goal to help guide with the flow rate adjustment. It should be noted that this goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience (Puls and Barcelona, 1996).

12. Non-dedicated and dedicated system - Measure the discharge rate of the pump with a graduated cylinder and a stop watch. Also, measure the water level and record both flow rate and water level on the groundwater sampling log. Continue purging, monitor and record water level and pump rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to

ensure minimal drawdown in the monitoring well.

13. Non-dedicated and dedicated system - During the purging, a minimum of one tubing volume (including the volume of water in the pump and flow cell) must be purged prior to recording the water-quality indicator parameters. Then monitor and record the water-quality indicator parameters every three to five minutes. The water-quality indicator field parameters are turbidity, dissolved oxygen, specific electrical conductance, pH, redox-potential and temperature. Oxidation-reduction potential may not always be an appropriate stabilization parameter, and will depend on site-specific conditions. However, readings should be recorded because of its value as a double check for oxidizing conditions. Also, for the final dissolved oxygen measurement, if the readings are less than 1 milligram per liter, it should be collected and analyze with the spectrophotometric method (Wilde et al., 1998 Wilkin et al., 2001), colorimetric or Winkler titration (Wilkin et al., 2001). The stabilization criterion is based on three successive readings of the water quality field parameters; the following are the criteria which must be used:

Parameter	Stabilization Criteria	Reference
pH	± 0.1 pH units	Puls and Barcelona, 1996; Wilde et al.,
Specific electrical conductance (SEC)	± 3% $\mu\text{S}/\text{cm}$	Puls and Barcelona, 1996
oxidation-reduction potential (ORP)	± 10 millivolts	Puls and Barcelona 1996
turbidity	± 10 % NTUs (when turbidity is greater than 10 NTUs)	Puls and Barcelona, 1996 Wilde et al., 1998
dissolved oxygen	± 0.3 milligrams per liter	Wilde et al., 1998

Once the criteria have been successfully met indicating that the water quality indicator parameters have stabilized, then sample collection can take place.

14. If a stabilized drawdown in the well can't be maintained at 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off (for 15 minutes) and allow for recovery. It should be noted whether or not the pump has a check valve. A check valve is required if the pump is shut off. Under no circumstances should the well be

pumped dry. Begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again turn pump off and allow for recovery. If two tubing volumes (including the volume of water in the pump and flow cell) have been removed during purging then sampling can proceed next time the pump is turned on. This information should be noted in the field notebook or ground-water sampling log with a recommendation for a different purging and sampling procedure.

15. Non-dedicated and dedicated system - Maintain the same pumping rate or reduce slightly for sampling (0.2 to 0.5 liter per minute) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump tubing prior to passing through the flow-through cell. Disconnect the pump's tubing from the flow-through-cell so that the samples are collected from the pump's discharge tubing. For samples collected for dissolved gases or Volatile Organic Compounds (VOCs) analyses, the pump's tubing needs to be completely full of ground water to prevent the ground water from being aerated as the ground water flows through the tubing. The sequence of the samples is immaterial unless filtered (dissolved) samples are collected and they must be collected last (Puls and Barcelona, 1996). All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container. When filling the VOC samples a meniscus must be formed over the mouth of the vial to eliminate the formation of air bubbles and head space prior to capping. In the event that the ground water is turbid, (greater than 10 NTUs), a filtered metal (dissolved) sample also should be collected.

If filtered metal sample is to be collected, then an in-line filter is fitted at the end of the discharge tubing and the sample is collected after the filter. The in-line filter must be pre-rinsed following manufacturer's recommendations and if there are no recommendations for rinsing, a minimum of 0.5 to 1 liter of ground water from the monitoring well must pass through the filter prior to sampling.

16A. Non-dedicated system - Remove the pump from the monitoring well. Decontaminate the pump and dispose of the tubing if it is non-dedicated.

16B Dedicated system - Disconnect the tubing that extends from the plate at the wellhead (or cap) and discard after use.

17. Non-dedicated system - Before locking the monitoring well, measure and record the well depth (to 0.1 feet). Measure the total depth a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.

18. Non-dedicated and dedicated system - Close and lock the well.

DECONTAMINATION PROCEDURES

Decontamination procedures for the water level meter and the water quality field parameter sensors.

The electronic water level indicator probe/steel tape and the water-quality field parameter sensors will be decontaminated by the following procedures:

1. The water level meter will be hand washed with phosphate free detergent and a scrubber, then thoroughly rinsed with distilled water.

2. Water quality field parameter sensors and flow-through cell will be rinsed with distilled water between sampling locations. No other decontamination procedures are necessary or recommended for these probes since they are sensitive. After the sampling event, the flow cell and sensors must be cleaned and maintained per the manufacturer's requirements.

Decontamination Procedure for the Sampling Pump

Upon completion of the ground water sample collection the sampling pump must be properly decontaminated between monitoring wells. The pump and discharge line including support cable and electrical wires which were in contact with the ground water in the well casing must be decontaminated by the following procedure:

1. The outside of the pump, tubing, support cable and electrical wires must be pressured sprayed with soapy water, tap water and distilled water. Spray outside of tubing and pump until water is flowing off of tubing after each rinse. Use bristle brush to help remove visible dirt and contaminants.

2. Place the sampling pump in a bucket or in a short PVC casing (4-in. diameter) with one end capped. The pump placed in this device must be completely submerged in the water. A small amount of phosphate free detergent must be added to the potable water

(tap water).

3. Remove the pump from the bucket or 4-in. casing and scrub the outside of the pump housing and cable.
4. Place pump and discharge line back in the 4-in. casing or bucket, start pump and re-circulate this soapy water for 2 minutes (wash).
5. Re-direct discharge line to a 55-gallon drum, continue to add 5 gallons of potable water (tap water) or until soapy water is no longer visible.
6. Turn pump off and place pump into a second bucket or 4-in. casing which contains tap water, continue to add 5-gallons of tap water (rinse).
7. Turn pump off and place pump into a third bucket or 4-in. casing which contains distilled/deionized water, continue to add three to five gallons of distilled/deionized water (final rinse).
8. If a hydrophobic contaminant is present (such as separate phase, high levels of PCB's, etc.) An additional decon step, or steps, may be added. For example, an organic solvent, such as reagent-grade isopropanol alcohol may be added as a first spraying/bucket prior to the soapy water rinse/bucket.

FIELD QUALITY CONTROL

Quality control (QC) samples must be collected to verify that sample collection and handling procedures were performed adequately and that they have not compromised the quality of the ground water samples. The appropriate EPA program guidance must be consulted in preparing the field QC sample requirements for the site-specific Quality Assurance Project Plan (QAPP).

There are five primary areas of concern for quality assurance (QA) in the collection of representative ground-water samples:

1. Obtaining a ground-water sample that is representative of the aquifer or zone of interest in the aquifer. Verification is based on the field log documenting that the field water-quality parameters stabilized during the purging of the well, prior to sample collection.
2. Ensuring that the purging and sampling devices are made of materials, and utilized in a manner, which will not interact with or alter the analyses.
3. Ensuring that results generated by these procedures are reproducible; therefore, the sampling scheme should incorporate co-located samples (duplicates).

4. Preventing cross-contamination. Sampling should proceed from least to most contaminated wells, if known. Field equipment blanks should be incorporated for all sampling and purging equipment, and decontamination of the equipment is therefore required.
5. Properly preserving, packaging, and shipping samples.

All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The chain of custody procedures for the QC samples will be identical to the field ground water samples. The following are quality control samples which must be collected during the sampling event:

<u>Sample Type</u>	<u>Frequency</u>
● Field duplicates	1 per 20 samples
● Matrix spike	1 per 20 samples
● Matrix spike duplicate	1 per 20 samples
● Equipment blank	Per Regional requirements or policy
● Trip blank (VOCs)	1 per sample cooler
● Temperature blank	1 per sample cooler

HEALTH AND SAFETY CONSIDERATIONS

Depending on the site-specific contaminants, various protective programs must be implemented prior to sampling the first well. The site Health and Safety Plan should be reviewed with specific emphasis placed on the protection program planned for the sampling tasks. Standard safe operating practices should be followed, such as minimizing contact with potential contaminants in both the liquid and vapor phase through the use of appropriate personal protective equipment.

Depending on the type of contaminants expected or determined in previous sampling efforts, the following safe work practices will be employed:

Particulate or metals contaminants

1. Avoid skin contact with, and incidental ingestion of, purge water.
2. Use protective gloves and splash protection.

Volatile organic contaminants

1. Avoid breathing constituents venting from well.
2. Pre-survey the well head space with an appropriate device as specified in the Site Health and Safety Plan.
3. If monitoring results indicate elevated organic constituents, sampling activities may be conducted in level C protection. At a minimum, skin protection will be afforded by disposable protective clothing, such as Tyvek®.

General, common practices should include avoiding skin contact with water from preserved sample bottles, as this water will have pH less than 2 or greater than 10. Also, when filling pre-acidified VOA bottles, hydrochloric acid fumes may be released and should not be inhaled.

POST-SAMPLING ACTIVITIES

Several activities need to be completed and documented once ground-water sampling has been completed. These activities include, but are not limited to:

1. Ensure that all field equipment has been decontaminated and returned to proper storage location. Once the individual field equipment has been decontaminated, tag it with date of cleaning, site name, and name of individual responsible.
2. All sample paperwork should be processed, including copies provided to the Regional Laboratory, Sample Management Office, or other appropriate sample handling and tracking facility.
3. All field data should be compiled for site records.
4. All analytical data when processed by the analytical laboratory, should be verified against field sheets to ensure all data has been returned to sampler.

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SAMPLING CHECKLIST

Well Identification: _____

Map of Site Included: Y or N

Wells Clearly Identified w/ Roads: Y or N

Well Construction Diagram Attached: Y or N

Well Construction:

Diameter of Borehole: _____ Diameter of Casing: _____

Casing Material: _____ Screen Material: _____

Screen Length: _____ Total Depth: _____

Approximate Depth to Water: _____

Maximum Well Development Pumping Rate: _____

Date of Last Well Development: _____

Previous Sampling Information:

Was the Well Sampled Previously: Y or N
(If Sampled, Fill Out Table Below)

Table of Previous Sampling Information				
Parameter	Previously Sampled	Number of Times Sampled	Maximum Concentration	Notes (include previous purge rates)

Ground-Water Sampling Log

Site Name:

Well #:

Date:

Well Depth(Ft-BTOC¹):

Screen Interval(Ft):

Well Dia.:

Casing Material:

Sampling Device:

Pump placement(Ft from TOC²):

Measuring Point:

Water level (static)(Ft):

Water level (pumping) (Ft):

Pump rate (Liter/min):

Sampling Personnel:

Other info: (such as sample numbers, weather conditions and field notes)

Water Quality Indicator Parameters

Time	Pumping rates (L/min)	Water level (ft)	DO (mg/l)	ORP (mv)	Turb. (NTU)	SEC ³ (μS/cm)	pH	Temp. (C°)	Volume pumped (L)

Type of Sample collected:

1-casing volume was:

Total volume purged prior to sample collection:

Stabilization Criteria

DO	±	0.3 mg/l
Turb.	±	10%
SEC	±	3%
ORP	±	10 mv
pH	±	0.1 unit

¹BTOC-Below Top of Casing

²TOC-Top of Casing

³Specific electrical conductance

Appendix D
Field Monitoring Form

