Final

Work Plan
Destruction of Inactive Monitoring Wells at Selected Sites
Former Marine Corps Air Station El Toro
Irvine, California

27 December 2007

Prepared for:

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108

Prepared by:

CDM Federal Programs Corporation
9444 Farnham Street, Suite 210
San Diego, California 92123

Under Subcontract with:

JONAS & ASSOCIATES INC.

Jonas & Associates Inc.
8 (a), HUBzone, WBE, DBE
1350 Arnold Drive, Suite 202
Martinez, California 94553

Prepared under:

Naval Facilities Engineering Command
Contract Number N68711-04-D-1110
Contract Task Order 0006
DCN: JNS.1110.0006.0145

Final

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Former Marine Corps Air Station El Toro

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Contract Number: N68711-04-D-1110
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Work Plan

Destruction of Inactive Monitoring Wells at Selected Sites

Former Marine Corps Air Station El Toro

Irvine, California

Contract No. N68711-04-D-1110
Delivery Order Number 0006
DCN: JNS.1110.0006.0145

Prepared by:

for Jason Golumbfskie
CDM Engineer

12/27/07
Date

Approved by:

Larry Davidson, P.E.
CDM Program Manager

12/27/07
Date

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December 27, 2007

Mr. Louie Cardinale
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108

Subject: Navy Contract No. N68711-04-D-1110, Delivery Order 006,
Final Work Plan for Destruction of Inactive Monitoring Wells at Former Marine Corps Air Stations (MCAS) El Toro, Orange County, California
DCN: JNS.1110.0006.0145

Dear Mr. Cardinale:

Enclosed for your distribution are four bound copies of the Final Work Plan for Destruction of Inactive Monitoring Wells at Former MCAS El Toro, Irvine, California. Five copies of the Work Plan have been distributed to the BCT and other interested parties under the Navy's cover letter; one additional copy has been sent to the El Toro library (c/o Marge Flesch). Two bound copies, one unbound copy (with original, "wet" signature pages), and three electronic copies of the Work Plan have been sent directly to Ms. Diane Silva for the Administrative Record.

If you have any questions, please call me at (925) 374-0020 or Randa Chichakli with CDM at (858) 268-3383.

Sincerely,

JONAS AND ASSOCIATES INC.

Romena Jonas
Program Manager

c: G. Tinker (NAVFAC Southwest)
D. Silva (NAVFAC Southwest)
R. Chichakli (CDM)
File

DRAFT
WORK PLAN ADDENDUM
DESTRUCTION OF INACTIVE MONITORING WELLS
AT SELECTED SITES

DATED 01 DECEMBER 2009

THIS RECORD IS ENTERED IN THE DATABASE AND FILED AS

RECORD NO. M60050_004701

FINAL
WORK PLAN ADDENDUM
DESTRUCTION OF INACTIVE MONITORING WELLS
AT SELECTED SITES

DATED 01 APRIL 2010

THIS RECORD IS ENTERED IN THE DATABASE AND FILED AS

RECORD NO. M60050_004794

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Acronyms and Abbreviations

BCT	BRAC Cleanup Team
BRAC	Base Realignment and Closure
CDM	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chain-of-custody
DOT	Department of Transportation
IRP	Installation Restoration Program
MCAS	Marine Corps Air Station
MSL	mean sea level
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
OCHCA-EH	Orange County Health Care Agency Environmental Health Division
P.G.	Professional Geologist
PM	Project Manager
PPE	personal protective equipment
QA	quality assurance
ROICC	resident officer in charge of construction
RPM	remedial project manager
SOP	standard operating procedure
SOW	scope of work
SHASP	Site Health and Safety Plan
STLC	soluble threshold limit concentration
TCLP	toxicity characteristic leaching procedure
TTLC	total threshold limits concentrations
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WET	whole effluent toxicity

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Distribution List

Work Plan Recipients	Title	Organization	Telephone	E-mail Address
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Section 1
Introduction

CDM Federal Programs Corporation (CDM) has prepared this Work Plan for well destruction activities that will be conducted at the Former Marine Corp Air Station (MCAS) El Toro, Irvine, California (Figure 1). Under the Naval Facilities Engineering Command (NAVFAC) Southwest, Contract Number N68711-04-D-1110, Delivery Order Number 0006. The work will be conducted in accordance with State of California requirements, California Water Well Standards, and applicable Orange County Health Care Agency Environmental Health Division (OCHCA-EH) requirements.

1.1 Project Objective

The objective of this project is to properly destroy inactive groundwater monitoring wells at the Former MCAS El Toro. CDM will perform up to four mobilizations to conduct the well decommissioning activities. Prior to each mobilization, a notification packet with well-specific information will be submitted to the applicable regulatory agencies and will include all necessary well lists, figures, boring logs, and tables listing well construction details and grout volume calculations.

1.2 Work Plan Organization

The Work Plan includes discussions of the site background, notification requirements, and inactive groundwater monitoring well destruction procedures. The Work Plan also describes waste management and disposal, data evaluation and reporting, and project management. Site Health and Safety Plan (SHASP) Standard Operating Procedures (SOPs), and well destruction requirements are included as appendices.

The Work Plan is organized as follows:

Section 1.0	Introduction
Section 2.0	Site Location and Background
Section 3.0	Notification Process
Section 4.0	Well Destruction Procedures
Section 5.0	Reporting
Section 6.0	Waste Management Procedures
Section 7.0	Project Management Plan
Section 8.0	References

The following appendices are included:

Appendix A	Site Health and Safety Plan
Appendix B	Standard Operating Procedures
Appendix C	OCHCA Well Destruction Requirements

Section 2
Site Background

2.1 Site Location and Description

Former MCAS El Toro is situated in a semi-urban agricultural area in south-central Orange County, California (Figure 1). The majority of the station is within an unincorporated area of Orange County; however, property within the south portion of the station 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 (CDM 2004).

The 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 that range in 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).

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 Base Realignment and Closure (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.

At its maximum acreage, Former MCAS El Toro comprised approximately 4,712 acres of property. Since base closure, approximately 3,792 acres have been transferred. 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 Federal Aviation Administration. 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.

Section 3
Notifications

Prior to the initiation of fieldwork, a list of wells (and a figure showing their location) being proposed for destruction will be provided to the Base Realignment and Closure (BRAC) Cleanup Team (BCT) members for comment and/or concurrence. Immediately following concurrence from the BCT, a well destruction notification packet will be forwarded to the OCHCA-EH for informational purposes (Figure 2). CDM will obtain and comply with all required information requests. Information will be submitted to Content Arnold, Navy Lead Remedial Project Manager (RPM), for review and submittal to OCHCA-EH.

These site activities are being performed under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) compliance programs for each site. Therefore, fees for well destruction are waived. CDM will complete the appropriate well destruction informational packet and provide it to the Navy for review and submittal to the OCHCA-EH for record-keeping purposes. Requirements by the OCHCA-EH that must be included with the information packet include copies of closure letters for the site or approved Corrective Action Plans showing the monitoring wells selected for destruction along with well construction diagrams. In addition, OCHCA-EH requires that the top 5 feet (or deeper if grading during property development will reduce the elevation of the current land surface) be over-drilled, with the well head, casing, and monument removed and the borehole concreted to match the existing grade. During well destruction activities, as needed, CDM will maintain coordination with the concerned agencies. CDM will also coordinate with the future landowner of the property where the wells are located to discuss future grading activities, proposed land use within these areas, and the impact of well destruction activities. The Navy will provide coordination

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Section 4
Well Destruction Procedures

A selected number of inactive groundwater monitoring wells, to be determined by the Navy, are to be destroyed. All of the monitoring wells will be decommissioned by pressure grouting in accordance with the standards set by the California Department of Water Resources Bulletin 74-90 (1990), under the supervision of a Professional Geologist (P.G.). Decommissioning activities will also follow the guidelines specified by OCHCA-EH for well destruction (see Appendix C) using the pressure-grouting method described briefly below (OCHCA-EH 2007).

Prior to closure, each well will be opened and gauged with a sounding probe to measure depth to water and to check for debris or obstructions that might interfere with the grouting procedure. The total depth of each well will also be measured and recorded to calculate the minimum volume of grout needed to seal the well.

$$G = \pi r^2 \times d \times 1.2$$

G = minimum amount of grout to be pumped

d = total depth of the well

r = radius of well casing

A 1.2 multiplier is applied to the casing volume equation to ensure that there is sufficient grout to completely seal the well casing and penetrate the filter pack, preventing a conduit for contaminants. If the well construction log indicates that the well to be destroyed was not constructed with an annular seal, the submerged blank casing of the well will be perforated during destruction to ensure that a conduit for contaminants is not created.

At each location, the decommissioning process will be started by using a rig-mounted wireline hammer to punch a hole through the bottom of the well. A sealant material consisting of a high-plasticity bentonite grout will be mixed at the surface and prepared for use. The grout material used will be well mixed to insure that it will be of a size and consistency that will pass through the 0.01-inch well slots. The grout will be pumped into the well at 120 pounds per square inch to reduce the possibility of bridging and to force some of the sealant through the screen and into the surrounding pore spaces of the filter pack.

In the event that a well is found to be obstructed, damaged, bridged, or collapsed, the well will be over drilled to remove the well casing, screen, and filter pack. The borehole will then be filled with grout.

Monitoring well decommissioning procedures will include the demolition and removal of surface completions, traffic posts, bollards, concrete pads and well

monuments. The top 5 feet of casing will be drilled out using a hollow-stem auger. The borehole will be backfilled with native materials and then compacted to avoid subsidence. The top 1 foot of the borehole will be filled with concrete. The location will then be restored to match pre-existing site conditions.

Section 5
Reporting

Well destruction reports will be completed following each field event. A total of four well destruction reports will be prepared and will include, at a minimum, the following sections:

- Introduction;
- Site Location and Background;
- Well Destruction Activities; and
- References.

A table will be included listing survey coordinates of each well, borehole diameters, total well depths, screened intervals, casing volumes, estimated grout volumes at 120 percent of each casing volume, and actual grout volumes used to decommission each well. Appropriate detailed figures will be included showing site and well locations. Appendices will include the well destruction information provided to OCHCA-EH and boring logs of each well, if available.

Each report will be provided to the Navy as a draft report. After the report is reviewed it will be finalized within 90 days of completion of fieldwork.

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Section 6
Waste Management Procedures

The waste generated during this project will be appropriately stored, profiled, and disposed of offsite in accordance with federal, state and local laws, regulations and instructions. The Navy will be the generator and will sign any required manifests. All waste will be stored on-site (no longer than 90 days after date of generation) in the Department of Transportation (DOT) approved 55-gallon drums. The soil will be screened with a PID and visually inspected for contamination. Soil determined to be "contaminated" will be segregated from the "clean" soil and will be stored in labeled 55-gallon steel drums. Any hazardous waste disposal outside of California will be in accordance with United States Environmental Protection Agency (USEPA), DOT, and local requirements. Tracking of the waste disposition will be documented in the field logbook.

The wastewater from equipment decontamination cleaning will be stored and sealed in DOT-approved 55-gallon steel drums. The 55-gallon drums will be labeled appropriately and temporarily stored onsite prior to treatment or disposal at an approved and certified waste disposal facility.

6.1 Waste Sampling and Analysis

The soil and wastewater generated during the cleaning of the equipment and destruction of wells will be sampled for disposal characterization purposes.

On a case-by-case basis, the following laboratory analytical methods may be used to characterize the waste for disposal.

- TPH-gas (8015M);
- TPH-diesel (8015M);
- TPH-oil (418.1);
- VOCs - U.S. EPA 8260B;
- Title 22 Metals - U.S. EPA 6010B/7471A;
- TCLP extraction for metals and volatile organics - U.S. EPA 1311;
- TCLP for metals - U.S. EPA 6010B/7470A;
- TCLP for volatile organics - U.S. EPA 8260B;
- WET procedure - California Code of Regulations Title 22;
- STLC for metals - U.S. EPA 6010B/7470A (if total metal exceed 10 times the STLC limit);

- STLC for volatile organics – U.S. EPA 8260B (if VOC exceed 10 times the STLC limit);
- pH – U.S. EPA 9045C; and
- Moisture Content – ASTM D2216.

The results of the analyses will be compared to the most recent published state total threshold limits concentrations (TTLC) and soluble threshold limit concentration (STLC) limits and U.S. EPA limits for toxicology characteristic leaching procedure (TCLP). In addition to comparing the analytical results to regulatory hazardous waste limits, VOC and total metals concentrations will be compared to U.S. EPA Region 9 Preliminary Remedial Goals (PRG) concentrations for residential soil and the 95th percentile upper confidence limit (UCL) for the former station (BNI 1996).

6.2 Waste Disposal

The hazard characterization of the soil and decontamination water will be based on the results of the laboratory analytical data. Soil and wastewater manifests will be signed by the appropriate base personnel and disposed of at an approved offsite facility. After wastewater characterization is completed, contaminant levels will be evaluated to determine the feasibility of disposing of the wastewater into the existing groundwater remediation system. If contaminant levels exceed the designed maximum influent level criteria for the remediation system, the wastewater will be transported offsite for disposal at a certified waste disposal facility.

Specific equipment decontamination procedures are described in CDM's SOP 4-5, *Field Equipment Decontamination at Non-Radioactive Sites* (Appendix B). On a case-by-case basis waste generated from the Well Destruction Activities may consist of the following four types:

- Personal protective equipment (PPE);
- Soil cuttings from over-drilling activities;
- Decontamination water from decontamination activities; and
- Uncontaminated materials.

Approximately one drum of PPE and soil waste, and one drum of aqueous waste may be generated during each well destruction. The drums will be stored on-site in a secured area.

Soil: Soil waste will be placed in an appropriately labeled, DOT-approved, 55-gallon drum and maintained onsite until all analytical work is completed. If site samples associated with a particular drum are determined to be hazardous, the soil waste will be disposed offsite as hazardous waste. If the soil is determined to be non-hazardous, an evaluation will be conducted to determine if the soil can be spread on-site (based

on criteria used at several other Former MCAS El Toro sites) or should be disposed of offsite as non-hazardous waste.

PPE: PPE generated during field activities (e.g., gloves and sampling supplies) will be collected from each boring location in plastic bags and stored in an appropriately labeled, DOT-approved, 55-gallon drum. The bags will be labeled to indicate the soil boring location, contents, and collection date. If the soil collected from a soil boring is characterized as hazardous, then the corresponding PPE will be disposed as hazardous waste. Otherwise, all PPE will be disposed as non-hazardous solid waste.

Uncontaminated materials: Well monuments, bollards, and other uncontaminated materials generated during the destruction process will be disposed of at a Class III landfill. The materials will be loaded into a truck and disposed of by the well decommissioning Subcontractor.

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Section 7
Project Management Plan

This section presents the management structure for the groundwater monitoring well decommissioning work at the Former MCAS El Toro as described in this Work Plan. The following subsections present project organization and key personnel, subcontract support services, and the project schedule/ deliverable commitment.

7.1 Project Organization and Key Personnel

The project team consists of the Project Manager, Project Geologist, Sampling Technician, Health and Safety Officer, Site Health and Safety Officer, and Quality Assurance Coordinator. The CDM Project Manager, Mike Higman, will have overall responsibility for all aspects of the project and for communications between Jonas and Associates, CDM, and the Navy. Day-to-day operations and subcontractor oversight is the responsibility of the Project Geologist (to be designated), who will report to the PM on a regular basis.

Technical review will be conducted by an in-house senior staff member to assure that all documents are reviewed and are internally consistent prior to submittal to the Navy.

The Health and Safety Officer, Chuck Myers (CDM), is responsible for oversight and review of all site-specific Health and Safety Plans. The Site Safety Officer is responsible for plan implementation and policy conformance by all field personnel and subcontractors at the site.

The Quality Assurance Coordinator, Randa Chichakli (CDM), is responsible for all contractual QA requirements as well as in-house QA requirements for project deliverables and subcontractor work products.

7.2 Subcontractors

A State of California certified drilling subcontractor will perform destruction of groundwater monitoring wells. Soil and decontamination water analyses will require services from a subcontracted laboratory. EMAX in Torrance, California has been retained to provide the analytical services. EMAX is a California-accredited and Navy-approved laboratory.

7.3 Project Schedule

The proposed schedule for completing the tasks identified in this Work Plan has been developed based on the Navy's Scope of Work. The Project Schedule is presented as Table 1. The schedule indicates the major tasks described in this Work Plan, their anticipated duration and Navy deliverable deadlines.

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Section 8
References

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Tables

Table 1
Project Schedule

Project Milestone	Scheduled Date
Well Closure Work Plan	
Draft Work Plan	19 June 2007
Final Work Plan	28 December 2007
Well Closures	
Submit list of wells proposed for closure to BCT	As directed by Navy RPM
BCT concurrence	10 days after receipt of well list
Well notification packet to OCHCA-EH	As directed by Navy RPM
Fieldwork	As directed by Navy RPM
Well Closure Reports	
Draft Submittal	60 days after well closure activities are completed
Navy Comments	21 days after receipt of Draft
Final Submittal	30 days after receipt of Navy comments

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Figures

SENSITIVE RECORD

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

FIGURE 1 – FORMER MCAS EL TORO FACILITY MAP

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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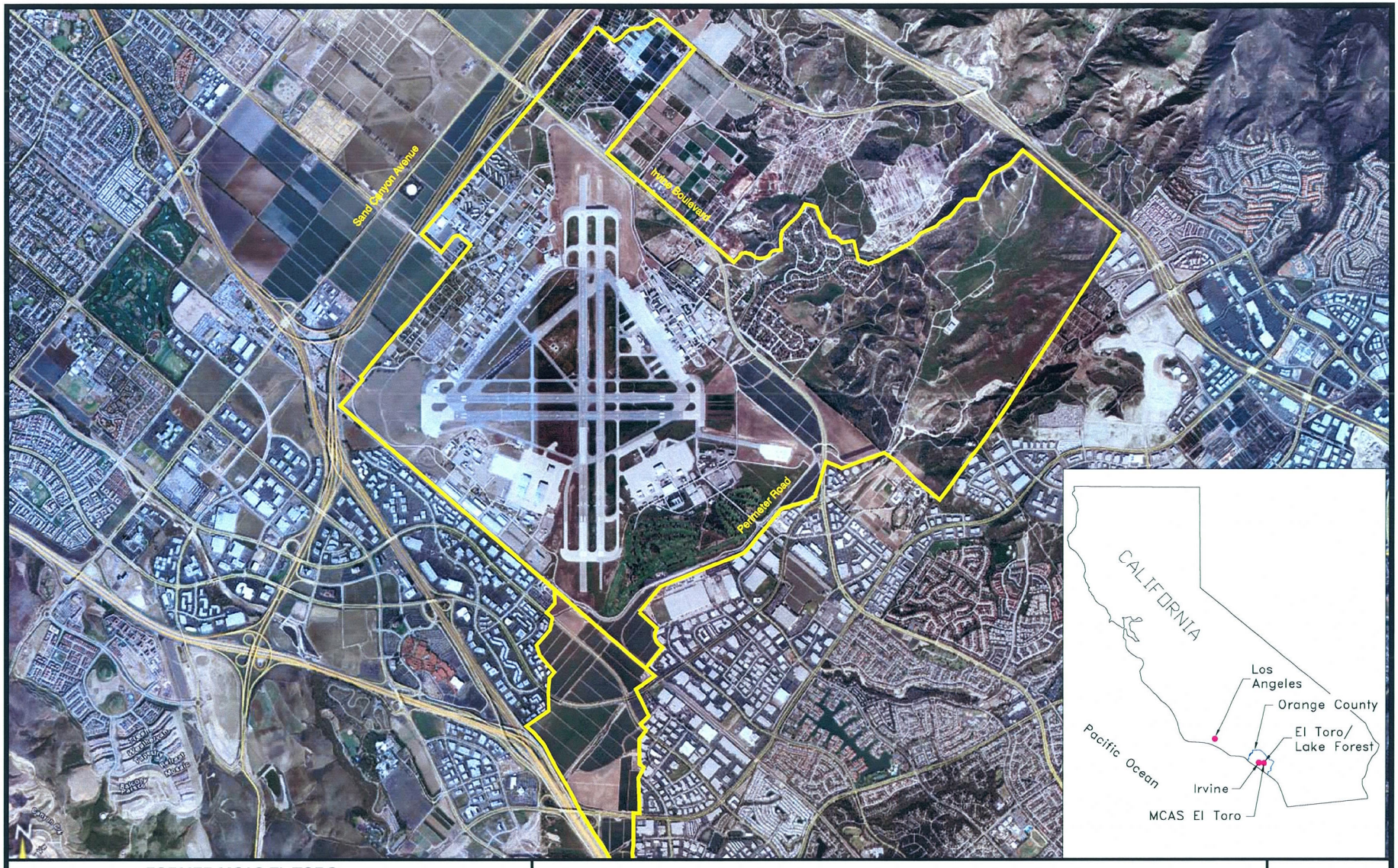
E-MAIL: diane.silva@navy.mil

SENSITIVE



FORMER MCAS EL TORO IRVINE, CALIFORNIA		
CDM 9444 Farnham Street San Diego, CA 92123 858-268-3383	DATE: 12/2007	Former MCAS El Toro Facility Map
	FN: 003_WP	FIGURE 1
MODIFIED BY: J. Brown	PROJECT NO. 6228-003	

C:\cad\6228\003\w11\003_WP.dwg, 1b, 12/19/2007 12:55:19 PM

SENSITIVE

FIGURE 2

APPLICATION FOR WELL DESTRUCTION

ORANGE COUNTY HEALTH CARE AGENCY
ENVIRONMENTAL HEALTH DIVISION
1241 E. DYER ROAD, SUITE 120
SANTA ANA, CA 92705-4720
(714) 433-6000
FAX: (714) 433-6481

CITY | DATE

WELL LOCATION (ADDRESS IF AVAILABLE)

NAME OF WELL OWNER | NAME OF CONSULTING FIRM

ADDRESS | BUSINESS ADDRESS

CITY ZIP TELEPHONE | CITY ZIP TELEPHONE

NAME OF DRILLING CO. | C-57 LICENSE NUMBER

CITY ZIP TELEPHONE

WELL DEPTH _____ Feet
DIAMETER _____ Inches

TYPE OF WELL/TOTAL NUMBER _____
☐ WATER
☐ CATHODIC
☐ MONITORING
☐ OTHER

SEALING MATERIAL / ESTIMATE AMOUNT OF SEALING MATERIAL NEEDED | PROPOSED START DATE

METHOD OF DESTRUCTION

DIAGRAM OF WELL SITE *(Use additional sheets and/or attachments)*

☐ SITE PLAN ATTACHED

I HEREBY AGREE TO COMPLY IN EVERY RESPECT WITH ALL REQUIREMENTS OF THE HEALTH CARE AGENCY AND WITH ALL ORDINANCES AND LAWS OF THE COUNTY OF ORANGE AND OF THE STATE OF CALIFORNIA PERTAINING TO WELL CONSTRUCTION, RECONSTRUCTION AND DESTRUCTION.

APPLICANT'S SIGNATURE DATE

PRINT NAME

PHONE NUMBER FAX NUMBER

FOR ACCOUNTING USE ONLY:

HSO NO. _____ CHECK NO. _____

DATE _____ AMOUNT _____

INTL _____

APPROVAL BY OTHER AGENCIES:

JURISDICTION _____

REMARKS _____

AUTHORIZED SIGNATURE DATE

DISPOSITION OF PERMIT (DO NOT FILL IN):

☐ APPROVED SUBJECT TO THE FOLLOWING CONDITIONS:

A. ☐ NOTIFY THIS AGENCY AT LEAST 48 HOURS PRIOR TO START.

B. ☐ SUBMIT TO THE AGENCY A WELL DESTRUCTION REPORT. PLEASE REFERENCE PERMIT NUMBER.

C. ☐ OTHER _____

☐ DENIED _____

PERMIT ISSUED BY DATE

PRINT NAME PHONE NUMBER

WELL PERMIT NUMBER

WHEN SIGNED BY ORANGE COUNTY HEALTH CARE AGENCY REPRESENTATIVE, THIS APPLICATION IS A PERMIT.

F272-09.1543 (R9/96)

Appendix A

Site Health and Safety Plan

Final

Appendix A

Site Health and Safety Plan

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Irvine, California

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Appendix A

Site Health and Safety Plan

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Former Marine Corps Air Station El Toro

Irvine, California

Contract No. N68711-04-D-1110
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CDM Engineer

Approved by: _____ 12/27/07
Larry Davidson, P.E., Date
CDM Program Manager

Approved by: _____ 12/27/07
for Shawn Oliveira, CHSM Date
CDM Corporate Health and Safety Manager

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Acronyms and Abbreviations

AHA	Activity Hazard Analysis
APR	air-purifying respirator
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
HAZWOPER	hazardous waste operations and emergency response
HSO	health and safety officer
IDLH	immediately dangerous to life and health
LF	linear feet
MCAS	Marine Corps Air Station
mg/m3	milligram per cubic meter
MHSA	Mine Health and Safety Administration
MSL	Mean Sea Level
NAVY	United States Department of Navy
NAVFAC	Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Service Center
NIOSH	National Institute of Safety and Health
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PEL	permissible exposure limit
P.E.	Professional Engineer
P.G.	Professional Geologist
PM	project manager
PPE	personal protective equipment
ppm	parts per million
RPM	remedial project manager
SHASP	site health and safety plan
SOP	standard operating procedure
TLV	threshold limit value
U.S. EPA	United States Environmental Protection Agency
WBGT	wet bulb globe temperature
WD	Well Destruction

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Section 1
Introduction

CDM Federal Programs Corporation (CDM) has prepared this Site Health and Safety Plan (SHASP) for performing well destruction (WD) at the former MCAS El Toro in Irvine, California. This event is being performed for Naval Facilities Engineering Command (NAVFAC) Southwest under Navy Contract No. 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 WD. 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

Well demolition required under this Navy project has the potential to result in employee exposure to recognized and potential health and safety hazards. CDM has developed this SHASP to mitigate these concerns. CDM will obtain full compliance with this plan by its employees and subcontractors.

The SHASP objectives are to ensure that all necessary precautions for field work are in place and that appropriate health and safety procedures are followed at all times to protect personnel; to prevent damage, injury, or loss, of property and equipment; and to respond quickly and effectively to CDM activity-related emergencies.

Before commencing WD field work, all CDM employees assigned to the investigation will receive a copy of the SHASP and will be trained in its provisions. A copy of the SHASP will be kept onsite at all times. Supervisory personnel will be responsible for ensuring that the SHASP requirements are understood by field personnel and that site activities are performed with the utmost regard for the safety and health of all CDM personnel involved. CDM is only responsible for the health, safety, and emergency response activities related to its activities. The requirements of this section are based on current information and understanding of the existing impacts at the site. Activity Hazard Analyses (AHAs) will be submitted to CDM by subcontractors and accepted before work is performed under this contract.

Scope

This SHASP will apply to work performed by CDM at the Former MCAS El Toro. This SHASP will address the reasonable possibility for employee and subcontractor

exposure to safety or health hazards associated with the WD, as well as emergency response requirements.

CDM's proposed field program is described in detail in the Work Plan. Proposed demolition sites will be determined at a later date by the Navy. The field investigation for this WD will consist of the following elements:

- Destroy up to 5000 linear feet (LF) of monitoring wells located within the Former MCAS El Toro;
- Maintain a field logbook for all site activities;
- Conduct IDW characterization, manifesting, and disposal;
- Prepare and submit a report documenting field activities, findings, and analytical results for NAVFAC Southwest approval; and
- Provide a State of California Professional Geologist (P.G.) to supervise and review all sampling activities and interpretation of data interpretation.

1.2 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

This section provides a brief description of the site and its history.

2.1 Site Location and Description

Former MCAS El Toro is situated in a semi-urban agricultural area in south-central Orange County, California (Figure 9-1). The majority of the station is within an unincorporated area of Orange County; however, property within the south portion of the station 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 (CDM 2004).

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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. Shawn Oliveira is a certified safety professional with eight years of experience in environmental engineering, industrial hygiene and occupational safety, environmental chemistry, specializing in design, implementation, and assessment of Health and Safety and Injury/Illness Prevention Programs.

Mr. Oliveira's 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. Jake Dunk. The alternate site HSO will be Mr. Matt Brookshire. 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 WD, 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 WD 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 5.4.4).

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; and
- Before initiating any non-routine operation, personnel must consult the site HSO about health and safety requirements for that operation.

5.4.2 Personal Protective Equipment and Clothing

Based on information available from the Navy, the WD will be performed using Level D PPE. CDM personnel and subcontractors will wear Level D PPE for all WD 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 30-foot diameter circle around any area where WD 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 offsite 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, field personnel will travel to the closest building containing a working phone. This location will be determined on a daily basis prior to commencing field work. 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.

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 asses 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 WD, 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 field 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 offsite 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, a suite of web-based training courses, including courses designed to comply with the annual refresher requirements of 29 CFR 1910.120 and the OSHA 10-Hour Construction Safety Course, are available to all employees through CDM University. These courses, selected by qualified CDM H&S professionals, are designed to expand on and clarify the initial training.

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 WP, 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
- Buddy Teams
- Hospital Route/Nearest Phone Location
- Weather Concerns
- Problems Previously Occurred
- Potential Problems

Action Levels: __11-200 ppm sustained 5 min. in BZ=Level C_____
Other: _____

*Protective Clothing/Equipment:*_____

*Special Equipment:*_____

*Chemical Hazards:*_____

*Physical Hazards:*_____

*EmergencyActions:*_____

*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

	Please Print - Name/Firm/Office	Signature
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 the Former MCAS El Toro poses the potential for hazardous and/or toxic chemicals to be present in the soil 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." An Activity Hazard Analysis (AHA) of all hazards that have potential of occurring during this project can be found in Attachment C.

7.1 Chemical Hazards

Previous investigations performed at the Former MCAS El Toro have identified the potential for organic contaminants in the soil. 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 WD is considered low.

Chemical categories presented in Table 7-2 are identified based on past soil 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. An emergency eyewash station will be maintained and kept with the first aid kit. 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

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
Chemical	Skin/Eye	• 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	• Wear appropriate protective equipment (respirator), as described in Section 5.4.2. • Stand upwind of chemical release.
Physical	Heat Stress	• Follow heat stress prevention procedures in Section 5.4.7. See Attachment B.
	Slips, Trips & Falls	• 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	• Allow equipment to be operated by trained/experienced personnel only. • Wear a hard hat.
	Noise	• Wear earplugs or acoustic earmuffs.
Biological	Insects	• Use insect repellent, where necessary. • Wear protective clothing such as leather boots, long pants, hat and work gloves.
	Vermin	• 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.

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
Total Petroleum Hydrocarbons (gas and diesel)	5 mg/m^3 (mist)	2500 mg/m^3	5 mg/m^3	Inhalation	Irritated eyes, nose, throat, skin

ppm = parts per million
mg/m^3 = milligrams per cubic meter
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 identified for selected compounds within chemical category

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Section 8
Decontamination

This section discusses decontamination techniques that will be performed for field 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 B of the Work Plan). All waste will be stored onsite in Department of Transportation (DOT) approved 55-gallon drums no longer than 90 days after date of generation. All investigation-derived waste (IDW) classified as hazardous will be transported offsite by a State of California and U.S. EPA-approved hazardous waste hauler and disposed of at a State of California licensed hazardous waste disposal facility. Any hazardous waste disposed of outside of California will be in accordance with U.S. EPA requirements. 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 case of an emergency such as a fire at an offsite 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 field activities, 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 each morning when the field teams meet for daily activities. In case of an emergency, all CDM workers and subcontractors will meet at this designated area containing emergency equipment and PPE.

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 onsite health and safety requirements 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 the Former MCAS El Toro is:

16200 Sand Canyon Ave.
Irvine, California 92718
General Number (949) 753-2000
Emergency 911

The hospital route to this facility appears in Figure 9-1.

Directions to Hospital from former MCAS El Toro: Exit former MCAS El Toro using gate Number 9 at the intersection of South Marine Way and Perimeter Road. 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 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 be currently certified in First Aid and CPR.

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 advice 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. Offsite 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. 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 omitted 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
Hospital (Western Medical Center)		(714) 953-3331 General
Poison Control System		(800) 222-1222
Police		(949) 724-7000
CDM Federal Programs Corporation		
Larry Davidson	Program Manager	office (858) 627-1542
Randa Chichakli	Project Manager	office (858) 627-1544
Jake Dunk	Field Team Leader/HSO	office (858) 627-1557
Shawn Oliveira	CHSM	office (406) 293-8595 cell (406) 293-1547
Dr. Ken Chase	Occupational Physician	office (800) 777-9642
Onsite Navy Contact		
Scott Kehe	Bldg. 307 – Former MCAS El Toro	(949) 726-2506
Navy Contacts		
Louie Cardinale	NAVFAC Southwest RPM	(619) 532-0979

Notes:

CHSM = corporate health and safety manager
HSO = health and safety officer
NAVFAC = Naval Facilities Engineering Command
RPM = remedial project manager

SENSITIVE RECORD

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

FIGURE 9-1 – FORMER MCAS EL TORO
HOSPITAL ROUTE MAP

FOR ADDITIONAL INFORMATION, CONTACT:

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

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

From Trabuco Road proceed to Sand Canyon Road.
Turn left on Sand Canyon Road and proceed to 16200 Sand Canyon Road.
Make a left turn into Irvine Regional Hospital.
Irvine Regional Hospital
(949) 753-2000

FORMER MCAS EL TORO IRVINE, CALIFORNIA		
CDM 9444 Farnham Street San Diego, CA 92123 858-268-3383	DATE: 06/2007 FN: 003_WP	Former MCAS El Toro Hospital Route Map
MODIFIED BY: J. Brown	PROJECT NO. 6228-003	FIGURE 9-1

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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 Damage? • Yes • No
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
- First Aid only
- Medical treatment
- Lost workdays - restricted activity
- Lost workdays - away from work
- Fatality Date: _____
- Total number of lost days _____

OSHA Illness Code
- Occupational skin diseases or disorders
- Dust diseases of the lungs
- Respiratory conditions due to toxic agents
- Poisoning
- Disorders due to physical agents
- 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
- Ankle
- Arm
- Back
- Brain
- Chest
- Digestive
- Ear
- Elbow
- Eye
- Face
- Finger
- Foot
- Hand
- Head
- Heart
- Hips
- Kidneys, Intestines
- Knee
- Leg
- Lungs
- Multiple
- Musc. Skel
- Neck
- Nervous System
- Scalp
- Shoulder
- Skull
- Thigh
- Toe
- Wrist
- Other _____
- Unknown

(2) Injury Type:

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

(3) Injury Source:

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

(4) Accident Type Code:

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

(5) Hazardous Conditions:

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

(6) Accident Part Code

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

Description of Accident: _____

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

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

HEALTH AND SAFETY PLAN FORM CDM Health and Safety Program Project No.: 6228.003	This document is for the exclusive use of CDM, U.S. Navy, and their subcontractors.	CDM Programs Corporation	
The following personnel have read and fully understand the contents of this Health and Safety Plan and further agree to all requirements contained herein.			
Name	Affiliation	Date	Signature

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 devises 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 Load		
Work - Rest Regimen	**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 Analysis

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004 **7-2001**

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.

[2] Work Location:
[3] Task Title:

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004 **7-2001**

[4] Work Phase:	**[5] List Work Groups Needed for Each Phase**
A. This AHA shall be reviewed annually or as requested by the workers, supervisors, and/or safety representative	**A.**
B.	**B.**

[6] Activity Steps	**[7] Work Groups**	**[8] Hazards**	**[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)**
Drilling		Environmental Protection	• At a minimum, plastic will be placed over the area to be drilled. If the contaminants warrant, plastic will be placed under the rig as well as a large area surrounding the rig. • If fuel or oil leaks on the plastic sheeting, absorbent pads will be used.
		Housekeeping – slips/trips/falls	• All sites will be kept clean and free of trash and other debris. • All trash will be properly containerized and removed or staged daily.
		Equipment Inspection	• Prior to use all drill rigs and related equipment will be inspected by health and safety and the STR or designate. • All rigs and related equipment will be scanned in by health physics prior to use. Documentation from health physics will be required prior to mobilization to the decontamination area. • Drill rigs and support equipment will be inspected daily and documented by the equipment operator.

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004 **7-2001**

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
		Drill rig failure	• The mast and cables must be able to support all equipment and drill rods. • Wire cables must be maintained in good condition, free from kinks or broken strands. • All rotating shafts, pulleys or chains must be covered with protective guards. • All drill rigs must be equipped with an emergency kill switch, which is readily accessible to personnel at the rear of the rig. All personnel on the site will know the location of the kill switch and how to use it.
		Water tanks	• All water tanks must be securely fastened to the truck frame. • Water tanks should be constructed of materials with adequate side strength, baffled to prevent the sloshing of water side to side, and must have lids with gaskets to prevent water loss.
		Eye injury	• Safety glasses will be required during drilling operations
		Foot injury	• Leather steel-toes boots will be required.
		Hearing loss	• Hearing protection will be required during hammering operations. • Sound level readings will be taken during the initial startup of the operation to determine the hearing protection buffer zone, if a zone is necessary.
		Hand injury	• Gloves will be worn during routine drilling activities. • Keep hands away from rotating augers, the hammer, and all other moving parts.

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004 **7-2001**

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
		Head injury	• Hard hats will be required during drilling operations. • Hard hats will not be required during site set up, but will be required once the mast has been raised.
		Unauthorized operation	• Only trained and authorized personnel will operate and/or assist in drilling operations. • Operators must comply will all applicable state certifications.
		Slips/trips	• If mud pans are used, the pan will be cleaned out as often as possible to avoid slippery conditions.
		Crushing injuries	• Drill rids and drill bit stabilizer will be properly transported by either a rack, the rig, or utility trailer. • If transported on a trailer, the rods or stabilizers will be held securely in place. • If feasible, all vehicles and wheeled equipment will have chocks placed under the wheels to prevent rolling.
		Rig/equipment damage	• Wire cables will be inspected daily. Cables with broken strands, weak spots, kinking, or mashed areas will be replaced prior to use.
		Fire prevention	• Drill rigs will contain at least on ABC type fire extinguisher. • Fire extinguishers will be fully charged and inspected weekly. • Fuels will be stored in appropriate containers.

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004 **7-2001**

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
		Severe weather	• Drilling will stop when rain interferes with the safety of the operators. • Drilling activities will stop during lightning. • Operators, crew, and other support personnel will move out of the exclusion zone and take shelter in other vehicles.
		Cathead hazards	• The operator must be trained and experienced in the use of a cathead. • The rope must be in good condition. • The operator shall not wear loose clothing.
		Power lines/underground utilities	• Ensure that there are not any power lines or underground utilities prior to drilling activities. • If work is near an overhead line, care will be taken to ensure there is clearance with raising the mast. • While working near power lines, drill rods will not be leaned against the mast. • If the drill bit encounters anything hard, drilling will stop and the Geologist will be notified.
Decontamination Using a steam cleaner		Hand injury	• Skid mounted steam cleaners will have protective guarding on all rotating shafts, belts, and pulleys. • Nitrile gloves will be worn while operating the steam cleaner. • Keep hands clear of the water spray.
		Hearing loss	• Hearing protection will be worn during steam cleaning operation.
		Fire	• Turn off the steam cleaner and allow it to cool before refueling. • Generators will be turned off while being refueled. • Smoking is prohibited during refueling operation.
		Electrical	• If steam cleaners are being powered by a generator, a Ground-Fault Circuit Interrupter (GFCI) will be required.

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004 **7-2001**

[10] Attachments:

Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
Procedure	PTSA-5001 "Decontamination of Drilling-Related Equipment"	All	Decontamination
	PTSA-5002 "Decontamination of Field Equipment"	All	Decontamination
	PTSA-5003 "Operation of the C-752-C Decontamination Pad"	FTL/Waste Crew	
	PTSA-5006 "Field Decontamination of PCB-Detectable Items"	All	Decontamination
Comments:			

[11] References:

Document Type	Document Number	Applies to Work Group	For Work Step(s)/Phase(s)
General Health and Safety Plan		All	All
Site Specific Health and Safety Plan			

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

[13] Change Summary

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004 **7-2001**

[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	Environmental, Safety, and Health			
2	Site Supervisor			

ACTIVITY HAZARD ANALYSIS FOR DRILLING SAFETY

[1] AHA No. CDM-004

PRE-JOB BRIEFING ATTENDANCE

AHA No: CDM-004	Job Title: AHA for Drilling Safety	Date:
Service Supervisor	Performer Organization:	Time:

I agree to work within the scope of work and follow the work controls described in the briefing.

Signature	Badge No. or SSN	Organization

ACTIVITY HAZARD ANALYSIS FOR GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

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 GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

[2] Work Location: Decontamination Pad	
[3] Task Title: Decontamination	
[4] Work Phase:	**[5] List Work Groups Needed for Each Phase**
A. Physical Hazards	**A.** All
B. Loading/Unloading Equipment	**B.** All
C. Mixing Grout	**C.** All
D. Operation	**D.** All

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. Physical Hazards	All	Temperature extremes	• Employees shall be trained in the recognition of heat stress symptoms and appropriate precautions to take. • ES&H representative will monitor personnel for signs of heat stress. • Personnel will maintain fluid levels to avoid dehydration. • Personnel will utilize the "buddy system" to monitor coworker's condition.
		Noise Hazards	• Hearing protection will be required during pumping activities for all personnel in the Exclusion Zone

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

ACTIVITY HAZARD ANALYSIS FOR GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
A. Physical Hazards (continued)	All	Insects, Spiders, Ticks	• Personnel will be instructed to be cautious of insects, spiders, and ticks. • Insect/tick repellant will be provided for use by employees.
		Severe Weather	• When weather interferes with safety, all work will stop until conditions are safe. • Work will stop during lighting storms.
B. Loading/Unloading Equipment	All	Lifting, Strains, Sprains	• Use proper lifting techniques, size up the load, use teamwork, never twist or turn when lifting. • Use mechanical lifting devices when possible. • Know your limitations and get help when needed.
		Pinch Points	• Wear leather gloves where potential pinch points exist. • Keep all body parts clear of all potential pinch points. • Keep hands clear of moving parts of equipment. • Use caution when loading or unloading or stacking heavy equipment to ensure that hands and feet are kept clear at all times.
		Foot Injury	• Steel-toed safety shoes will be worn while loading and unloading equipment.
C. Mixing Grout	All	Pinch Points, Impacts from Mixing Tools	• Keep all body parts clear of grout mixing tub or hopper. • Loose or unbuttoned clothing, loose belts, loose hair, or jewelry are not allowed.

ACTIVITY HAZARD ANALYSIS FOR GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
C. Mixing Grout (continued)	All	Exposure to Grout	• Safety glasses with side shields or safety goggles are required. • MSDS will be onsite and available. • Eyewash station will be maintained onsite. • PPE will include company issued clothes, nitrile gloves, safety glasses or goggles. • Keep hands clear of grout mixing tub or hopper. • Avoid skin exposure to grout. • Ensure pressurized pipe and hose fittings are tight prior to startup of pump.
E. Operation	All	Pinch Points	• Ensure that all guards are securely in place. • Avoid contact with any moving parts on pump.
		Slips, Trips, Falls	• Tripping hazards will be identified and removed if possible. If hazard removal is not feasible, hazard will be isolated by the use of barrier tape, cones or snow fence. • Good housekeeping practices will be implemented. • Keep area clear of debris, materials, and liquids. • Use caution when working on plastic or uneven ground. • Avoid steep, slippery, and/or unstable terrain.
		Unsafe acts or work conditions	• Only authorized personnel will operate the grout pump. • Grout pump will be operated in accordance with the manufacturers specifications. • Inspection will be performed on the equipment for leaks or malfunctions prior to use. • Tag damaged or faulty equipment out of service.
		Electrical Shock	• GFCI will be used on electrical equipment and hand tools.

ACTIVITY HAZARD ANALYSIS FOR GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
E. Operation (cont.)	All	Head injury	• Hard hats will be worn by personnel operating grout pump.
		Foot Injury	• Steel-toed safety shoes will be worn by personnel operating grout pump.
		Eye Injury	• Safety glasses with side shields that meet the ANSI-Z-87 standard will be worn by all personnel operating grout pump.

ACTIVITY HAZARD ANALYSIS FOR GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

[6] Activity Steps	[7] Work Groups	[8] Hazards	[9] Hazard Controls (Engineered, Operational, Documents, PPE, Qualifications)
E. Operation (cont.)	All	Fire Hazards	• Equipment will be shut down and allowed to cool prior to refueling. • Adequate fire protection devices will be available and have proper inspection. • Combustible liquids (i.e. gasoline and diesel fuel) shall be stored in approved containers. • No hot work, or smoking shall be allowed within 50 ft of flammable and combustible liquid storage areas.

ACTIVITY HAZARD ANALYSIS FOR GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

[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	Environmental, Safety, and Health			
2	Site Supervisor			

ACTIVITY HAZARD ANALYSIS FOR GROUT PUMP OPERATION

[1] AHA No. AHACDM-048

[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	Environmental, Safety, and Health			
2	Site Supervisor			

ACTIVITY HAZARD ANALYSIS

PRE-JOB BRIEFING ATTENDANCE

AHA No: AHACDM-047	Job Title Decontamination (Steam Cleaner)	Date:
Service Supervisor	Performer Organization:	Time:
I agree to work within the scope of work and follow the work controls described in the briefing.		
Signature	**Badge No. or SSN**	**Organization**

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: PGDP Locations (Inside and Outside Security Perimeter			
[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 Waste Purge Water		**B.** 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, *Opening Containerized Waste* and CDM Environmental Management Program Procedure CDM-031, *Sampling Containerized Waste.*
		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.
B. Disposal of Waste Purge Water	All	Truck/Trailer Contact With Employee, Building, or Equipment	Request spotter to assist with backing the trailer toward the C-612 Treatment Facility. Back slowly and check side view mirrors and/or spotter frequently.

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

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

ACTIVITY HAZARD ANALYSIS FOR WASTE HANDLING AND DISPOSAL

[1] AHA No. CDM-050 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 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

PRE-JOB BRIEFING ATTENDANCE

AHA No: CDM-050	Job Title: Waste Handling and Disposal	Date:
Site Supervisor:	Performing Organization:	Time:
I agree to work within the scope of work and follow the work controls described in the briefing.		
Signature	**Badge No. or SSN**	**Organization**

Appendix B

Standard Operating Procedures

Appendix B
Table of Contents

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

- 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; and
- SOP 4-8, Environmental Data Management.

Guide to Handling Investigation-Derived Waste

SOP 2-2
Revision: 5
Date: March 2007

Prepared: Tim Eggert

Technical Review: Matt Brookshire

E-Signed by Michael C. Malloy
VERIFY authenticity with ApproveIt

QA Review: Jo Nell Mullins

Approved:

Signature/Date

E-Signed by P. Michael Schwan
VERIFY authenticity with ApproveIt

Issued:

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 before field activities
- Removing 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 aboveground containerization
- Complying with federal, state, local, 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 - 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, sludge, liquid, gaseous, or multiphase materials that may be classified as hazardous or nonhazardous.

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 and local 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 nondisposable protective clothing and 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 General 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.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site/project specific quality assurance plan.

4.0 Required Equipment

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required shall 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
- Polyethylene or steel bulk storage tanks

Containment of IDW shall be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device shall be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking shall 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.
- 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 shall be predetermined and in accordance with site-specific and/or client requirements. Arrangements shall be made before 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 shall 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 for liquid IDW storage and as appropriate for solid IDW storage.

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 shall 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 shall 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 Collection and 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).

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 before 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, only when IDW is not contaminated.

4. Send to onsite TSDF - may require analysis before 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 nontransparent 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 before treatment/disposal.

5.2 Collection for Offsite Disposal

Before sending to an offsite TSDF, analysis may be required. Manifests are required. In some instances, a bill of lading can be used for nonhazardous solid IDW (i.e., wooden pallets, large quantities of plastic sheeting). Arrangements must be made with the client responsible for the site to sign as generator on any waste profile and all manifests or bill of ladings; it is CDM's policy not to sign manifests. The TSDF and transporter must be permitted for the respective wastes. Nonbulk containers (e.g., drums) must have a DOT-approved label adhered to the container and all required associated placard stickers before leaving for a TSDF off site. These labels must include information as required in 49 CFR 172. Bulk containers (i.e., rolloffs, tanks) do not require container specific labels for transporting off site, but must include appropriate placards as required in 49 CFR 172.

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 shall 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 with appropriate secondary containment) until final disposal. The management option selected shall 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).

5.2.3 Disposable PPE

When the final site remedy requires offsite treatment disposal, the IDW may be containerized and stored. The management option selected shall 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 Collection and Interim Management

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:
   - Returning wastes (especially sludges and soils) to their onsite source area would require reexcavation for disposal in the final remediation alternative.
   - Interim storage in containers may be necessary to provide adequate protection to human health and the environment.
   - 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.
   - Interim storage may be necessary to provide time for sampling and analysis.

2. Segregate and containerize all waste for future treatment and/or disposal.
   - Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.
   - Containment options for aqueous liquids may include mobile tanks or drums.
   - Containment options for PPE may include drums or roll-off boxes.

6.0 Restrictions/Limitations

Site Managers Shall 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 Shall These Types of Materials Be Brought Back to the Office or Warehouse.**

7.0 References

Environmental Resource Center. 1997. *Hazardous Waste Management Compliance Handbook 2nd Edition*. Karnofsky (Editor).

Academy of Certified Hazardous Materials Manager. May 1999. *Hazardous Materials Management Desk Reference*. Cox.

Title 49 Code of Federal Regulations, Department of Transportation. 2005 or current revision. *Hazardous Materials Table, Special Provisions, Hazardous, Materials Communications, Emergency Response Information, and Training Requirements*, 49 CFR 172.

U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

_____. August 1990. *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees*, EPA/530-SW-90-057.

_____. May 1991. *Management of Investigation-Derived Wastes During Site Inspections*, EPA/540/G-91/009.

_____. January 1992. *Guide to Management of Investigation-Derived Wastes*, 9345.3-03FS.

_____. Region IV. November 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.*

Attachment 1
IDW Management Options

Type of IDW	*Generation Processes*	*Management Options*
Soil	■ Well/Test pit installations ■ Borehole drilling ■ Soil sampling	**Onsite Disposal** ■ 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 **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal
Sludge/Sediment	■ Sludge pit/sediment sampling	**Onsite Disposal** ■ Return to boring, pit, or source immediately after generation ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal
Aqueous Liquids (groundwater, surface water, drilling fluids, wastewaters)	■ Well installation/development ■ Well purging during sampling ■ Groundwater discharge during pump tests ■ Surface water sampling ■ Wastewater sampling	**Onsite Disposal** ■ Pour onto ground close to well (nonhazardous waste) ■ Discharge to sewer ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite commercial treatment unit ■ Client to send to publicly owned treatment works (POTW) **Interim Management** ■ Store for future treatment and/or disposal
Decontamination Fluids	■ Decontamination of PPE and equipment	**Onsite Disposal** ■ Send to onsite TSDF ■ Evaporate (for small amounts of low contamination organic fluids) ■ Discharge to ground surface **Offsite Disposal** ■ Client to send to offsite TSDF ■ Discharge to sewer **Interim Management** ■ Store for future treatment and/or disposal
Disposable PPE and Sampling Equipment	■ Sampling procedures or other onsite activities	**Onsite Disposal** ■ Place in onsite industrial dumpster ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ 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: 6
Date: March 2007

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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 General 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 before 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.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities should be defined in the field plan or site-/project-specific quality assurance plan.

4.0 Required Equipment

- Site-specific plans
- Field logbook
- Indelible black or blue ink pen
- Ruler or similar scale

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 or vehicle for easy reference.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered before initial use of the logbook. Before 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 (if applicable).
- Activity (if the logbook is to be activity-specific), site name, and location.
- Name of CDM contact and phone number(s) (typically the project manager).
- Start date of entries.
- End date of entries.
- 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	Pages
(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. The table of contents should be completed as activities are completed and before placing the logbook in the records file.

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 does not need to 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.

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 used
  - Serial numbers of instruments
  - Equipment 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.
- Visitors to the site.

5.3 Post-Operation

To guard against loss of data as a result of 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 nonsubjective. Field logbooks, and entries within, are not to be used for personal use.

7.0 References

Sandia National Laboratories. 1991. *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.

Sandia National Laboratories. 1992. *Field Operation Procedure for Field Logbook Content and Control.* Environmental Restoration Department, Division 7723, Albuquerque, New Mexico.

Photographic Documentation of Field Activities

SOP 4-2
Revision: 7
Date: March 2007

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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 or DVD 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 or digital versatile discs (DVD) 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 Associated Procedures

- CDM Federal SOP 4-1, *Field Logbook Content and Control*

2.3 Discussion

Photographs and videotape or DVD recordings made during field investigations are used as an aid in documenting and describing site features, sample collection activities, equipment used, and possible 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, videotape recordings (or video footage), and recordings on DVDs. 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.

3.0 General Responsibilities

Field Team Leader - The field team leader (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. Responsibilities will be defined in the project sampling plan.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site/quality assurance project plan (QAPP).

4.0 Required Equipment

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 and appropriate storage media (e.g., video tapes, DVDs)
- Logbook
- Indelible black or blue ink pen
- Standard reference markers
- Slates
- Arrows or pointers
- Contrasting backgrounds
- Medium speed, or multi purpose fine-grain, color, 35mm 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 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.

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 before commencing field activities. The site health and safety plan must be read before 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 35mm 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 or DVD brand along with 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

It is recommended that 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).

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
- Photographer
- Description of activity/item shown (e.g., name of facility/site, specific project name, project number)
- Direction (if applicable)

When directed by the sampling plan, 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 to a personal computer; the files should be in either "JPEG" or "TIFF" format. Files should be renamed at the time of download to correspond to the logbook. It is recommended the electronic files be copied to a compact disc for backup.

Close-Up and Feature Photography

When directed by the sampling plan, 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 sampling plan, 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.

To shoot a panoramic series using a standard 35mm or digital camera, the following procedures are 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 or DVD recording. The following guidelines are set for documentary videotape or DVD recordings only and should be implemented at the discretion of the site personnel.

Documentary videotape or DVD 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 video recordings will not be edited. This will maintain the integrity of the information contained on the videotape or DVD. If editing is desired, a working copy of the original video recording can be made.

A label should be placed on the videotape or DVD with the appropriate identifying information (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/DVD 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.
- 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 or DVD to the project management representative to be placed in the project files.

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

- Photographs and the associated set of uncut negatives, digital media, and original unedited documentary video recordings will be submitted to the project files and handled according to contract records requirements. The project manager will ensure their proper distribution.
- 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 photographer is responsible for specific operational activity or procedure. Questions concerning specific procedures or requirements should be directed to the project manager or 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. 2001. *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3. Appendix F. February.

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

_____. Region IV. 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. Athens, Georgia. November.

Field Equipment Decontamination at Nonradioactive Sites

SOP 4-5
Revision: 7
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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 general guide and is applicable at most sites; however, it shall be noted that site-specific conditions (i.e., type of contamination, type of media sampled), the governing agency (e.g., EPA, DOE, USACE), and site-specific work plans, sampling and analysis plans and/or quality assurance (QA) project plans may require modifications to the decontamination procedures provided in this SOP. 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.

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 shall be stored only in clean glass, stainless steel, or plastic containers that can be closed when not in use.

Clean - Free of 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.

Material Safety Data Sheets (MSDS) - These documents discuss the proper storage and physical and toxicological characteristics of a particular substance used during decontamination. These documents, generally included in site health and safety plans, shall be kept on site at all times during field operations.

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 shall 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.

Sampling Equipment - 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.

Soap - Low-sudsing, nonphosphate detergent such as Liquinox™.

Solvent Rinse - Pesticide grade, or better, isopropanol, acetone, or methanol.

2.2 Associated Procedures

- CDM Federal SOP 1-1 - *Surface Water Sampling*
- CDM Federal SOP 1-3 - *Surface Soil Sampling*
- CDM Federal SOP 1-4 - *Subsurface Soil Sampling*
- CDM Federal SOP 1-5 - *Groundwater Sampling Using Bailers*
- CDM Federal SOP 1-7 - *Wipe Sampling*
- CDM Federal SOP 1-9 - *Tap Water Sampling*
- CDM Federal SOP 1-11 - *Sediment/Sludge Sampling*
- CDM Federal SOP 2-2 - *Guide to Handling Investigation-Derived Waste*
- CDM Federal SOP 3-1 - *Geoprobe® Sampling*

3.0 Responsibilities

The project manager or designee, generally 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 SOP and site-specific work plans. The FTL may also be required to collect and document rinsate samples (also known as equipment blanks) to provide quantitative verification that these procedures have been correctly implemented.

Note: Responsibilities may vary from site to site. Therefore, all field team member responsibilities shall be defined in the field plan or site-/project-specific QA plan.

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, plastic bags, and/or aluminum foil to keep decontaminated equipment clean between uses
- 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 [HNO_3], acetone, methanol, isopropanol, hexane)
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums or tanks for temporary storage of decontamination water (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 shall be decontaminated before coming into contact with any sampled media or personnel using the equipment. Decontamination of equipment shall 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 shall include an appropriately sized bermed and lined area on which equipment decontamination shall 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 shall be transported to and from 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 shall 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 shall be transferred into 55-gallon drums or portable tanks for temporary storage. Typically, decontamination water shall be staged until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined (SOP 2-2, *Guide to Handling Investigation-Derived Waste*). The exact procedure for decontamination waste disposal shall be discussed in the work plan. Also, solvent and acid rinse fluids may need to be segregated from other investigation-derived wastes.

All items that shall come into contact with potentially contaminated media shall be decontaminated before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, they shall 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 shall be free of all contaminants of concern. Following the field QA sampling procedure described in the work plan, analytical data from the water source may be required.
- Sampling equipment that has come into contact with oil and grease shall 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 shall be stated in the work plan.
- All solvents and acids shall be pesticide grade or better and traceable to a source. The corresponding lot numbers shall be recorded in the appropriate logbook.

  Note: Solvents and acids are potentially hazardous materials and must be handled, stored, and transported accordingly. Solvents shall never be used in a closed building. See the site-specific health and safety plan and/or the chemical's MSDS for specific information regarding the safe use of the chemical.
- Decontaminated equipment shall be allowed to air dry before being used.
- Documentation of all cleaning and field QA sampling shall be recorded in the appropriate logbook.
- Gloves, boots, safety glasses, and any other personnel protective clothing and equipment shall be used as specified in the site-specific health and safety plan.

5.1 Heavy Equipment Decontamination

Heavy equipment includes drilling rigs, well development 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 shall be upwind of the area under investigation.
- With the rig in place, spray areas (rear of rig or backhoe) exposed to contaminated media 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 shall 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 shall 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 shall 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

Follow these steps when decontaminating sampling equipment:

- Set up a decontamination line on plastic sheeting. The decontamination line shall 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*: Polyvinyl chloride or plastic items shall 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 shall 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). 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.
- 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 shall 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 shall 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 shall 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. shall be decontaminated between samples and after use with analyte-free, or better, water.

5.6 Waste Disposal

Refer to site-specific plans and SOP 2-2 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 shall be generated, each type of waste shall be contained in separate containers.
- Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste.
- Waste liquids shall 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 shall 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.

_____. Hazardous Waste Remedial Actions Program. 1996. *Quality Control Requirements for Field Methods*, DOE/HWP-69/R2. September.

U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

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_____. Region 2. 1989. *CERCLA Quality Assurance Manual*, Revision 1.

_____. Region 4. 2001. *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*. November.

Environmental Data Management

SOP 4-8
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Date: March 2007

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1.0 Objective

The objective of this standard operating procedure (SOP) is to provide instruction to data managers, technical staff, and project managers in preparing an environmental project data management plan. The data management plan identifies and documents a project's requirements and responsibilities for managing and using environmental information. Details determined and provided in the data management plan must clearly define:

- Data types the project will generate and use
- Responsibilities for activities associated with information management
- How the project data will be managed
- When data transfers will occur and who will provide and receive data

Additionally, this SOP defines the technical approach for data management activities associated with the collection and analysis of environmental data.

2.0 Background

The data management plan must be completed at the beginning of the project lifecycle. This ensures that the necessary environmental data management systems and personnel are identified and in place before the initiation of data collection. Reviews and updates of the data management plan must also be completed as necessary.

The data management plan only addresses the management of a project's environmental information. Environmental information includes electronic and hardcopy records that document environmental processes and conditions and are used to support the project objectives related to environmental and remedial decisions. Information generated by the project activities (e.g., chemical, physical) and information obtained from outside sources (e.g., historical data) are managed within the scope of the data management plan. Information such as human resources and financial records are not within the scope of the data management plan.

Project managers, technical staff, and data coordinators have the responsibility for developing the data management plan. Additional staff (e.g., field team leaders, data users) shall also be involved in the data management plan generation as necessary. The minimum project data requirements will depend on the statement of work for individual projects. The project team shall work together to identify project data management requirements, define the environmental data collection and handling process, and define the project data management responsibilities. The process to generate a data management plan is provided in Section 4.0.

2.1 Associated Procedures

All SOPs used to collect environmental data are subject to the procedures and processes presented in this SOP. These include:

- CDM Federal SOP 1-1, *Surface Water Sampling*
- CDM Federal SOP 1-2, *Sample Custody*
- CDM Federal SOP 1-3, *Surface Soil Sampling*
- 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 1-7, *Wipe Sampling*
- CDM Federal SOP 1-8, *Volatile Organic Compound Air Sampling Using USEPA Method TO-15 with SUMMA® Canister*
- CDM Federal SOP 1-9, *Tap Water Sampling*
- CDM Federal SOP 1-10, *Field Measurement of Organic Vapors*
- CDM Federal SOP 1-11, *Sediment/Sludge Sampling*
- CDM Federal SOP 2-1, *Packaging and Shipping Environmental Samples*
- CDM Federal SOP 3-1, *Geoprobe Sampling*
- CDM Federal SOP 3-2, *Topographic Survey*
- CDM Federal SOP 3-4, *Geophysical Logging, Calibration, and Quality Control*
- CDM Federal SOP 3-5, *Lithologic Logging*
- CDM Federal SOP 4-1, *Field Logbook Content and Control*
- CDM Federal SOP 4-3, *Well Development and Purging*
- CDM Federal SOP 4-4, *Design and Installation of Monitoring Wells in Aquifers*
- CDM Federal SOP 4-6, *Hydraulic Conductivity Testing*

3.0 General Roles and Responsibilities

A general description of roles and responsibilities associated with environmental data management is provided below. It shall be understood that not all roles listed below will be required on all projects and that one person may perform multiple roles.

Project Manager - The project manager has the overall responsibility for completing the project. With respect to data management, this involves directing the project team in identifying existing sources of data, identifying the specific project study parameters (e.g., scope of the project), and selecting an effective data collection approach. Additionally, the project manager ensures that data management requirements are effectively communicated in subcontractor statements of work.

Technical Leader - The technical leader serves as the single point of contact for technical issues. This person provides support during the planning, implementation, and reporting of the project.

Project Team - The project team consists of technical and support staff (e.g., data management and administrative staff) who completes various tasks on the project. The project team is responsible for the development of requirement documents (e.g., sampling plans) and ensuring that client contractual requirements are met.

Field Team Leader - The field team leader supervises field teams during planning and implementation of field data collection. The field team leader ensures that field activities are documented according to project-specific requirements, reviewed as required, and that deviations are tracked and justified.

Field Team - The field team consists of individuals who perform activities detailed in the project-specific requirement documents. Field team responsibilities include recording field activities and information as required by the project-specific planning documents. Quality assurance reviews of procedure implementation are completed by a qualified field team member. Quality assurance reviews include ensuring samples are collected as required, calibrations are completed correctly, and that all information is recorded as required.

Data Management Team - The data management team consists of a data manager and data support staff. The data manager is responsible for developing and implementing the project data management plan and ensuring that requirements specified in the data management plan are met. The data manager ensures that existing data and new data generated during the course of the project are incorporated into the project files and applicable databases. The data manager also identifies and obtains appropriate data management training for the project team. The data manager is responsible for overseeing the data support staff.

Data support staff are responsible for entering environmental project data into the project files or database and ensuring that all information is entered accurately. Data support staff also work with the field teams and data users to ensure that data collection is complete and access to the data is appropriate.

Laboratory Coordinator - The laboratory coordinator develops the project-specific analytical statement of work. Analytical methods, detection limits, laboratory quality control requirements, and deliverable requirements must be detailed in the statement of work. The laboratory coordinator also communicates with the data manager to ensure that hardcopy and electronic deliverable formats are specified and meet project requirements.

Data Validation Coordinator - The data validation coordinator is responsible for developing the data validation process specific to the project requirements and is responsible for supervising data validation staff. Included in this process is the approach to verifying that analytical data and field data are complete and accurate, have fulfilled the requested analyses, and are in concurrence with the contract requirements. If discrepancies arise, the data validation coordinator interfaces with the laboratory for resolution. If data validation occurs via a subcontractor, the data validation coordinator is responsible for the development of the subcontractor statement of work and supervision and review of the subcontractor's work.

Data validation staff are responsible for ensuring that analytical data and field data are accurate according to a project-specific set of criteria, including the evaluation of quality control samples to ensure analyses are performed within specified control limits. All validation issues must be identified and corrected. Qualifiers may be assigned to the data to indicate concerns about usability.

Data User - Data users are members of the project team who require access to project information for project decisions and to prepare deliverables. The data user is responsible for documenting information used (e.g., geographic information system [GIS] coverage, database queries, statistical analysis completed) to generate any data deliverables (e.g., data tables, maps). This requirement ensures that deliverables may be reproduced in the future using an identical process. Additionally, the data user is responsible for determining whether or not the data used meet their specific usability requirements.

Note: Responsibilities may vary from site to site. Therefore, all team member responsibilities shall be defined in a work plan or site-/project-specific quality assurance project plan (QAPP).

4.0 Data Management Plan

This section describes the process to complete preparation of a project data management plan. The data management plan must be completed early in the life cycle of a project to ensure that the necessary and appropriate data management systems and personnel are identified and in place before a project begins to generate data. The data management plan identifies and documents the project requirements and responsibilities for managing and using environmental information. The data management plan must provide enough detail to clearly define:

- The types of data the project will generate and use
- Responsibilities for information management activities and procedures to follow
- How the project will manage its data
- When data transfers will occur and who will provide and receive data

4.1 Data Management Plan Outline

The project manager, data manager, and technical leader will evaluate project and client requirements to prepare the data management plan. The following outline shall be customized to meet the project-specific requirements. Additionally, as the project evolves over time, the data management plan must be reviewed and updated periodically to ensure that it suitably meets modifications to the project requirements.

Section 1 - Introduction

- Briefly describe project objectives
- Briefly describe data quality and management objectives
- Briefly describe data management plan objectives and organization
- Summarize the types of data required by the project
- Summarize the data management activities

Section 2 - Data Sources and Needs
- Identify the project data needs (e.g., internal sources, external sources)
- Identify data collection formats (e.g., field forms to be used, GIS coverage)

Section 3 - Data Management Team Organization
- Present roles and responsibilities
- Identify lines of communication

Section 4 - Data Management Activities
- Project planning and setup and data flow process (e.g., sample locations and identification nomenclature, laboratory subcontracting)
- Field data collection (e.g., sample tracking, field data entry, historical data)
- Data validation, evaluation, and qualification
- Database entry and post qualification
- Data analysis and output (e.g., mapping format and specifications, data sharing, figure generation)
- Data quality assurance and quality control
- Data usability

Section 5 - Data Management and Geographic Information System and Process Administration
- Identify project data management and geographic information systems to be used
- Identify any project-specific systems to be used for analysis, modeling, or mapping
- Describe how the project will ensure that data, geographic, and analysis systems and processes are controlled (e.g., configuration change control, security)
- Project documentation and storage (records management)
- Quality control implementation (e.g., quality control of electronic documents, GIS software guidelines, other analytical software guidelines)

4.2 Data Management Plan Preparation

Data management plan development includes a seven-step process. Each of the steps involved in the process are annotated below. Critical issues of the data management plan are the definition of project activities, roles, and responsibilities related to data management.

- **Determine the Data Manager** - Every project must have a project data manager. The data manager is responsible for assisting in identification of data management and data record needs according to project and client requirements. The data manager will work with the project technical leader in the development of the data management plan.

- **Identify the Project Data Needs and Sources** - The data needs and sources will be determined during project scoping meetings and by discussions with the project team. The data types, sources, and uses must be considered when requirements are being defined. Identification of data types includes topics such as:

  - Maps
  - Field measurements
  - Inspection information
  - Sample media
  - Analyses
  - Locations
  - Quantity of samples
  - Quality for intended use
  - Observations

  Data source considerations will include historical, project-generated, and other similar projects. Examples of data uses include modeling (contaminant contouring/transport, geospatial), regulatory compliance, remedial investigation, and risk assessment.

- **Identify Existing Database Requirements** - A requirement may exist that all project information shall be transferred into a pre-existing client database. Close coordination with the client data managers and review of guidance will provide information associated with specific requirements. These requirements will include specific data loading tools, submission file groupings, and data entry guidance.

- **Identify Records Management Requirements** - The project manager, data manager, and technical leader will identify the records management requirements. Additionally, they will identify the types and quantities of records that will be generated and determine what requirements are necessary for their transmittal to the client or central storage location. Records will consist of the guidance and planning documents (sampling plan, quality assurance plan) that detail how samples and data are collected, processed, evaluated, and used by the project.

- **Define Data Management Activities and Responsibilities** - This step details the data flow process for the project. Within this process, responsibilities for data collection, data transfer, updates, and maintenance are defined. A clear understanding of these responsibilities is critical to ensure that the technical activities of the project are completed efficiently and effectively. Section 5.0 of this procedure provides generic activity descriptions and responsibilities common to many environmental projects.

  The data flow process must be reviewed by the project team to ensure completeness and project specificity. Small projects may allow one individual to complete several roles and responsibilities whereas large projects may require multiple personnel to complete one role. Project team understanding and comprehension of the activities and responsibilities are important to the efficient implementation of the overall data management program.

- **Determine Database Needs** - The project manager, data manager, and technical leader will determine the database needs and requirements. Project components to consider during this process are the complexity, types, and volume of data the project will generate; types, frequency, and detail of reports required; and required accessibility of the data. Based on these components and any other project requirements, a database need will be determined. Automation of the database shall also be considered during this step. Database automation consideration shall include factors such as:

  - Volume of data
  - Frequency that data will be received
  - Format of the received data (electronic or hardcopy)
  - Time constraints on data reports
  - Complexity of the data

  After database needs have been determined, the project manager and data manager will identify appropriate personnel to support the data management process. Personnel identification support can include geographical information system specialists, laboratory coordinators, and data support staff. Additionally, the project manager and data manager must identify any training requirement appropriate to the project data management process.

- **Prepare the Data Management Plan** - Based on the decisions made in the preceding steps and the customized outline, the data manager and technical leader will prepare the data management plan.

5.0 Project Data Management Activities

This section identifies typical environmental data management activities in the context of a generic project lifecycle. It is unlikely that all activities presented will be implemented on a single project. Only activities applicable to project-specific data management requirements need to be implemented. The activities presented below have been grouped into three sections. Section 5.1 presents planning activities that will identify the project data needs, identify existing information, plan for project data collection, and identify data management requirements. Section 5.2 presents data collection activities, which include data management support that will provide for efficient field data and field sample collection, data processing, and reporting. Section 5.3 provides review and data use activities that include the evaluation of data quality and project reporting.

5.1 Planning Activities

Environmental projects are most commonly conducted to determine contaminant characterization, remedial design parameters, remedial action requirements, or to complete environmental monitoring of some type. Data generated from these activities are used as the basis for decisionmaking.

5.1.1 Project Scoping

Before making decisions on data management requirements, a complete understanding of the project is required. Completing a scoping exercise based on client requirements and available information is the first step in planning for development of data management requirements. The following activities are included in the project scoping exercise:

- **Project Definition** - The effort to define projects is highly variable and completely dependent on the complexity of the project. For example, the project may be defined specifically in the client statement of work (e.g., sample wells 1, 2, and 3 and analyze water for volatile organics) or may be iterative where a specific condition may require investigation with further refinement of the project scope based on the results and findings (e.g., delineate nature and extent of contamination). Some projects may also be defined by first determining what questions need to be answered to meet the project objective. Therefore, project scoping can be conducted in multiple phases. First, the project scope is initially determined based on limited information and data (such as the information provided in the client statement of work). Next, after the review of more detailed and specific information, the project may be defined more accurately. Some projects may go through a systematic planning process such as implementing the data quality objective (DQO) steps where contractor, client, and regulators are involved. Project definition serves as the method of focusing and developing a conceptual model of the project so that appropriate management tools can be identified. For example, for a project where characterizing the nature and extent of contamination is the objective, the conceptual site model will include determining the environmental setting, the area of contamination, the contaminants of concern, fate and transport of contaminants of concern, and potential human health and ecological risks associated with contaminants of concern.

- **Identify Historical Information** - Information may exist from previous investigations and similar projects within the project boundaries. This information can prove to be valuable in providing insight into operational processes, contaminants of concern, and environmental compliance issues as well as geographical information.

- **Project Scoping Meeting** - A project scoping meeting must be held to finalize the project objectives, project decisions, and project tasks necessary to meet the project objectives. The scoping meeting may include the project team members only or may also include clients, regulators, and other technical team members such as project engineers/geologists and risk assessors.

- **Implement DQOs** - During the scoping meeting, DQOs shall be discussed and resolved. The following seven step DQO process shall be implemented:

  1. State the problem
  2. Identify the goal of the study
  3. Identify information inputs
  4. Define the boundaries of the study
  5. Develop the analytic approach
  6. Specify performance or acceptance criteria
  7. Develop the plan for obtaining data

- **Project Data Requirements** - During the scoping meeting, project data collection needs shall be clearly identified in terms of data use, quantity, and quality. Additionally, decision criteria, acceptable levels of uncertainty, and acceptable levels of false positive and false negative decisions need to be established in accordance with applicable data quality objective guidance.

5.1.2 Acquiring Existing Data

Environmental data collected during previous investigations and studies can prove to be valuable with respect to descriptive information and contaminants. Historical information may contain details in areas such as environmental compliance, geographical data, and characterization investigations. Existing data shall undergo the same review and evaluation as any recently collected information. This review assists in ensuring the quality of data collected during the initial stages of the project. While a quality review of this data is advisable, obtaining the necessary quality control data is not always possible. Included in the process of acquiring existing data are the following activities:

- **Locate the Existing Data** - The project manager will define the criteria by which existing data will be considered relevant (e.g., time period). Based on these criteria and additional information potentially provided by the client, a file search will be completed. These data can include physical, chemical, and geographic information.

- **Document Existing Data** - Once existing data have been located and acquired, documentation of these data must be completed. These data will be transferred into the project data management files.

- **Evaluate Existing Data** - Data users will evaluate the existing data for relevance to the current project objectives and data requirements. An essential part of this step is to determine the quality and suitability of the existing data to the current project objectives and requirements. Existing data may have been collected for very different intended uses. After evaluation, the project team will determine which existing data are useful and applicable to the current project. Documenting and inventorying the evaluation and data selected for inclusion to the project files must then be completed.

- **Process Existing Data** - The data manager will incorporate the appropriate existing data into the project database. Processing the data includes converting information into common systems to be used for the project (e.g., common coordinate systems). All data processing steps completed during conversion and incorporation must be documented.

5.1.3 Project Data Collection Planning

Before starting this step, the project goals and data requirements must be defined to allow for the development of more detailed project plans. Included in the process of planning project data collection are the following activities:

- **Data Requirements** - Project data requirements need to have been developed during the previous project scoping activities. Types of data that will be required include site operations with respect to:

  - Hazardous substances
  - Disposal practices
  - Quantities of hazardous substances
  - Potential migration of contaminants
  - Site conditions
  - Historical and aerial photographs and base map data
  - GIS coverage of soils, geology, hydrogeology, and delineated contaminated plumes

- **Develop Project Work Plans** - All projects require that guidance documents be developed to describe in detail how the project objectives will be met. These guidance documents will range in complexity dependent on the project type, project complexity, and the project regulatory requirements. The guidance document must be developed using the level of detail required to enable any entity to implement it. Examples of projects requiring guidance documents include:

  - Remedial investigation/feasibility studies
  - Remedial design/remedial action
  - Engineering evaluation/cost analysis

  Additionally, supporting plans and procedures may need to be developed to supplement the work plan. Examples of supplemental plans are:

  - Sampling and analysis plans
  - Quality assurance plans
  - Health and safety plans
  - Waste management plans

- **Develop the Laboratory Statement of Work** - The laboratory coordinator will prepare the laboratory statement of work specific to the project requirements determined in the project work plans. The laboratory statement of work must detail:

  - The number of samples to be sent for analysis
  - The analytical methods
  - Reporting limits
  - Laboratory quality assurance/quality control requirements
  - Data deliverable requirements

  The statement of work must define the electronic data deliverable format and requirements and request an example from the laboratory to confirm requirements will be met. Additionally, the laboratory statement of work must define the data deliverable requirements necessary to ensure that validation and evaluation may be completed.

- **Develop Data Validation and Evaluation Criteria** - The data validation coordinator is responsible for developing the data validation and evaluation process. The data validation and evaluation process will document the approach to verify that project DQOs are achieved. The range of effort required to meet the project validation and evaluation needs

may range from none to very exhaustive, dependent on the client and project objectives. Validation and evaluation criteria may be modeled after national guidelines (e.g., National Functional Guidelines), client requirements (e.g., specific client work instructions or procedures), or a combination of both. Variables that are usually considered include:

- Sample preservation and holding times
- Calibration of instruments
- Blanks
- Laboratory quality control samples
- Field quality control analysis

The data validation and evaluation process will be included as a section in the project work plan or equivalent. If data validation and evaluation are completed by a subcontractor, the statement of work (detailing the project required process) will be developed.

5.2 Data Collection

The following data collection activities identify the data management team support and project team interactions that will ensure efficient field data and field sample collection, event documentation, data processing, and reporting.

5.2.1 Field Activity Preparation

After completing the work plan and detailed project plans, preparing for field activities is the next step. Preparing for field activities ensures that data and sampling processes for the project are complete and appropriate. Field preparation activities may include obtaining permits, surveying and marking sample locations, installing wells, and testing any required equipment. Data management team preparation activities include ensuring all data users have been trained and have access to the data management system, laboratory data deliverables can be transferred into the project database (laboratory test electronic data deliverables have been received and checked), project field forms have been created, and the records management requirements identified in the data management plan are established. Additional field preparation activities are detailed below.

- **Data Management Plan and Data File Management** - The data manager will ensure that the data management plan is implemented. Implementation of the plan must begin before collecting field data to ensure that the system developed is appropriate and functional. The data manager will also ensure that the data file management system is established before collecting field samples or measurements.

- **Site Survey** - The field team leader inspects the project site area for placement of sampling locations and equipment. These locations shall be documented on site maps and stored in the project files (hardcopy, GIS etc.). These identified locations shall be physically marked at the site with flagging, paints, stakes, etc.

- **Identification of Sampling Locations** - The sampling stations identified are differentiated by assigning a unique identifier to each location. Historical location identifiers must be confirmed and consistently used throughout the project. Geographic coordinates must then be obtained for each sampling location. The method of determining the geographic location shall be selected based on project accuracy requirements. Information used to select and document accuracy must be maintained. Examples of this information include the type of equipment, processing software, and accuracy reports.

- **Installation of Sampling Locations** - Sampling location installation will include the placement of:
  - Monitoring wells
  - Boreholes
  - Direct push locations
  - Cone penetrometer locations

  Record and maintain the following information:
  - Drilling and monitoring well construction information (e.g., borelogs, construction logs)
  - Development logs
  - Purging logs
  - Associated measurements (e.g., air monitoring, water quality monitoring)

- **Instrumentation and Equipment** - After placement of the sampling locations, any required instrumentation and equipment must be installed. An inventory of the instrumentation and equipment must be maintained. Included in the inventory will be:

  - The type and manufacturer of the instrument and equipment
  - Calibration requirements
  - Identification numbers
  - Type of data the instrument will collect

- **Project Database Update** - All information and data collected during the preparation activities shall be captured in the project database. After these preparatory steps have been completed, the collection of environmental data will begin. The project data manager shall be kept current on sampling and data collection schedules and activities.

5.2.2 Field Data Collection

Depending on the type of project, field data may consist of several different types. Field data may consist of observations, checklists, photographs, or preliminary field screening analytical data. Any time field data collection activities are conducted, they must be planned and scheduled. Data entry items such as checklists, field logbooks, and field data forms must be generated during the planning stage to ensure that the required data are captured. Information and data collected during the field data collection activities must enable the project team members to recreate or reconstruct the events that occurred during the activity. Due to project data needs ranging from simple to complex, not all steps provided below will apply to all projects.

- **Schedule** - The project manager is responsible for scheduling the field activity. Each field activity event will be defined by the site requirements and the data requiring collection. The appropriate work plans will be referenced to specify the data that will be collected. After completing the schedule, the field team and data manager are informed of the requirements by holding a field planning meeting.

- **Mobilization** - Mobilizing for a field activity includes generating any specific field forms or checklists, ordering, receiving and inspecting required field equipment, and conducting required project-specific training.

- **Field Data Forms** - Field data forms that will contain predefined information about the field event (e.g., location identifiers, site name, and quality control samples) shall be preprinted to ensure consistency and increase efficiency in the field. Some projects may have automated field data collection systems that would replace the need for field forms (e.g., data loggers). These data loggers will be prepared and tested at this time.

- **Field Instruments** - Many instruments used for collecting field measurements require calibration. Calibration of these instruments provides for accurate field measurements. Information that must be collected during the calibration of field equipment includes the type of instrument, instrument serial number or property number, time and date of calibration, instrument reading before and after calibration, and the calibration medium used. Calibrations of field equipment shall always be completed in accordance with the manufacturer's recommendations. For field equipment that only requires a calibration check, the vendor's date of calibration shall be recorded.

- **Field Data** - Field data are always collected at the same time as analytical samples. Examples of field data are:
  - Photographs
  - Water quality parameters
  - Checklists
  - Surveys
  - Time and date of sample collection
  - Weather conditions

- **Quality Assurance Review** - The project manager is responsible for ensuring that quality assurance reviews are completed. A quality assurance review of the field data collected will be completed. The field data (e.g., logbooks, field forms) review ensures that the data are recorded correctly and the activities are completed in compliance with the planning documents. The quality assurance review will determine if discrepancies between the planned events and actual events occurred.

- **Compilation of Field Data** - The field team leader is responsible for ensuring that the field data are compiled and submitted to the data manager. Compiling the field data will include copying the field forms, downloading data loggers, and verifying that the field data were recorded as required.

5.2.3 Field Data Processing

Processing field data provides the mechanism for making the data available to the data users. The project manager is responsible for completing this process. Field data will include logbook copies, field forms, checklists, and data logger data. Since project data collection will vary significantly from one project to the next, not every project will require the completion of the following steps. An important part of preparing the data management plan is defining this process specific to the project requirements.

- **Project Files** - The field data collected during the field activity and any changes or deviations implemented must be documented and placed into the project files.

- **Field Data** - The following steps only apply to a project where an electronic database is required. Hardcopy field data will be entered into the electronic database. The data entry will be reviewed for accuracy by an independent person to verify correctness. Electronic field data (e.g., from data loggers) will be processed by programs that are designed for use with the specific piece of equipment that logged the data.

- **Error Resolution** - Any errors identified during field data processing or on review of field documentation must be resolved. Resolution is accomplished through discussions with project personnel.

- **Updates** - Upon completion of field data processing, the project database and project files must be updated. The data manager then makes the data available to project personnel for use.

5.2.4 Field Sample Collection

Field sample collection includes all activities implemented to gather samples from a particular site. Field sampling activities are planned and scheduled. Before implementation, the required field data forms, field logbooks, etc. are prepared. Recorded information is intended to provide data and observations to enable the reconstruction of the field sampling activities. The following process steps can be implemented as required:

- **Schedule** - The project manager will prepare a schedule of sampling events. The schedule shall include the types and number of samples to be collected at each location.

- **Generation of Sampling Labels and Forms** - Each sample collected during the scheduled sampling event will receive a sample label and sample collection form. Information to be captured on the sample container labels includes the sample location, container type, preservative, and analysis. Field forms for each can also be generated. Field forms may be preprinted and include lines for documenting conditions under which the sample was collected (e.g., moisture content, depth, water quality parameters).

- **Notification of Analytical Laboratories** - The analytical laboratories need to be notified of the sampling activity schedule. The laboratory needs to be informed of the anticipated arrival of sample shipments including the numbers of samples and the types of analyses that will be requested.

- **Acquisition of Equipment and Supplies** - All equipment required to complete the field sampling activity must be ordered, received, and documented. Notation of all equipment identification numbers and serial numbers must be made. An equipment checklist may be used to document this step. All supplies needed to accomplish the scheduled sampling activities, including sample containers and shipping materials need to be assembled.

- **Sample Collection** - Samples will be collected in accordance with required sampling procedures. Information regarding sampling activities, site conditions, and deviations from the planning documents will be recorded in the field logbook or field data forms.

- **Sample Processing -** Samples collected in the field may need additional preparation before shipping to the laboratory. Two examples of additional processing that may be required are compositing of samples and filtering of an aliquot of the sample.

- **Updates -** The project database and project files need to be updated with the information collected during the field activities. A part of this process includes the verification that field data entered into the database are correct. Verification consists of comparing field forms and field logbooks to the information entered.

5.2.5 Submitting Samples for Analysis

Submitting samples to a laboratory for analysis includes preparation, packing, documenting, shipping, and verification of sample receipt. The process for submitting samples to a laboratory for analysis is detailed below.

- **Preparation for Shipment -** Preparing to ship samples includes the final sample processing such as splitting, compositing, or filtering. All sample containers shipped to a laboratory must have labels identifying, at a minimum, the sample number or identifier, analyses to be completed, and sample collection date and time. Sampling shipments shall be completed in accordance with CDM Federal SOP 2-1, *Packaging and Shipping of Environmental Samples.*

- **Chain-of-Custody Documentation -** All samples collected need to be documented and accompanied by a chain-of-custody form. The chain-of-custody must identify, at a minimum, the following:

  - Sample identification number
  - Matrix
  - Collection date and time
  - Sample type
  - Preservative
  - Analyses
  - Signature blocks for documenting sample transfers

  Sample chain-of-custody must be completed in accordance with CDM Federal SOP 1-2, *Sample Custody.*

- **Shipping Samples -** Samples will be shipped in accordance with CDM Federal SOP 2-1, *Packaging and Shipping of Environmental Samples.* Each sample shipped shall be checked against the chain-of-custody as it is packed for shipment.

- **Laboratory Receipt of Samples -** The laboratory will confirm that custody seals are still intact, the number of samples received matches the chain-of-custody, and the analyses match the sample labels and chain-of-custody. Additionally, the laboratory will note the condition of the samples when they are received against any noted requirements (e.g., 4° Celsius) on the chain-of-custody. The chain-of-custody will be signed and dated as received by the laboratory. A copy of the chain-of-custody shall be faxed back to the shipper for confirmation of sample receipt.

- **Confirmation of Sample Receipt -** The laboratory coordinator is responsible for confirming that the information provided by the laboratory is accurate. Confirmation is required for the following items:

  - What samples were received
  - Condition of samples upon receipt
  - Presence of signature on laboratory chain-of-custody form
  - Sample identification numbers
  - Types of analyses performed

  The laboratory coordinator is responsible for resolution and reconciliation of any conflicting information.

- **Sample Shipping Documentation -** Sample shipment files will include information with respect to the completion of the shipping process. This documentation will include:

  - Signed copy of the chain-of-custody
  - Shipping company airbill if applicable
  - Laboratory sample receipt or login form
  - Field forms associated with samples included in the shipment

- **Laboratory Analysis -** The laboratory will analyze samples according to the laboratory statement of work and the requested analyses identified on the chain-of-custody.

5.2.6 Sample Data Processing

Sample data processing includes receiving and processing the laboratory data package and making the data available for review. Activities associated with this process are data package receipt, evaluation of the data package, and updating the project database with the data package information. The process for these activities is detailed below.

- **Receiving the Data Package** - The laboratory shall send the data package to the project laboratory coordinator. At a minimum, the data package will consist of a hardcopy of the analytical results. The laboratory coordinator will note which samples the data package represents and review the data package for completeness and legibility. Any problems identified during this review must be communicated to the laboratory and corrected. If an electronic data deliverable is a part of the data package, it may be either sent directly to the data management team or retained by the laboratory coordinator and distributed after review. If an electronic data deliverable is not provided as a component of the data package and the data needs to be entered into the database, the laboratory coordinator will provide a copy of the data package to the data management team as required for data entry.

- **Evaluation of the Data Package** - Upon receipt of electronic data deliverables, the CD-ROM or other media will be scanned for possible viruses before loading the information onto a computer. If a virus is detected, the laboratory will be notified immediately and another electronic deliverable requested. Electronic data deliverables shall be compared to the hardcopy version of the data package to ensure consistency and accuracy. In cases where no electronic copy exists, and the entry of the hardcopy data package into an electronic database is a project requirement, verification of the accuracy of the entered data is required subsequent to completion of data entry. All errors and problems identified during the evaluation must be documented and resolved during the evaluation. Any changes made to the hardcopy data package and the electronic data package must be documented.

- **Update the Project Database** - The project database will be updated with the sample results and associated laboratory data qualifiers. Some projects may also require additional quality control information in the database. Examples of the type of information that may be required include:

  - Results from the matrix spike/matrix spike duplicates
  - Percent recoveries
  - Laboratory control samples
  - Blanks

  Documentation of problem resolution and changes made to the data package must be maintained.

5.3 Review and Data Use

The data review process determines whether a set of environmental data meets the requirements established during the project scoping. The process involves the data management team, the laboratory coordinator, and the data users. Before completing the data review, the data validation and evaluation process must be completed to ensure data meet analytical guidelines since qualifiers affect the usability of the data..

5.3.1 Data Validation and Evaluation

Validation and evaluation of environmental data is performed to evaluate the usability of the data for the intended application. The process is equally applicable to field data as well as analytical laboratory data. Data of questionable quality or representativeness are qualified to inform the data user of the limitations associated with the data use. The process to complete a data validation and evaluation is presented below.

- **Data Deliverables** - Data are received in either hardcopy or electronic format by the data validation coordinator. These data deliverables are evaluated against the requirements specified in the analytical laboratory statement of work or the client requirements. Upon completion of the evaluation of the data deliverables with respect to the contract requirements (laboratory subcontract or client contract), the data deliverables are forwarded to the validation and evaluation personnel. If the data validation and evaluation is not required for the data deliverable, it is forwarded to the data manager for uploading into the project database.

- **Validation and Evaluation of Data** - Data deliverables are validated and evaluated according to the procedures and requirements established during the project planning and data management plan development. Following validation and evaluation, the data are forwarded to the data management team for subsequent update of the project database.

- **Data Validation and Evaluation Report** - The data validator and evaluator will prepare a report documenting the process used to validate and evaluate the data, the usability of the data, and the qualification of the data, if applicable.

5.3.2 Data Review

Review of the data encompasses all data and supporting documentation, historical and recent, collected by the project activities as defined during the project scoping. Evaluation of the data will include the following process.

- **Evaluate Data for Outliers** - The data evaluation will first review the data to detect possible outliers. If extreme values are observed, a review of the potential for sampling and analysis problems must be completed to determine the accuracy of the data point. This review may include the evaluation of historical data ranges for the particular analyte at a particular location, or comparing similar analytical method results for samples processed differently (e.g., filtered vs. unfiltered). Based on the results of this evaluation, a determination about the use of the outlier result can be made.

- **Evaluate Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC)** - Precision, accuracy, representativeness, completeness, and comparability make up the PARCC parameters.

Precision is the degree of agreement between independent measurements and is determined by the evaluation of laboratory control sample and laboratory control sample duplicate pairs, the matrix spike/matrix spike duplicate pair or an environmental sample and environmental duplicate pair analyses.

Accuracy is the closeness of agreement between an observed value and an accepted value. Accuracy is determined by comparing percent recovery of spiked samples such as laboratory control samples and matrix spike samples.

Representativeness expresses the degree to which the data accurately reflect the analyte or parameter for the environmental media examined at the site. Representativeness is a qualitative term and is evaluated based on use of proper sample design, sample collection methods, use of standard analysis methods, etc.

Completeness is the measure of the amount of valid data received from the laboratory or field measurements. Completeness is determined by dividing the number of valid results by the number of possible results.

Comparability is the confidence with which one data set may be compared to another data set produced by different laboratories or field instruments. Comparability is a qualitative term and can be evaluated by reviewing sampling methods, sampling devices, and standard control limits. Understanding the PARCC parameters provides a level of confidence in the data reported for decisionmaking purposes.

- **Evaluate Data Quality** - An integral component of the data review process is the comparison of results against the project-specific data quality requirements established during project planning. Results of the data quality evaluation will determine if the data meet or exceed the data quality requirements necessary for decisionmaking. A final usability determination is made by the data reviewers. If required, data qualifiers are placed on the data to indicate usability.

- **Update Database** - After the data review is complete, the project database must be updated with the qualifiers assigned. Updating of the database also includes noting the qualifiers on the hardcopy of the data package.

5.3.3 Data Analysis and Use

Data analysis and use consists of the activities necessary to process the data and transform the entire data set into customized data sets for the generation of deliverables for decisionmaking and reporting. Data users may use only portions of data (e.g., geological or chemical) or summarize the data to generate tables, graphs, text, maps, or other deliverables necessary to describe the results obtained and the conclusions drawn. The analysis process is very often iterative. Results and conclusions from one analysis will often lead to other analyses. The process for data analysis and use is presented below.

- **Data Selection** - Data analysis will usually focus on a particular subset of the data collected. Data selection involves defining these subsets, querying the data, consolidating these data from the project database, and transferring the data to the appropriate tool for analysis (drafting, GIS, statistical program, etc.). Standardization may also need to occur at this point in the process (e.g., units, analytes, spatial).

- **Report and Analyze Data** - Data analysis involves summarizing the data to ensure that the technical requirements of the project are met. Examples of data analysis include statistical, risk assessment, and modeling. Results of the analysis are then used to report information in the form of tables, graphs, maps, text, and three-dimensional visualizations.

- **Documentation** - The information necessary to recreate a data analysis must be documented and kept. This includes the query criteria used to acquire the data subset, the database that provided the data for analysis, the procedure completed to perform the analysis, and the date the analysis is performed.

6.0 Software and Computer System

This section defines the documentation, quality assurance, and configuration control requirements for software and databases used on environmental projects. Section 6.1 applies to all projects using an electronic database and provides requirements for project-specific databases and software. Section 6.2 applies to all projects using an electronic database and defines requirements for the day-to-day operation of the data management system. The project data manager is responsible for implementation and providing guidance to meet the project objectives.

6.1 Project-Specific Database and Software Requirements

The need for a project-specific database and software will vary depending on the requirements of the project. A project may use an existing data management system and therefore not have project-specific software or databases, while other projects may develop project-specific databases and spreadsheets or software programs to analyze the project data. This section presents the minimum documentation, quality assurance, and configuration control requirements for project-specific databases and software developed during the course of a project.

- **Database Documentation** - Project databases will include spreadsheets and databases defined by the project data management team. The database documentation will identify the commercial database product, the database name, structure, and location using an entity relationship diagram (ERD) and data dictionary. The backup and recovery plans and processes for the database will also be documented. The minimum database documentation will consist of the name of the software used, names of the project databases created, database structure definitions (including names and field descriptions), any table relationships, and the storage location.

- **Software Documentation** - Software documentation will include the software program name, description, special requirements, revision, completion date, and evidence of technical and quality review. Documentation of deliverables created must also include the necessary information required to describe exactly how the data deliverable was produced. Software documentation may be maintained in hardcopy or included as a comment block embedded within the project software program. The minimum software documentation will consist of the name of the commercial software, name and version of any software written by the project personnel, author, date, revision, system requirements, and storage location.

- **Software Quality Assurance** - The project will define the quality assurance requirements for project-specific software. At a minimum, the functionality and analytical results of software programs will be reviewed to ensure that they meet requirements and objectives. The reviewer of the software will be someone other than the person who wrote the program. The project-specific software quality assurance requirements will be defined in the project data management plan.

- **Software Configuration Control** - Project-specific software will be protected from unauthorized modification or deletion. This can be accomplished by administrative controls or file security options. Changes to project software will be documented and maintained in the project files. The minimum project software configuration control documentation will include the commercial software used, the program names, revisions including the date, and the storage location.

6.2 System Administration

This section addresses the day-to-day operations of the data management system, including backups, access, security, data entry, and database control. All projects using an electronic database will adhere to the requirements in this section. The data manager is responsible for implementation of system security.

- **System Backup** - Project data will be protected from loss through a preventive backup and recovery process. Database backups will be performed on a periodic basis at a frequency to be defined for each project in the data management plan. The frequency will be selected to minimize the extent of consequences of data loss and time required to recover the data. Recovery procedures will be developed and documented. The detailed description of the backup and recovery procedures will be presented in the data management plan.

- **System Access** - Access to the computer system will be made available only to authorized personnel with an assigned role that specifies their access rights. Before gaining access, personnel may login by providing a login name and password.

- **Database Access** - Projects will protect data from unauthorized access by implementing administrative controls. Access will be managed based on the specific data user role. The mechanism for implementing control will be documented in the project data management plan.

- **Data Security** - Security considerations must establish a balance between making the data inaccessible to unauthorized individuals while still making it accessible to those who have access and maintaining the integrity of the data. Security processes apply to field data, electronic data, the database, and distribution of data outside of CDM. Original copies of all field records (e.g., chain-of-custody forms, sample collection sheets, and shipping airbills) will be placed in the permanent project file. All electronic files will be maintained in an electronic file management system and administered accordingly. Security of data distributed outside of CDM will be maintained by providing read only access to the data and/or including time, date, and version on the data files within the file naming convention.

- **Data Entry** - Data entry and transcription activities will be reviewed and checked to ensure that data integrity is maintained. Review and checking must occur for all data when moving or copying data from one media to another. For example, if a field technician collects data from a water quality instrument and records it in a logbook, enters the data from the logbook into an electronic format, and then transfers the data into a deliverable, verification of accuracy would be completed during or immediately after the transcription. The mechanism for data entry and transcription must be documented in the project data management plan.

- **Database Control** - Each project must establish database control requirements for the contents of the project database. The requirements must ensure traceability of field and laboratory data from its original reported values through changes to current values stored in the database. The control requirements will define the approval process required for making changes to the database and the documentation required for each database change. The minimum information maintained for each database change will include:

  - Description of the change
  - Reason the change was made
  - Name of the individual making the change
  - Date the change was made

7.0 References

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Appendix C

OCHCA Well Destruction Requirements

DESTRUCTION OF MONITORING WELLS AND SOIL BORINGS

All abandoned monitoring wells and soil borings shall be properly destroyed. A monitoring well is considered abandoned if it has not been used for one year.

1. Monitoring wells may be destroyed by the following methods:

   - Overdrilling the entire well, removing the well casing, filter pack, annular seal, and well box. The borehole shall then be filled with an approved sealing material.

   - Pressure grouting with an approved sealing material that flows through the perforations. This method is acceptable if there is no possibility of cross-contamination occurring between different zones. The casing may need to be ripped or punctured to ensure sealing material penetrates the filter pack and all other voids. The top five feet of the well and the well box shall be removed.

   - If the site is to be excavated, the monitoring wells may be excavated, the casing pulled, and any voids filled with sealant.

2. Soil borings are to be destroyed by filling borehole with an approved sealing material.

3. Approved sealing materials are:

   - Bentonite
   - Bentonite grout
   - Bentonite-cement
   - Neat cement
   - Sand cement grout
   - Concrete

DESTRUCTION OF WATER SUPPLY WELLS

All water supply wells shall be properly destroyed. An approved Well Destruction Permit must be obtained and a C-57 licensed contractor must be utilized. The following items are minimum requirements. More stringent requirements such as perforating the casing, may be required if conditions warrant.

1. Remove all obstructions, contaminants, and pumping apparatus from the well casing.

2. Measure total depth and casing diameter, calculate amount of sealing material required.

$$\frac{3.14 \times r^2 \times h}{27} = \text{cubic yards (yd)}^3 \text{ of sealing material}$$

r = radius = ½ diameter in feet
h = total depth of well in feet

3. Excavate around casing, a minimum of six (6) feet deep. Cut casing one (1) foot above excavation.

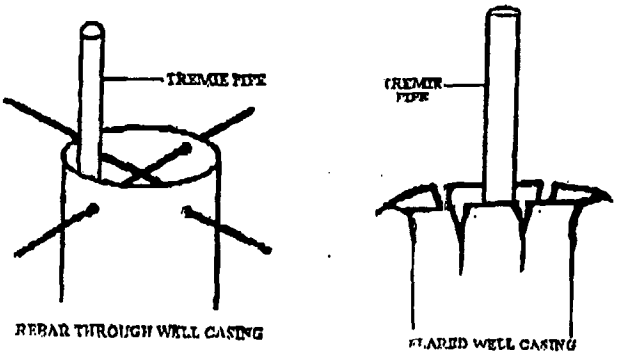
4. Flare casing (vertically cut casing a minimum six (6) inches in several places and bend metal outward). An alternate method is by drilling four (4) holes in the casing and installing rebar.

5. Pump an approved sealing material using a tremie pipe from the bottom to the top, allow the sealant to spill over into the excavation to form a cap at least one (1) foot thick.

6. Fill the excavation to grade.

Approved Sealing Materials:

- Neat Cement
- Sand-Cement Grout (10.3 Sack)
- Class A Concrete
- Bentonite



REBAR THROUGH WELL CASING

FLARED WELL CASING