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DRAFT TECHNICAL MEMORANDUM PHASE II EXPANDED REMEDIAL INVESTIGATION WORK PLAN FOR SIRE 2 ST JULIENS CREEK ANNEX VA

7/30/2004

CH2M HILL

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Draft Technical Memorandum

Phase II Expanded Remedial Investigation Work Plan for Site 2

St. Juliens Creek Annex
Chesapeake, Virginia

Prepared for

Department of the Navy

Naval Facilities Engineering Command Atlantic

Contract No. N62470-95-D-6007
CTO-0150

July 2004

Prepared by

CH2MHILL

SIGNATURE PAGE

Draft Technical Memorandum

Phase II Expanded Remedial Investigation Work Plan for Site 2

St. Juliens Creek Annex
Chesapeake, Virginia

Navy CLEAN II Program

Contract Number N62470-95-D-6007

Contract Task Order Number—0150

Prepared by

CH2MHILL

July 2004

Approved by: William J. Friedmann Jr. Date: July 30, 2004
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Senior Reviewer

Site 2 History & Description

Site 2 (Waste Disposal Area B) is an unlined waste disposal area that operated from 1921 to 1947. Site 2 covers approximately 1.5 acres at the corner of St. Juliens Drive and Cradock Street in the southwestern portion of the facility (Figure 1). Garbage, acids, and waste ordnance were reportedly disposed by open burning on-site and the ash was used to fill the adjacent inlet. The total volume of waste prior to burning is reported to have been approximately 35,185 cubic yards. Abrasive blast media (ABM) from ship overhaul and repair operations were also disposed of at the site. Construction debris (concrete and brick), as well as ABM, is visible at the site.

In the center of Site 2 is a water body surrounded by brush, trees, and grass that is directly connected to St. Juliens Creek via a 24-inch culvert. This inlet is tidally influenced and drains surface water from adjoining base areas into the creek. The Site 2 topography is generally level, sloping towards the inlet and St. Juliens Creek. Groundwater flow mimics the topography and flows towards the inlet and creek. Site 2 is bounded to the north by a parking lot; to the east by a grass-covered field; to the west by a stormwater drainage ditch and Cradock Street; and to the south by St. Juliens Road and St. Juliens Creek (Figure 2).

Remedial Investigation (RI) field activities were conducted at Site 2 in three phases. CDM Federal (CDM) conducted the first and second phases from June to November 1997 and from April to October 1999, respectively. CH2M HILL conducted the third phase from June to August 2001. The RI report recommended an Expanded RI (ERI) be conducted to further define the nature and extent of shallow groundwater contamination, to assess the source of VOC contamination in inlet surface water through stormwater and surface water sampling, and to evaluate potential impacts from the Site 2 inlet to St. Juliens Creek through sediment sampling. The ERI activities were performed in December 2003 and January 2004.

The results of the ERI sampling indicated elevated concentrations of VOCs in shallow groundwater on the western side of the inlet (MW07S) and in the storm sewers to the north of the site. A VOCs plume has been identified in shallow groundwater (Site 21) just north of Site 2. These potential VOC source areas may be impacting the Site 2 inlet. These findings indicate that further delineation of VOCs in groundwater and the potential for groundwater discharge to sediment is warranted.

Additionally, the *Draft Technical Memorandum, Site 2 Outfall Sediment Investigation Results and Development of Reference Sediment Data in St. Juliens Creek* (CH2M HILL, June 2004) recommended limited bioassays to characterize the toxicity of the inlet sediments to benthic-dwelling organisms. The sediment chemical analytical data collected as part of this bioassay investigation was also recommended to be used to further evaluate the low level risks that were indicated to avian piscivores reptiles from the presence of mercury in inlet sediments.

Field Investigation & Sampling Activities

A description of the proposed field activities are included in the following subsections. The *Final Master Project Plan (MPP), St. Juliens Creek Annex, Chesapeake, Virginia* (CH2M HILL, 2003a) addresses the protocols and standard operating procedures (SOPs) to be used for all investigations at SJCA. Table 1 provides a list of the SOPs applicable to the Site 2

of the waiver form is provided as Attachment D. Investigative activities will only proceed following the NOSSA approval of the waiver form.

Waste Delineation

A 2001 test pit investigation at Site 2 identified waste in the northwest corner up to the parking lot; no test pits were advanced into the parking lot area. It is anticipated that waste extends beneath the parking lot. As part of the groundwater investigation and in order to calculate the volume of waste beneath the parking lot in the northwest corner of the site, the lateral and vertical extent of waste will be estimated using the DPT rig and drilling operations. The delineation will rely on visual observation of split spoon/acetate sleeve collection of material from the DPT and drill rig and cuttings during the installation of the monitoring wells. It is anticipated that based on site history, some debris will be buried at depths below the water table and that filler material was placed at the surface for grading purposes prior to the placement of the parking lot. If the extent of the waste can not be determined during the groundwater investigation, then a geophysical survey may be conducted at a later date to conclude the extent of waste.

Information collected from the waste delineation will be used in the development and selection of remedial alternatives in an Feasibility Study (FS) for Site 2.

MIP Investigation

To delineate the vicinity of elevated trichloroethene (TCE) concentrations, identify a possible source of the TCE, and assess the physical characteristics of the aquifer at the site, hydrogeologic and geochemical data will be gathered utilizing MIP technology. The MIP logging will be conducted by DPT and will extend from the ground surface to the confining clay layer (Yorktown Confining Unit), approximately 20 feet (ft) below ground surface (bgs) at SJCA. Some locations may be covered by concrete, asphalt, and\or gravel. Coring will be required in concrete-covered areas. A depth continuous MIP survey will be completed in the boreholes to derive the vertical distribution of VOCs in groundwater and obtain a real-time lithologic profile. This information will be used to determine where the greatest concentrations of VOCs are present in the groundwater. MIP equipment will be used to measure the following continuously with depth:

- PID to detect petroleum hydrocarbons,
- flame ionization detector (FID) to detect methane,
- electron capture detector (ECD)to detect chlorinated solvents, and
- electrical conductivity (EC) revealing differences in grain size and salinity to map soil types.

Approximately 10 to 20 MIP borings will be performed to delineate elevated TCE. Exact MIP locations will be determined in the field. Based on the levels of VOCs detected in nearby wells, the MIP investigation will proceed in a manner which best delineates the extent of TCE and identify its possible source while safeguarding the analytical instruments used in the MIP process. Figure 3 shows initial proposed MIP locations. The initial 10 MIP boring locations will begin in the vicinity of known elevated TCE concentrations in the area of MW07S. Preliminary objectives of the investigation are to:

areas for additional protection. A locking watertight cap will be placed on the PVC pipe and the wells will be clearly marked.

Following installation, each monitoring well will be developed and stabilized water levels will be measured.

Groundwater Sampling

Groundwater samples will be collected no sooner than 72 hours after installation from the newly installed monitoring wells. Groundwater levels will be measured and recorded before sampling wells. In addition, groundwater parameters will be measured in the field using a multi-purpose groundwater quality meter before each sample is collected. The following parameters will be monitored in the field and recorded in the field notebook; dissolved oxygen (DO), pH, temperature, conductivity, turbidity, salinity and oxidation reduction potential (ORP). Groundwater samples will be collected using a peristaltic pump following a low-flow sampling protocol.

The groundwater samples will be analyzed for Target Compound List (TCL) VOCs, TCL semivolatile organic compounds (SVOCs), TCL pesticides/polychlorinated biphenyls (PCBs), Target Analyte List (TAL) total and dissolved metals, cyanide, explosives, total organic carbon (TOC), sulfate, nitrate, alkalinity, and ferrous iron (Table 2). The existing monitoring well, SJS02-MW07S, with elevated VOCs will also be monitored for field parameters and sampled for TCL VOCs, TOC, sulfate, nitrate, alkalinity, and ferrous iron analyses.

All groundwater samples will be collected by placing the sample tubing intake in the screened interval. For the collection of water samples for VOC analysis, the pre-preserved bottles will be filled completely so as to minimize aeration, and capped to prevent the entrapment of any air bubbles in the vial.

Samples will be contained in laboratory-prepared, pre-preserved sample bottles and packed on ice for overnight shipment to an off-site laboratory. Table 3 shows the required containers and holding times for samples as well as the analytical methods. The detection limits for the analytical methods are listed in the MPP.

Sediment Sampling for VOCs

Three sediment samples (Figure 3) will be collected from 0 to 6 inches below sediment surface with a stainless steel hand auger or trowel to minimize the potential loss of fine-grained sediments. The samples will be placed into a decontaminated stainless-steel bowl and homogenized prior to their placement in the sample containers (sediment collected for VOC analysis will be placed directly into the sample container and will not be homogenized). Water quality parameters (pH, temperature, conductivity, salinity, DO, turbidity, and ORP) of the overlying surface water will be collected and recorded in the field notebook. The sediment samples will be logged by a CH2M HILL geologist. The sediment samples will be analyzed for TCL VOCs, TOC, and grain size (Table 2).

Sediment Sampling for Toxicity Tests

Nine sediment samples will be collected for toxicity testing (6 potentially site-impacted samples and 2 reference samples). Three of the sediment samples will be collected from the

Rising and falling head slug tests will be performed in monitoring wells to evaluate aquifer hydraulic conductivity in the vicinity of the well. Slug tests will be performed after groundwater sampling using solid PVC slugs with clean bailer rope. A pressure transducer, such as a MiniTroll® transducer/data recorder capable of measuring to 0.01 foot will be used along with an electronic recording device, such as an In-Situ Hermit™, to obtain water level readings during the slug testing activities. The transducer and recording device will be used to record changes in pressure associated with water level recovery. A slug test will be considered complete when water level have recovered to 90% of its pretest level. Each test will be reviewed to determine if it was properly performed. Based on the known hydrologic conditions at the site and the quick response of the aquifers to slug tests (less than 10 minutes), the effects of tidal fluctuations within the inlet will not impact the results of the slug test.

Sampling Equipment Decontamination

All non-disposable sampling equipment; such as the water level indicator, trowels, bowls, hand auger, and slug test equipment; will be decontaminated immediately after each use in accordance with the applicable SOPs.

Heavy equipment such as drill rig and DPT equipment (augers, rods, or split spoons) will be steamed clean prior to each new DPT, MIP, or monitoring well location. A decontamination pad will be set up to prevent the run off of decontamination water and to allow for easy collection of decontamination fluids into a 55-gallon drum and treated as investigation derived waste (IDW).

Sample Identification

A standardized numbering system will be used to identify all samples collected during the field event (Table 4). The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples collected.

Quality Control (QC) Samples

QC duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and to provide an estimate of the components of variance and the bias in the analytical process. The details with regard to the number and frequency of field QC samples to be collected during the Site 2 investigation are included in Table 5.

Investigation Derived Waste (IDW)

IDW is expected to consist of drill cuttings from the soil borings from monitoring well installations, purge water (from well development and groundwater sampling), and decontamination fluids. Aqueous and soil IDW will be containerized in 55-gallon drums, which will temporarily be stored on-site. IDW drums will be labeled in accordance with the procedures outlined in the MPPs. Groundwater analytical results will be used for waste characterization and disposal of purge water. The soil-related wastes per individual monitoring well will be analyzed for Toxicity Characterization Leaching Procedure (TCLP) parameters. The IDW will be properly disposed of based on the results of the waste characterization.

and tracking, preparation and review of invoices, personnel resources, planning and allocation of resources, subcontractor coordination, preparation of monthly progress reports, and communication and coordination of events with the Navy and the project team.

Field activities are scheduled to begin in September 2004. Prior to initiating field activities, CH2M HILL will notify the Navy of the CH2M HILL staff and subcontracted personnel that will conduct the field investigations. It is estimated that it will require a minimum of two and possibly three mobilizations of up to 5 days each to complete the field activities.

Data Evaluation and Reporting

Following receipt of the validated data from the analytical laboratory, the groundwater results will be compared to the background 95% upper tolerance limits (UTLs) for groundwater and Maximum Contaminant Levels (MCLs) to determine the nature and extent of contamination. Hydraulic conductivities will be calculated from the slug test data to provide a better understanding of shallow groundwater characteristics. A revised Human Health Risk Assessment (HHRA) will be conducted for shallow groundwater incorporating the additional data collected at Site 2.

The sediment bioassay results will be used in conjunction with the chemical and physical sediment data to characterize the potential for adverse effects to benthic organisms in inlet sediments. Bioassays were selected for analysis because they directly measure the toxicity of sediments, accounting for both the bioavailability of chemicals in sediment and the toxicity of complex chemical mixtures. If the bioassays indicate sediment toxicity, the data will be further evaluated to identify (to the extent possible) the chemical(s) causing the observed toxicity. The chemical data collected will be evaluated to further characterize the low level risks that were indicated to avian piscivores from the presence of mercury in sediment.

The results from the Site 2 ERI and this further delineation will be incorporated into an addendum to the RI/HHRA/ERA for Site 2. The report will include a narrative explanation of the activities conducted, data evaluation, and recommendations for further action at Site 2. The report will be provided to the Navy, VDEQ, and EPA for review. Final reports will be prepared following review and approval.

References

CH2M HILL, 2003a. *Final Master Project Plan (MPP), St. Juliens Creek Annex, Chesapeake, Virginia.* July 2003.

CH2M HILL, 2003b. *Final Work Plan for the Expanded Remedial Investigation at Sites 2 and 5.* St. Juliens Creek Annex, Chesapeake, Virginia. December 2003.

CH2M HILL, February 2004. *Final Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment Report for Site 2.* St. Juliens Creek Annex, Chesapeake, Virginia.

CH2M HILL, June 2004. *Draft Site 2 Outfall Sediment Investigation Results and Development of Reference Sediment Data in St. Juliens Creek.* St. Juliens Creek Annex, Chesapeake, Virginia.

Phase II Expanded Remedial Investigation Work Plan for Site 2, St. Juliens Creek Annex, Chesapeake, Virginia

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July 30, 2004

Introduction

This technical memorandum provides the approach for the further delineation of potentially contaminated groundwater and sediment at Site 2, St. Juliens Creek Annex (SJCA), Chesapeake, Virginia. The objectives of the investigation are to:

- Further delineate the horizontal and vertical extent of waste on the eastern and northeastern side of the Site 2 inlet
- Further define the nature and extent of shallow (Columbia Aquifer) groundwater contamination with volatile organic compounds (VOCs) using membrane interface probe (MIP) technology followed by shallow monitoring well installation and groundwater sampling
- Determine if VOCs have impacted the deeper (Yorktown Aquifer) groundwater by installing one deep monitoring well and conducting groundwater sampling
- Evaluate the hydraulic characteristics of the shallow aquifer by conducting slug tests
- Assess if VOC-contaminated groundwater is discharging to the inlet by collecting sediment samples in the inlet
- Collect additional information necessary to evaluate the potential human health risks from shallow groundwater and make recommendations for a path forward
- Characterize the toxicity of inlet sediments to benthic-dwelling organisms by conducting sediment bioassays
- Further investigate the low level risks that were indicated to avian piscivores from the presence of mercury in inlet sediments with the additional chemical analytical data collected as part of the sediment bioassays

investigation. A health and safety plan (HASP) to address site-specific details relevant to the MPP is provided in Attachment A.

Mobilization Activities

As part of the field mobilization, CH2M HILL will procure the following subcontractors to support investigation activities:

- Utility clearance firm
- Munitions & Explosives of Concern (MEC)/ unexploded ordnance (UXO) avoidance support
- Direct-push technology (DPT) with MIP capabilities
- Drilling company able to provide hollow stem auger and well construction capabilities
- Analytical laboratory
- Data validation
- Investigation-derived waste (IDW) handler with hazardous waste disposal capabilities
- Licensed surveyor

Mobilization for the field effort includes procurement of necessary field equipment and initial transport to the site. Equipment and supplies will be brought to the site when the CH2M HILL field team mobilizes for field activities.

Prior to beginning any phase of work, CH2M HILL and its subcontractors will have field meetings to discuss the work items, worker responsibilities, and familiarize workers with the HASP (Attachment A). Prior to any intrusive activities, all appropriate permits (i.e. dig permit, hot work permit, etc.) will be obtained and the site will be marked for utilities. CH2M HILL will coordinate subsurface utility clearances with Miss Utility through the Naval Facilities Engineering Command (NAVFACENGCOM). No intrusive activities will be initiated until the utility clearance has been completed. A photo-ionization detector (PID) and colorimetric tube will be used for monitoring sample locations for VOCs as a health and safety precaution (Attachment A).

Due to the nature of investigative work being conducted, MEC/UXO avoidance practices will be implemented during intrusive activities. The MEC/UXO subcontractor for this project will be USA Environmental, Inc., a Navy approved MEC/UXO contractor. USA Environmental's work plan and Health and Safety Plan are provided as Attachment B. All CH2M HILL employees and subcontractors will be responsible for following the CH2M HILL Standard of Practices HSE-35 (Drilling) and HSE-91 (Ordnance Explosives) as provided in Attachment B. Notification procedures if any suspected live MEC/UXO is encountered are provided as Attachment C.

In accordance with Naval Ordnance Safety & Security Activity (NOSSA) Instruction 8020.15 dated March 8, 2004, NAVFACENGCOM submitted a Request to Waive Explosives Safety Submission form to NOSSA on July 30, 2004. The purpose of the waiver form is to provide sufficient information to waive the submission of Explosive Safety Submission (ESS). A copy

- Identify the highest TCE concentrations in the groundwater
- Define the extent of the "source area" (where concentrations are greater than 1 parts per million (ppm) or dependent on MIP instrument resolution)
- To guide the placement of three to five shallow and one deep groundwater monitoring wells

Monitoring Well Installation

Following completion of the MIP investigation, locations for three to five shallow and one deep monitoring wells will be determined. Of the three to five shallow wells, one will be placed upgradient of contamination and the remaining wells will be positioned at the downgradient extent of the detected contamination. The deep well will be placed in the center of the highest concentrations of contamination found during the MIP investigation to determine if there is potential vertical transport of contaminants to the Yorktown Aquifer.

If monitoring wells are installed in areas of ABM, a temporary casing will be used to seal off surface ABM while installing the well to preserve the integrity of the well and subsequent groundwater samples. The deep monitoring well will be constructed as a double-cased well to prevent potential VOCs contamination to the deep aquifer. During well installation, a CH2M HILL geologist will observe and record soil descriptions that include grain size, color, moisture content, relative density, consistency, soil structure, mineralogy, and other relevant information such as possible evidence of waste or soil and groundwater contamination. Soil samples for characterization will be collected at depths that are indicated by the MIP to contain the highest levels of VOC contamination.

Each new monitoring well will be constructed with 2-inch inside diameter (ID) Schedule 40 polyvinyl chloride (PVC) screen and riser. Ten ft long monitoring well screens will be machine slotted to 0.010-inch. The Columbia Aquifer well screens will be placed at a depth just above the Yorktown Confining Unit, estimated at 20 ft bgs. The Yorktown Aquifer well will be screened just below the Yorktown Confining Unit, estimated at 40 ft bgs. The final screen interval will be determined in the field by the on-site geologist based on depth to the top of the Yorktown Confining Unit and Yorktown Aquifer. A silica filter pack will be placed around the annular space of the well screen from the bottom of the boring extending to a depth of 2 ft above the top of the screen. A 2-ft bentonite layer will be placed at the top of the sand pack. After the bentonite has been hydrated, a cement-bentonite grout will be placed in the remaining annular space.

For the installation of the Yorktown monitoring well, the depth of the top of the Yorktown Confining layer will be determined and a minimum 8-inch ID Schedule 40 PVC casing will be installed a minimum of two feet into the top of the confining layer. The space between the native material and the PVC will be grouted to the ground surface and allowed to set a minimum of 24 hours prior to drilling into the Yorktown Aquifer.

The monitoring wells will be completed flush to ground surface with a watertight steel cover where wells will be placed in concrete, asphalt, or areas where using above-grade wells is not permitted. The above-grade monitoring wells will be completed with a locking steel protective casing set in a concrete pad. Guard posts may be installed in high-traffic

areas identified during the Steps 1 through 3 ERA as posing the greatest potential risk to benthic-dwelling organisms: SJS02-SD03, SD05, and SD06 (Figure 4). One sample will be collected upstream and two samples will be collected downstream from these locations. Additionally, sediment will be collected from the general area of three reference locations in St. Juliens Creek: SJREF-SD01, SD04, and SD05 (Figure 4). Representatives from the Biological Technical Assistance Group (BTAG) will be invited to participate in the selection of specific sample locations in the field.

The eight sediment toxicity samples will be collected in the same manner as the sediment VOC samples, however, a split of the homogenized sample will be sent to the analytical laboratory and the remaining portion of the homogenized sample will be submitted for bioassay analyses.

Water quality parameters (pH, temperature, conductivity, salinity, DO, turbidity, and ORP) and general conditions (e.g., tidal height/stage and the presence/absence of organisms) at each location will be determined and recorded at the time of sampling. The sediment samples will be logged. All sediment samples will be analyzed for toxicity, TCL SVOCs, TCL pesticides/PCBs, TAL metals, cyanide, TOC, grain size, acid-volatile sulfides/simultaneously extractable metals (AVS/SEM), and ammonia (Table 2).

A 28-day sediment bioassay with the amphipod *Leptocheirus plumulosus* (*L. plumulosus*) will be used for the sediment toxicity tests. *L. plumulosus* was selected for testing because it is tolerant of the salinity range expected to occur within the Site 2 drainage and the adjacent St. Juliens Creek to occur within the Site 2 drainage and the adjacent St. Juliens Creek, is indigenous to the Chesapeake Bay, and has direct exposure to chemicals in sediment via burrowing. Furthermore, studies have shown that *L. plumulosus* abundance in Chesapeake Bay sediments can be negatively correlated with the level of sediment contamination (Holland et al.1988, McGee and Fisher, 1999; as cited in EPA, 2001), suggesting its appropriateness for use as a bioindicator.

The *L. plumulosus* sediment bioassay will be conducted in a manner consistent with protocols presented in EPA (2001) and US Army Corps of Engineers (1996). Attachment E provides the toxicity-testing protocol and Quality control (QC) procedure of the laboratory most likely to perform the sediment bioassay. The endpoints of the 28-day bioassay are survival, growth, and reproduction. These endpoints are ecologically relevant and support the evaluation of benthic community viability which has been identified in the ecological risk assessment (ERA).

Hydrologic Characteristics

Further evaluation of the hydrologic conditions at Site 2 will be accomplished through groundwater gauging and slug testing to determine horizontal hydraulic conductivity at all monitoring well locations. Groundwater gauging will be used to further define the groundwater flow direction across the site. Groundwater levels will be measured with a water level indicator. The depth from the top of the casing to the groundwater level will be recorded to the nearest 0.01 feet. This information, when combined with other site-specific information such as hydraulic conductivity, extent of contamination, and chemical characteristics, may be used to estimate contaminant movement or source areas.

Disposable equipment, including personal protective equipment (PPE), poly sheeting, paper towels, and aluminum foil, will be disposed of as solid waste.

Surveying

Each monitoring well will be surveyed both vertically and horizontally using the Virginia State Plane Coordinate System. The vertical elevation accuracy will be ± 0.01 ft, while the horizontal location will have an accuracy of ± 0.1 ft. Specifically, the elevation for each monitoring well shall be established at the top of the monitoring well's inner PVC casing (this elevation point shall be designated by a permanent notch placed on top of each well's inner casing) and at ground surface. Locations of sediment samples will be determined by a CH2M HILL field scientist using a portable global positioning system (gps) unit.

Sample Analysis and Data Validation

CH2M HILL will track the samples from collection through analysis and obtain results from the subcontracted laboratory. All analyses will be conducted at a laboratory that fulfills all requirements of the Navy's Quality Assurance/Quality Control (QA/QC) Program Manual and U.S. Environmental Protection Agency's (EPA's) Contract Laboratory Program (CLP). A signed certificate of analysis will be provided with each laboratory data package, along with the applicable federal, state, and local regulations. All analyses will be performed following the highest level of Navy guidance. Analyses will include the proper ratio of field QC samples recommended by Navy Facilities Engineering Service Center (NFESC) guidance for the data quality objectives (DQOs). The laboratory will submit the data in hard copy and an electronic format that can be amended and readily incorporated into the geographic information system (GIS) for SJCA. The off-site laboratory has not been determined for this sampling event, however once the lab and data validator are identified, EPA will be notified.

Analytical results will be validated by a CH2M HILL subcontractor approved by the Navy. Procedures used for the validation process will be in accordance with *Region III Modifications to National Functional Guidelines for Organic Data Review Mutli-media, Multi-concentration* (EPA, September 1994), and *Region III Modifications to Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses* (EPA, April 1993). Data that should be qualified will be flagged appropriately. Results for QA/QC samples will be reviewed and the data will be qualified further, if necessary. Finally, the data set as a whole will be examined for consistency, anomalous results, reasonableness, and utility.

The data validator will be provided with the hard copy and electronic version of the laboratory results and will add data validation qualifiers to both versions. The electronic version will be examined for completeness and accuracy and downloaded into the CH2M HILL master database.

Project Staff and Schedule

The CH2M HILL Activity Manager for the SJCA is Mr. William Friedmann. Ms. Kim Henderson will act as the Project Manager. Activity and project management responsibilities include daily technical support and guidance, budget and schedule review

EPA, 2001. *Methods for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod Leptocheirus plumulosus* - First Edition. EPA/600/R-01/020.

EPA, 1993. *Region III Modifications to Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses.*

EPA, 1994. *Region III Modifications to National Functional Guidelines for Organic Data Review Multi-media, Multi-concentration.*

US Army Corps of Engineers, 1996. *Preliminary Protocol for conducting 28-day chronic sub-lethal sediment bioassays using the estuarine amphipod Leptocheirus plumulosus (Shoemaker).* Environmental Effects of Dredging Technical Notes, No. EEDP-01-36, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Table 1 List of Applicable Standard Operating Procedures from the Master Project Plans St. Juliens Creek Annex Chesapeake, Virginia
Field Parameters
Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature using the Horiba® U-22
Health and Safety Monitoring
Volatiles Monitoring with an OVM
Hydrogeologic Investigation
General Guidance for Monitoring Well Installation
Installation of Shallow Monitoring Wells
Water Level Measurement
Aquifer Slug Testing
Groundwater Sampling
Groundwater Sampling from Monitoring Wells
Low-Flow Groundwater Sampling from Monitoring Wells
Surface Water and Sediment Sampling
Sediment Sampling
Flat Bottom Boat Sampling Operations
Sample Preparation
VOC Sampling – Water
Preserving Non-VOC Aqueous Samples
Equipment and Field Rinse Blank Preparation
Field Filtering
Homogenization of Soil and Sediment Samples
Packaging and Shipping Procedures
Chain-of-Custody
Decontamination and Waste Management
Decontamination of Drilling Rigs and Equipment
Decontamination of Personnel and Equipment
Disposal of Waste Fluids and Solids
Utilities
Locating and Clearing Underground Utilities

Table 2
Site 2 Sample Summary
St. Juliens Creek Annex
Chesapeake, Virginia

Media	Number of Samples	Number of Field Duplicates	Analyses
New Groundwater Monitoring Wells	3 to 5	1	TCL VOCs, TCL SVOCs, TCL Pesticides/ PCBs, Explosives, TAL Total and Dissolved Metals, Cyanide, TOC, Sulfate, Nitrate, Ferrous Iron, Alkalinity
Existing Groundwater Monitoring Well SJS02-MW07S	1	0	TCL VOCs, TOC, Sulfate, Nitrate, Ferrous Iron, Alkalinity
Sediment (0-6")	3	1	TCL VOCs, TOC, Grain Size
Sediment (0-6")	4	0	Toxicity Bioassay, TCL SVOCs, TCL Pesticides/PCBs, TAL Metals, Cyanide, TOC, Grain Size, Ammonia, AVS/SEM

Notes:
AVS/SEM: Acid-Volatile Sulfides/Simultaneously Extractable Metals
PCBs: Polychlorinated Biphenyls
SVOCs: Semivolatile Organic Comounds
TAL: Target Analyte List
TCL: Target Compound List
TOC: Total Organic Carbon
VOCs: Volatile Organic Compounds

Table 3
Analytical Methods and Required Containers, Preservatives, and Holding Times For Samples
St. Juliens Creek Annex
Chesapeake, Virginia

Analysis	Method	Sample Container	Holding Time	Volume of Sample
Groundwater Samples and Aqueous QC Samples				
TCL VOCs	CLP OLM04	Three 40-ml glass vial with Teflon-lined cap	14 days	Fill completely; no air bubbles
TCL SVOCs	CLP OLM04	Two 1-liter amber bottles with Teflon-lined cap	7 days to extraction, 40 days to analysis	Fill to shoulder
TCL Pesticides/PCBs	CLP OLM04	Two 1-liter amber bottles with Teflon-lined cap	7 days to extraction, 40 days to analysis	Fill to shoulder
TAL Metals/Cyanide (total)	CLP ILM04	1-liter polyethylene bottle	6 months; 28 days for mercury; 14 days for cyanide	Fill to shoulder
TAL Metals (dissolved)	CLP ILM04	1-liter polyethylene bottle	6 months; 28 days for mercury	Fill to shoulder
Explosives	SW 846 8330	Two 1-liter amber bottles with Teflon-lined cap	7 days to extraction, 40 days to analysis	Fill to shoulder
TOC	EPA SM 415.1	100 mL glass bottle	28 days	Fill completely
Sulfate	EPA 375.4	100 mL polyethylene bottle	28 days	Fill to shoulder
Nitrate	EPA 352.1	250 mL polyethylene bottle	48 hours	Fill to shoulder
Ferrous Iron	EPA SM 3500D	250 mL polyethylene bottle	as soon as possible	Fill to shoulder
Ammonia	EPA SM 350.2	500 mL polyethylene bottle	28 days	Fill to shoulder
Alkalinity	EPA 310.1	250 mL polyethylene bottle	14 days	Fill to shoulder
Sediment Samples				
TCL VOCs	CLP OLM04	One 4-oz glass bottle with Teflon-lined cap	14 days	Fill completely
TCL SVOCs	CLP OLM04	One 8-oz glass bottle with Teflon-lined cap	14 days	Fill completely
TCL Pesticides/PCBs	CLP OLM04	Two 4-oz glass bottles with Teflon-lined cap	14 days	Fill completely
TAL Metals/Mercury/Cyanide	CLP ILM04	One 4-oz glass bottle with Teflon-lined cap	6 months; 28 days for Mercury; 14 days for Cyanide	Fill completely
TOC	EPA SM 415 or SW 846 9060	One 4-oz glass bottle with Teflon-lined cap	28 days	Fill completely
Toxicity Bioassay	28-d, Chronic *L. plumulosus* (EPA, 2001)	Two 1-gal polyethylene bottles	8 weeks	Fill completely
AVS	EPA 1991			
SEM	SW 846 6010B and 7471A	One 8-oz glass bottle with Teflon-lined cap	14 days	Fill completely (no air space)
Ammonia	EPA SM 350.2	One 4-oz glass bottle with Teflon-lined cap	28 days	Fill completely
Grain Size	ASTM D422	Not specified	Not specified	Not specified

Notes:
AVS/SEM: Acid-Volatile Sulfides/Simultaneously Extractable Metals
CLP: Contract Laboratory Program
PCBs: Polychlorinated Biphenyls
SVOCs: Semivolatile Organic Comounds
SW: Solid Waste
TAL: Target Analyte List
TCL: Target Compound List
TOC: Total Organic Carbon
VOCs: Volatile Organic Compounds

Table 4
Summary for Sample Identification Scheme
St. Juliens Creek Annex
Chesapeake, Virginia

First Segment		Second Segment		Third Segment	Fourth Segment
Installation	Site Type and Number	Sample Type	Sample Location; MW Depth	Solid Sample Depth	Sample Date; Qualifier
AA	ANN	AA	NNA	NN	NNAA
Installation: SJ = SJCA	Site Type: S = Site Site Number/Letter: 02 = Site 2	Sample Type: SD = Sediment MW = Monitoring Well	Sample Location: Sequential Location Number Monitoring Well Depth: S = Shallow D = Deep	Sample Depth: 00 = 0 to 0.5 ft bgs	Sample Date: NN = Last 2 digits of year A = Quarter of the Year: A = 1st Quarter B = 2nd Quarter C= 3rd Quarter D = 4th Quarter Qualifier (only if duplicate sample): P - Duplicate

Numbering format for QA/QC Samples:			
AAANN-AANNNNNN-AA			
AAANN = Installation, Site Type, and Number SJS02 = SJCA Site 2	AA = QA/QC type: TB = Trip Blank EB = Equipment Blank FB = Field Blank	NNNNN = DDMMYY (example = 091004)	AA = Media/Sample Type (example = SD)

Notes: "A"= alphabetic "N"= numeric

Table 5
General Requirements for QA/QC Sample Collection
St. Juliens Creek Annex
Chesapeake, Virginia

QA/QC Samples	QA/QC Sample Purpose	QA/QC Specified Collection Frequency
Field Duplicate	Measures accuracy of laboratory and field procedures	One per 10 samples per matrix or one duplicate per day, matrix, and site, whichever is more frequent
Trip Blank	Measures outside sources of potential VOCs contamination	One per cooler containing samples collected for VOC analysis
Equipment (Rinsate) Blank	Measures effectiveness of decontamination	One per day per equipment
Field Blank	Measures ambient condition	One per site per sampling event
Temperature Blank	Measures sample preservation temperature	One per cooler
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	Measures sample specific interferences due to the matrix of the sample	One per matrix for each group of up to 20 samples sent to a single laboratory (count QC samples)

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LEGEND

Site Boundary
Activity Boundary

N

0 500 1000 Feet

Figure 1
Location of Site 2
St. Juliens Creek Annex
Chesapeake, Virginia

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LEGEND

- Existing Deep Monitoring Well Locations
- Existing Shallow Monitoring Well Locations
- Site Boundary
- Site 2 Inlet Stream
- Extent of ABM
- Contours of Columbia Aquifer Potentiometric Surface (December 2003)
- Inferred Contours of Columbia Aquifer Potentiometric Surface (December 2003)
- Groundwater Flow Direction

N

0 100 200 Feet

Figure 2
Site 2 Existing Monitoring Wells
St. Juliens Creek Annex
Chesapeake, Virginia

CH2MHILL

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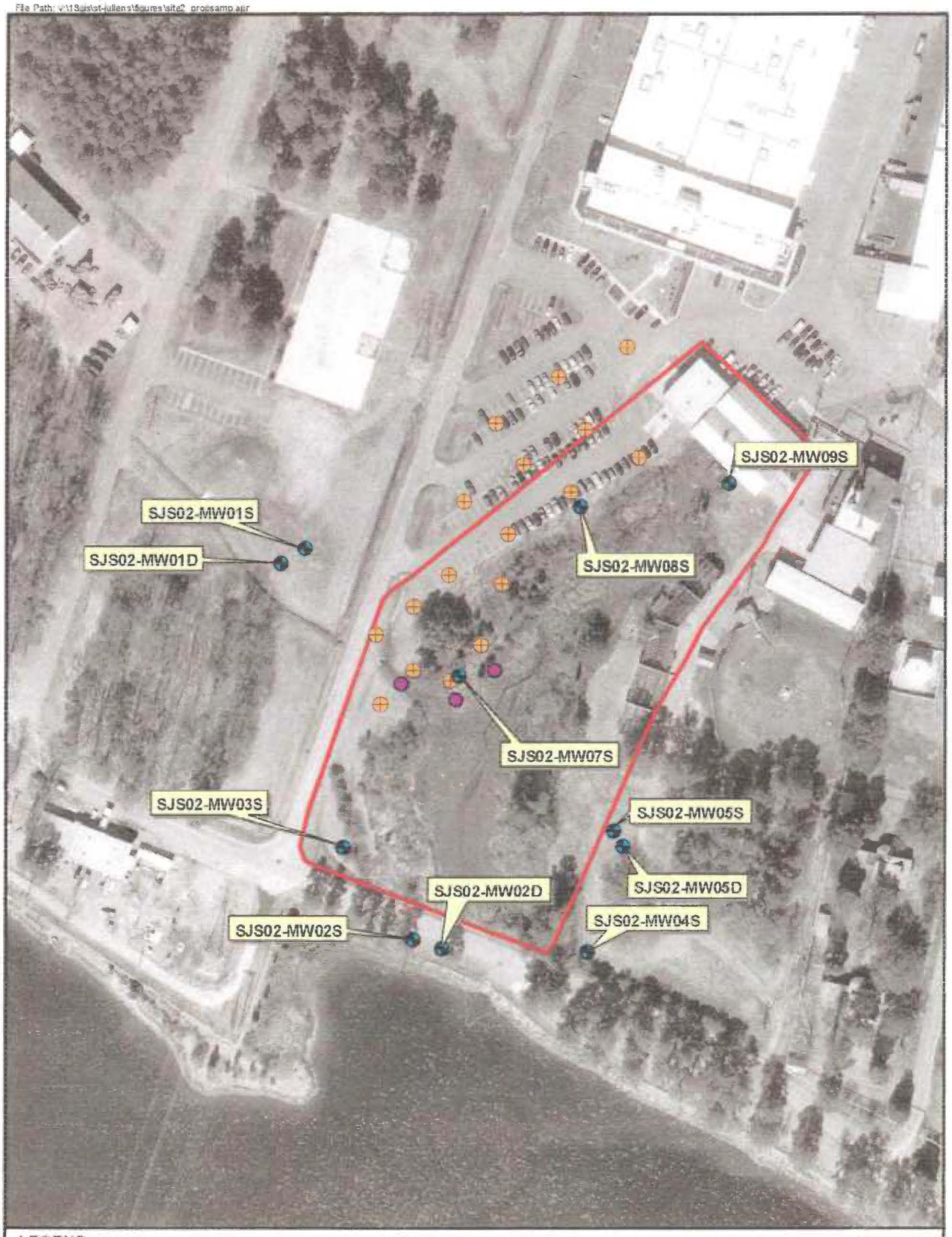

LEGEND
- Proposed MIP Locations
- Existing Monitoring Wells
- Proposed Sediment Sample Locations
- Site 2 Boundary

N

0 100 200 Feet

Figure 3
Site 2 Proposed Sample Locations
for VOCs Delineation
St. Juliens Creek Annex
Chesapeake, Virginia

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LEGEND
Site 2 Boundary
Proposed Sediment Toxicity Sample Areas

N

0 400 800 Feet

Figure 4
Proposed Sediment Toxicity Sample Locations
Site 2 and St. Juliens Creek
St. Juliens Creek Annex
Chesapeake, Virginia

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Attachment A
Project Specific Health & Safety Plan

Project-Specific Health and Safety Plan

Introduction

This Project-Specific Health and Safety Plan (HASP) presents the hazards known or anticipated to be present at the at the St. Juliens Creek Annex/Site 2 during the further delineation field effort scheduled to take place in the fall of 2004. This Project-Specific HASP will be used by CH2M HILL and its subcontractors to identify and mitigate task-specific hazards and to select appropriate health and safety protective measures not otherwise covered in the Master HASP.

The St. Juliens Creek Master HASP has been previously developed and must accompany/supplement this Project-Specific HASP. The Master HASP contains information pertinent to the general conditions at St. Juliens Creek, such as general site information, hazard evaluation and control, personnel responsibilities and requirements, a general description of personal protective equipment, customary decontamination procedures, and emergency response procedures. On-site personnel must review both the Master-HASP and the site-specific HASP and sign an agreement to comply with its provisions prior to commencing on-site work. The Master-HASP and site-specific HASP are considered operational documents that are subject to revisions in response to various site-specific conditions that may be encountered. However, these documents may be modified or updated only with the approval of the PHSO and Project Manager.

Policy

CH2M HILL's policy is that on-site hazardous waste management activities be performed in conformance with both the Master HASP and a Project-Specific HASPs. The documents are written based on the anticipated hazards and expected work conditions, and apply to field activities to be performed under the Work Plan. Applicability of this Master-HASP and the Project-Specific HASPs extends to all CH2M HILL employees, CH2M HILL's subcontractors, and visitors entering the site. CH2M HILL subcontractors must follow an established health and safety plan; in most cases, either adopting this master plan with appropriate site-specific HASP (e.g., surveyor), or adopting same and amending both with safety and/or health requirements specific to their work (e.g., driller). HASPs authored by a subcontractor must be reviewed by CH2M HILL's Project Health and Safety Officer (PHSO) before commencing on-site work. After being reviewed, this information will become part of the appropriate site-specific HASP.

This Project-Specific HASP in combination with the Master HASP will, at a minimum, meet the requirements under Occupational Safety and Health Administration (OSHA) Standard *29 Code of Federal Regulations* (CFR) 1910.120 (Hazardous Waste Operations and Emergency Response).

PRE-ENTRY REQUIREMENTS

During site mobilization, the Site Health and Safety Officer (SHSO) will perform a reconnaissance of each site as identified in the site-specific Work Plan (WP) to evaluate and determine the chemical, physical, and environmental hazards; establish or confirm emergency points of contact and procedures; and review any other issues deemed necessary to address site safety and health. The SHSO will then conduct a health and safety briefing with the site personnel to discuss data obtained from the previous site reconnaissance, provisions outlined in this Master HASP and site-specific HASP, and appropriate safety and health procedures and protocols.

CH2M HILL HEALTH AND SAFETY PLAN

This Project-Specific Health and Safety Plan (HASP) will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual,* as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must read both the Master HASP and this Project-Specific HASP, and sign Attachment 1 of both documents.

Project Information and Description

PROJECT NO:	157593
CLIENT:	Department of the Navy
PROJECT/SITE NAME:	St. Juliens Creek Annex/Site 2
SITE ADDRESS:	Victory Blvd. Chesapeake, VA
CH2M HILL ACTIVITY MANAGER:	Bill Friedmann
CH2M HILL OFFICE:	Virginia Beach
DATE HSP PREPARED:	June 2003; updated June 2004
DATE(S) OF SITE WORK:	Fall 2004
SITE ACCESS:	Main Gate (military pass required)
DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED:	Collection of groundwater and sediment samples; oversight of direct-push technology, drilling, and well installation; and logging of drill cuttings.

1 Tasks to be Performed Under this Plan

1.1 Description of Tasks

(Reference Field Project Start-up Form)

Refer to project documents (i.e., Work Plan) for detailed task information. A health and safety risk analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (Hazwoper).

1.1.1 Hazwoper-Regulated Tasks

- Drilling
- Direct-push sampling
- Groundwater sampling
- Sediment sampling
- Hand Augering
- Surveying
- Investigation-derived waste (drum) sampling and disposal
- Observation of material loading for offsite disposal
- Oversight of well installation

2 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC for clarification.

In addition to the controls specified in this section, Project-Activity Self-Assessment Checklists are contained in Attachment 6. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records, and be promptly submitted to the HSM.

Project-specific frequency for completing self-assessments: **Weekly, during drilling.**

2.1 Project-Specific Hazards

2.1.1 Arsenic

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride.
- Arsenic is considered a "Confirmed Human Carcinogen."
- Arsenic particulates (inorganic metal dust) are odorless. Vapor and gaseous odor varies depending upon specific organic arsenic compound.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.1.2 Cadmium

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Cadmium is considered a "Suspected Human Carcinogen."
- Cadmium particulates (fumes and dust) are odorless.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.1.3 Lead

The following requirements pertain to lead contaminated soils:

- Work shall progress in a sequence from less contaminated to more contaminated areas.
- Water should be added to soils prior to and during excavation, air rotary drilling, and other activities that create or have the potential to create airborne lead contaminated dust. For air rotary drilling operations, water can be added to the boring to reduce dust generation from the cyclone. Depending upon soil type, watering of soil may be required several days prior to commencing ground intrusive activities.
- Personnel working in the vicinity of lead contaminated soil shall wear disposable coveralls or equal and exercise enhanced personal hygiene (i.e., frequent hand washing prior to eating, drinking, and smoking; separation of work and street clothing/footwear; etc.).

2.1.4 Radar Hazards

- Airports and all branches of the military use radar of significant power for buildings, towers, aircraft, ships, armor vehicles and installations in general. Radar devices may emit harmful microwave radiation emissions.
- Microwave radiation is absorbed by the body and dissipated in the tissue as heat.
- The penetration ability of the radiation depends on the wavelength. Microwave wavelengths of 25-200 centimeters have the ability to reach the internal organs with potentially damaging effects. Wavelengths less than 25 centimeters are absorbed and dissipated by the skin and the human body is thought to be transparent to microwave wavelengths greater than 200 centimeters.
- The health effects of microwave radiation include deep burns and thermal damage to any organ or organ system with low blood flow, most notably the lenses of the eyes. If adequate time has elapsed between exposures, the repair mechanisms of the lens seems to limit damage.
- Studies have demonstrated that chronic microwave exposure can cause both psychological changes, disrupting task and function control, as well as chronic depression. Further studies suggest a possible relationship between mongolism (Down's Syndrome) in offspring and previous exposure of the male parent to radar, however the study was not conclusive.
- Microwave radiation can not be seen and it's effects can not be felt until serious damage has already occurred.
- Because of the inconclusive effects of microwave radiation, OSHA has set a conservative exposure limit of 10 milliwatt per square centimeter (10 mW/cm^2) averaged over any 6 minute period.
- Warning signs must be posted in areas where potentially damaging microwave radiation exists.
- The prevention method for microwave radiation exposure is to not be in the path of radar or other microwave emitting devices by either ensuring that the device is not operating or ensuring that there is sufficient shielding between you and the microwave source.

2.1.5 Drilling/Direct-Push

(Reference CH2M HILL SOP HS-35, *Drilling*)

- Only authorized personnel are permitted to operate drill rigs.
- Stay clear of areas surrounding drill rigs during every startup.
- Stay clear of the rotating augers and other rotating components of drill rigs.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should have it restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line de-energized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.

2.1.6 Working Above or Near Water

- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, U.S. Coast Guard-approved personal flotation devices (PDFs), or life jacket, shall be worn.
- Inspect PFDs prior to use. Do not use defective PFDs.
- A life-saving skiff must be provided for emergency rescue.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope must be provided for emergency rescue.
- Use sampling and other equipment according to the manufacturers' instructions.

2.1.7 Ordnance and Explosives (OE)

Due to the site history, the potential for exposure to Ordnance and Explosives (OE) exist, the chance for encountering ordnance items during sampling activities is very small. An OE hazards awareness safety brief should be included as part of the site-specific briefing and discussed at daily tailgate briefings.

- Prior to any action being performed on an ordnance item, all fuzing shall be positively identified. This identification will consist of fuze type by function, condition (armed or unarmed), and physical state/condition of the fuze (burned, broken, parts exposed or sheared, etc.).
- A projectile containing a base-detonating (BD) fuze is to be considered armed if the round has been fired.
- Arming wires and pop-out pins on unarmed fuzes should be secured prior to any movement.
- Do not depress plungers, turn vanes, rotate spindles, or move levers, setting rings, or other external fittings on OE items. Such actions may arm or activate the OE.
- Do not attempt to remove any fuzes from the OE. Do not dismantle or strip components from any OE item unless the item is included in the SOW.
- UXO personnel are not authorized to inert any OE item found on site unless it is a part of the SOW.
- OE/UXO items shall not be taken from the site as souvenirs or training aids.
- Civil War ordnance shall be treated like any other OE.
- Before entering U.S. Army-controlled areas or ranges contaminated with improved conventional munitions (ICM), an approved Department of the Army (DA) waiver must be obtained.
- Whenever suspect Chemical Weapons Material (CWM) is encountered during conventional OE site activities, all work shall immediately cease. Project personnel shall withdraw along cleared paths upwind from the discovery. A team consisting of two personnel shall secure the area to prevent unauthorized access. Personnel

should position themselves as far upwind as possible while still maintaining security of the area. The local point of contact designated in the work plan shall be immediately notified.

- Avoid inhalation and skin contact with smoke, fumes, and vapors of explosives and other related materials.
- Consider OE items that have been exposed to fire and detonation as extremely hazardous. Chemical and physical changes may have occurred to the contents, which might render them more sensitive than in their original state.
- Do not rely on the color coding of OE for positive identification. Munitions having incomplete or improper color codes have been encountered.

2.1.8 IDW Drum Sampling

Personnel are permitted to handle and/or sample drums containing investigation-derived waste (IDW) only; handling or sampling other drums requires a plan revision or amendment approved by the CH2M HILL HSM. The following control measures will be taken when sampling drums containing IDW:

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open.
- Picks, chisels, and firearms may not be used to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- PPE and air monitoring requirements specified in Sections 4 and 5 must address IDW drum sampling.
- Spill-containment procedures specified in Section 7 must be appropriate for the material to be handled.

2.1.9 Vinyl Chloride

(Reference CH2M HILL SOP HSE-69, *Vinyl Chloride*)

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Vinyl Chloride is considered a "Confirmed Human Carcinogen."
- A Short Term Exposure Limit (STEL: 15 minutes) exists for this material.
- Vinyl Chloride has a mild, sweet, chloroform-like odor.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (µg/L)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Metals[e]					
Aluminum	GW: 286 MW-06S	10 mg/m³	ND	Eye, skin and respiratory system irritant.	NA
Arsenic	GW: 31 MW-09S	0.01 mg/m³	5 mg/m³ Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Barium	GW: 124 MW-07S	0.5 mg/m³	50 mg/m³	Eye, skin and upper respiratory system irritant; skin burns; gastroenteritis; muscle spasms, slow pulse, extrasystoles; hypokalemia	UK
Cadmium (dissolved)	GW: 0.22 MW-06S	0.005 mg/m³	9 mg/m³ Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Calcium (dissolved) (as $CaCO_3$)	GW: 68700 MW-08S	15 mg/m³	ND	Eye, skin and respiratory system irritant; cough	NA
Cobalt (dissolved) (metals, dust, fumes)	GW: 18.8 MW-07S	0.05 mg/m³	20 mg/m³	Coughing, difficulty breathing, wheezing, decreased pulmonary function, diffuse nodule fibrosous, dermatitis, respiratory hypersensitivity, asthma	NA
Copper (dusts and mists)	GW: 15.6 MW-08S	1 mg/m³	100 mg/m³	Eye, nose and pharynx irritant; nasal perforation, metallic taste, dermatitis (in animals: lung, liver, kidney damage; anemia)	NA
Cyanide (Potassium cyanide as CN)	GW: 13.2 MW-06S	5 mg/m³	25 mg/m³	Eye, skin, nose and upper respiratory system irritant; weakness; headache; confusion; nausea, vomiting; increased respiration rate; slow, gasping breathing; thyroid and blood changes	NA
Iron	GW: 41900 MW-09S	10 mg/ m³	2500 mg/m³	Benign pneumoconiosis with x-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)	NA
Lead	GW: 4.8 MW-09S	0.05 mg/m³	100 mg/m³	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
Magnesium (oxide fume)	GW: 44200 MW-07S	15 mg/m³	750 mg/m³	Eye and nose irritant; metal fume fever; cough; chest pain; flu-like fever	NA
Manganese (dissolved)	GW: 1880 MW-08S	5 mg/m³	500 mg/m³	Parkinson's; asthenia, insomnia; mental confusion; metal fume fever; dry throat, cough, tight chest, dyspnea, rales, flu-like fever; low-back pain; vomiting; malaise; fatigue; kidney damage	NA

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (µg/L)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Nickel	GW: 3.4 MW-09S	1 mg/m³	10 mg/m³ Ca	Dermatitis, sensitization; allergic asthma, pneuitis	NA
Potassium (dissolved) (as KOH)	GW: 12800 MW-08S	2 mg/m³	ND	Eye, skin and respiratory system irritant; cough, sneezing; eye and skin burns; vomit, diarrhea	UK
Silver	GW: 5.9 MW-09S	0.01 mg/m³	10 mg/m³	Blue-gray eyes, nasal septum, throat and skin; irritation and ulceration of skin; GI disturbance	
Sodium	GW: 256000 MW-07S				
Thallium (dissolved)	GW: 2.3 MW-06S	0.1 mg/m³	15 mg/m³	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peripheral neuropathy, tremor; retrosternal tightness, chest pain, pulmonary edema, seizures, chorea, psychosis; liver and kidney damage; alopecia; paresthesia of legs	UK
Vanadium	GW: 1.1 MW-06S	C 0.05 mg/m³	35 mg/m³	Eye, skin and throat irritant; green tongue, metallic taste; eczema; cough; fine rales, wheezing, bronchitis, dyspnea	NA
Zinc (as ZnCl fume)	GW: 158 MW-09S	1 mg/m³	50 mg/m³	Eye irritant; (in animals: pulmonary irritation, eye injury; possible liver damage)	NA
Pesticides/ PCB's					
Heptachlor epoxide	GW: 1.06 MW-08S	0.5 mg/m³	500 Ca	Paresthesia of tongue, lips, hand, and face; tremors; dizziness; confusion; headache; fatigue; convulsion; eye and skin irritation; vomiting	UK
VOC's					
1,1,2-Trichloroethane	GW: 10 MW-07S	10 ppm	100 ppm Ca	Eye and nose irritation, CNS depression, liver damage, dermatitis	11.00
1,1-Dichloroethene	GW: 200 MW-07S	NL	ND Ca	Eye, skin and throat irritation; dizziness, headache, nausea, liver and kidney dysfunction, pneuitis, dyspnea	10.00
1,2-Dichlorobenzene	GW: 0.44 MW-06S	25 ppm	200	Nose and eye irritation, liver and kidney damage, skin blisters	9.06
Acetone	GW: 17 MW-08S	1000 ppm	2500 ppm	Eye, nose and throat irritant; headache, dizziness, CNS depression; dermatitis	9.69
Chloroform	GW: 1.1 MW-06S	2 ppm	500 Ca	Dizziness, mental dullness, nausea, confusion, disorientation, headache, fatigue, eye and skin irritation, anesthesia, enlarged liver	11.42

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (µg/L)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Ethylbenzene	GW: 2 MW-07S	100 ppm	800 ppm	Eye, skin and mucous membrane irritant; headache; dermatitis; narcosis; coma	8.76
Styrene	GW: 0.35 MW-07S	100 ppm C 200 ppm	700 ppm	Eye, nose and respiratory system irritation; headache, fatigue, dizziness, confusion, malaise, drowsiness, weakness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	8.40
Tetrachloroethene	GW: 21 MW-07S	25 ppm	150 ppm Ca	Eye, nose, and throat irritation; nausea; flushed face and neck; vertigo; dizziness; sleepiness; skin redness; headache; liver damage	9.32
Toluene	GW: 4.9 MW-07S	50 ppm	500 ppm	Eye and nose irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, excessive tearing, nervousness, muscle fatigue, paresthesia, dermatitis, liver and kidney damage	8.82
Trichloroethylene (TCE)	GW: 82000 MW-07S	50 ppm	1,000 Ca	Headache, vertigo, visual disturbance, eye and skin irritation, fatigue, giddiness, tremors, sleepiness, nausea, vomiting, dermatitis, cardiac arrhythmia, paresthesia, liver injury	9.45
Vinyl Chloride	GW: 3600 MW-07S	1 ppm	NL Ca	Weakness, abdominal pain, gastrointestinal bleeding, enlarged liver, pallor or cyanosis of extremities	9.99
Xylene, total	GW: 11 MW-07S	100 ppm	900	Irritated eyes, skin, nose, and throat; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; dermatitis	8.56
Cis-1,2-dichloroethene	GW: 34000 MW-07S	200 ppm	1000 ppm	Irritation of eyes and respiratory system; CNS depression	9.65
Trans-1,2-dichloroethene	GW: 160 MW-07S	100 ppm	900 ppm	Irritated eyes, skin, nose, and throat; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; dermatitis	8.56
SVOC's					
1,1'-Biphenyl	GW: 2 MW-07S	1 ppm	100ppm	Eye and throat irritant; headache, nausea, fatigue, limb numbness; liver damage	7.95
2,4-Dimethylphenol	GW: 2 MW-07S	UK	UK	Not Known	UK
2-Methylnaphthalene	GW: 8 MW-07S	UK	UK	Not Known	UK
Acenaphthene	GW: 8 MW-07S	UK	UK	Not Known	UK

2.5 Contaminants of Concern

(Refer to Project Files for more detailed contaminant information)

Contaminant	Location and Maximum[a] Concentration (µg/L)	Exposure Limit[b]	IDLH[c]	Symptoms and Effects of Exposure	PIP[d] (eV)
Carbazole	GW: 6 MW-07S	UK	UK	Not Concerned	UK
Di-n-butylphthalate	GW: 0.7 MW-08S	5 mg/m³	4000 mg/m³	Eye, upper respiratory system and stomach irritant	UK
Dibenzofuran	GW: 5 MW-07S	UK	UK	Not Known	UK
Fluorene	GW: 5 MW-07S	UK	UK	Not Known	UK
Naphthalene	GW: 120 MW-07S	10 ppm	250 ppm	Eye irritant; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; bladder irritation; profuse sweating; jaundice; hematuria, hemoglobinuria, renal shutdown; dermatitis; optical neuritis, corneal damage	8.12
Phenanthrene	GW: 4 MW-07S	UK	UK	Not Known	UK
Bis-(2-ethylhexyl)phthalate (DEHP, DOP)	GW: 0.6 MW-07S	5 mg/m³	5,000 Ca	Eye and mucous membrane irritant	UK

Footnotes:

[a] Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).

[b] Appropriate value of PEL, REL, or TLV listed.

[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

[e] Metal concentrations are of total metals unless noted

2.6 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4 and 5, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

3 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-01, *Medical Surveillance*, and HS-02, *Health and Safety Training)*

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SSC" have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, *Reproduction Protection*, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SSC/FA-CPR
Jamie Butler	VBO	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Dennis Ballam	VBO	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Kim Henderson	VBO	Field Team Member/SC-HW	Level C SC-HW; FA-CPR

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Client

Contact Name: Bob Schirmer
LANTNAVFACENGCOM
Phone: 757/322-4751

Facility Contact Name: Mr. Leroy Eaves
Civil Engineering
Phone: 757-485-6574

3.2.2 CH2M HILL

Activity Manager: William Friedman/VBO
Project Manager: Kim Henderson/VBO
Health and Safety Manager: Steve Beck/MKE
Field Team Leader : Jamie Butler/VBO, Dennis Ballam/VBO
Site Safety Coordinator: Jamie Butler/VBO, Dennis Ballam/VBO

The SSC is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact the client. The Health and Safety Manager should be contacted as appropriate.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

Ordnance Identification	**Utilities Location**
Subcontractor: **To be determined** Contact Name: Telephone:	Subcontractor: **To be determined** Contact Name: Telephone:
Drilling	**Surveying**
Subcontractor: **To be determined** Contact Name: Telephone:	Subcontractor: **To be determined** Contact Name: Telephone:

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (e.g., drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 6 are to be used by the SSC to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in project field logbook, daily reports, or other records.

4 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-07, *Personal Protective Equipment*, HS-08, *Respiratory Protection*)

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
• General site entry • Surveying • Observation of material loading for offsite disposal	D	Work clothes; steel-toe, leather work boots; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
• Surface water sampling • Sediment sampling • Surface soil sampling • Hand augering	Modified D	Work clothes or cotton coveralls **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
• Groundwater sampling • Soil boring • Investigation-derived waste (drum) sampling and disposal	Modified D	**Coveralls:** Uncoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Safety glasses Ear protection [d]	None required.
• Tasks requiring upgrade	C	**Coveralls:** Polycoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent[e].
• Tasks requiring upgrade	B	**Coveralls:** Polycoated Tyvek® **Boots:** Steel-toe, chemical-resistant boots OR steel-toe, leather work boots with outer rubber boot covers **Gloves:** Inner surgical-style nitrile & outer chemical-resistant nitrile gloves.	Hardhat [c] Splash shield [c] Ear protection [d] Spectacle inserts	Positive-pressure demand self-contained breathing apparatus (SCBA); MSA Ultralite, or equivalent.

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[f]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.

[b] No facial hair that would interfere with respirator fit is permitted.

[c] Hardhat and splash-shield areas are to be determined by the SSC.

[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.

[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is > 85%, or if organic vapor measurements are > midpoint of Level C range (refer to Section 5)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.

[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an SSC qualified at that level is present.

5 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-06, *Air Monitoring)*

5.1 Air Monitoring Specifications

PID: OVM with 10.6eV lamp or equivalent	All intrusive activities	Up to 1 ppm →	Level D	Initially and periodically during task	Daily
		1 to 25 ppm above b.g. (Sustained for 1 minute) →	Level D; collect vinyl chloride tube; vinyl chloride action level not exceeded		
		25 to 100ppm above b.g (Sustained for 1 minute) →	Level C		
		100 to 300ppm above b.g. (Sustained for 1 minute) →	Level B (Not Anticipated or authorized)		
Colormetric Tube: Drager vinyl chloride specific (0.5 to 30 ppm range) with pre-tube, or equivalent	All intrusive activities	<0.5 ppm→ 0.5 ppm→	Level D Level B	Initially and periodically when PID >1 ppm	Not applicable
Nose-Level Monitor[e]: Voice	All	Conversations can be held at distances of 3 feet without shouting →	No action required	Initially and periodically during task	N/A
		Conversations cannot be held at distances of 3 feet without shouting →	Hearing protection required Stop; re-evaluate		
Dust Monitor: Visual	Drilling, digging or if dusty conditions exist.	No visual dust →	Level D	Initially and periodically during tasks	N/A
		Visual Dust →	Level D – Use Dust Suppression techniques		

[a] Action levels apply to sustained breathing-zone measurements above background.

[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SSC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

[c] If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry (refer to Section 2).

[d] Refer to SOP HS-10 for instructions and documentation on radiation monitoring and screening.

[e] Noise monitoring and audiometric testing also required.

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument-maintenance procedures)

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing
PID: TVA 1000	100 ppm isobutylene	CF = 1.0	100 ppm	1.5 lpm reg T-tubing

10 Approval

This site-specific Health and Safety Plan has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: Dan Holloway **Date: 06/03/2003**

Approved By: SteveBeck/MKE **Date: 07/02/03**

Steven J. Beck

10.2 Revisions

Revisions Made By: SteveBeck/MKE **Date:**

Revisions to Plan:

Revisions Approved By: **Date:**

11 Attachments

Attachment 1: **Employee Signoff Form – Field Safety Instructions**
Attachment 2: **Project-Specific Chemical Product Hazard Communication Form**
Attachment 3: **Chemical-Specific Training Form**
Attachment 4: **Emergency Contacts**
Attachment 5: **Project H&S Forms/Permits**
Attachment 6: **Project Activity Self-Assessment Checklists**
Attachment 7: **Applicable Material Safety Data Sheets**
Attachment 8: **Metal Facts Sheet**

Employee Signoff Form

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: St. Juliens Creek Annex/Site 2 **Project Number:** 157593

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

Project-Specific Chemical Product Hazard Communication Form

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: St. Juliens Creek Annex/Site 2 **Project Number:** 157593

MSDSs will be maintained at the following location(s): Field Vehicle

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Isobutylene	1 liter, compressed	Support Zone			
Hydrochloric acid	< 500 ml	Support Zone / sample bottles			
Nitric acid	< 500 ml	Support Zone / sample bottles			
Sulfuric Acid	< 500 ml	Support Zone / sample bottles			
Sodium hydroxide	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

CHEMICAL-SPECIFIC TRAINING FORM

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # : 157593
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

Emergency Contacts Page

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency – 911 Facility Medical Response #: 757-396-3333 Local Ambulance #: 757-396-3333	**CH2M HILL Medical Consultant** Health Resources Dr. Jerry H. Berke, M.D.,M.P.H. 600 West Cummings Park, Suite 3400 Woburn, MA 01801 1-781-938-4653 or 1-800-350-4511 (After hours calls will be returned within 20 minutes)
Fire/Spill Emergency -- 911 Facility Fire Response #: 757-396-3335 Local Fire Dept #: 757-382-6297	**Corporate Director Health and Safety** Name: Mollie Netherland/SEA Phone: 206/453-5005 **24-hour emergency beeper: 888-444-1226**
Security & Police – 911 Facility Security #: 757-396-5111 Local Police #: 757-382-6161	**Regional Health, Safety & Environmental Manager** Name: John Longo/NJO Phone: 973-316-0159 ext. 4243
Utilities Emergency Water: 757-382-3550 Gas: 1-877-572-3342 Electric: 1-888-667-3000	**Health and Safety Manager (HSM)** Name: Steve Beck/MKE Phone: 414-272-2426 ext. 277
Designated Safety Coordinator (DSC) Name: Jamie Butler Phone: 757-460-3734 x39	**Regional Human Resources Department** Name: Cindy Bauder/WDC Phone: 703-471-6405 ext. 4243
Project Manager Name: Kim Henderson Phone: 757-460-3734 x40	**Corporate Human Resources Department** Name: Pete Hannon/DEN Phone: 303/771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation** Contact either the Regional Human Resources Dept. to have an Incident Report Form (IRF) completed. After hours contact Julie Zimmerman 303-664-3304 **Auto Claims** Rental: Carol Dietz/DEN 1-303-713-2757 CH2M Hill owned: Zurich Insurance Company 1-800-987-3373

Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: Sound Field Vehicle Horn (3x) **Evacuation Assembly Area(s):** Field Vehicle

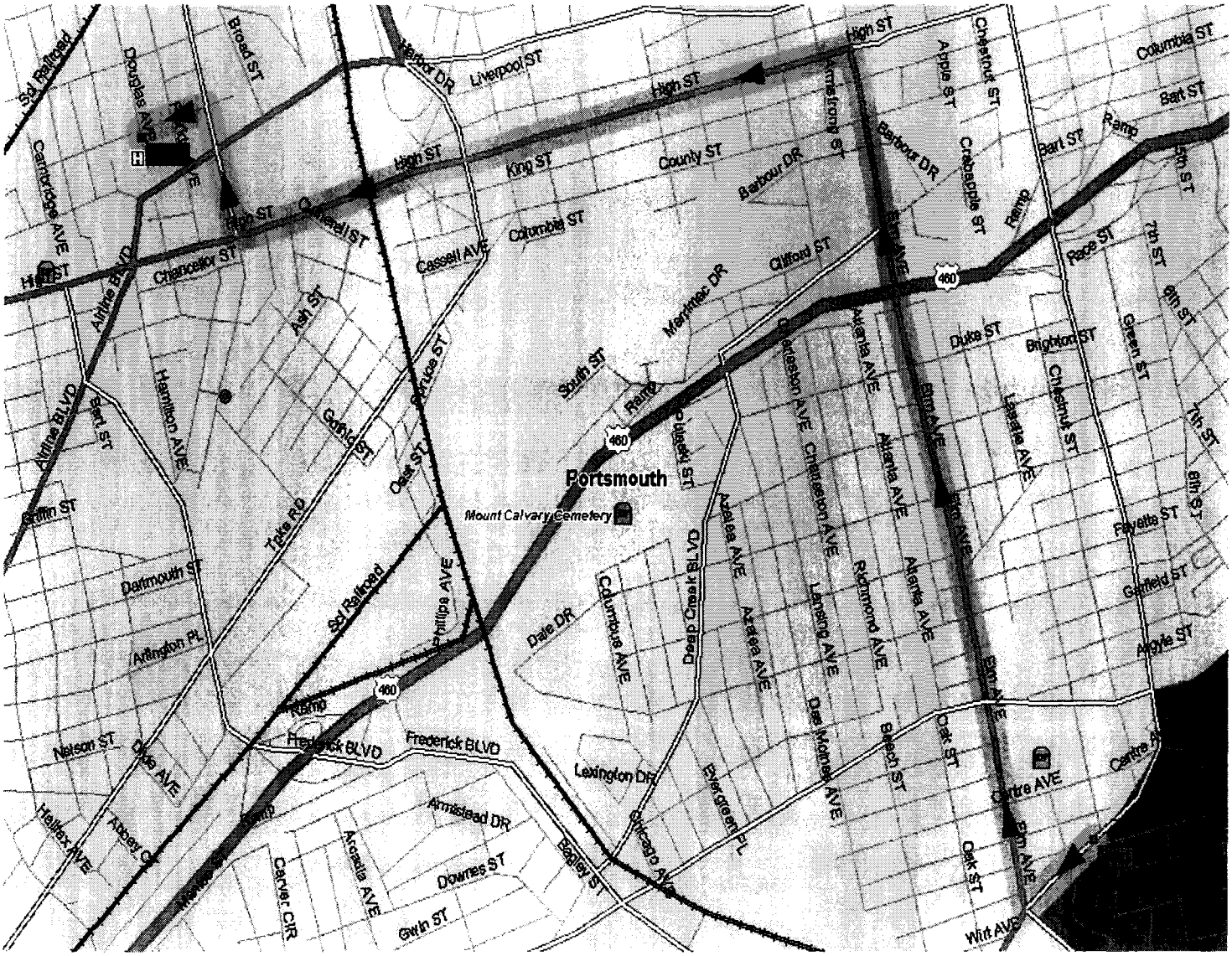
Facility/Site Evacuation Route(s): See Site Map

Hospital Name/Address:
Maryview Medical Center
3636 High Street
Portsmouth, VA 23707

Hospital Phone #: 757-398-2200

Directions to Hospital

Leave main gate of Annex and take left onto Victory Blvd.
At route 17 (George Washington Highway) take a right and go north.
Make left onto Fredrick Blvd, and continue on Fredrick until it dead ends.
Make left onto High Street, the Maryview Medical Center is on the right at the first light.



Project Forms

Site-Specific Investigation-Derived Waste Plan Checklist

This checklist supplements the Master IDW Plan with site-specific information. Once completed for a specific project, it provides necessary IDW information for each investigation. It is to be taken into the field with the Master IDW Plan.

Site: _____

1. IDW Media:
   - _____Soil cuttings
   - _____Well development or purge water
   - _____Decontamination residual soil and wastewater
   - _____PPE or disposable equipment
   - _____Other _____

2. Expected Regulatory Status:
   - _____Hazardous
   - _____Solid Waste
   - _____Unknown
   - _____Other _____

3. Site Location: _____

4. Nature of Contaminants Expected:

_____Petroleum contamination
_____Polyaromatic hydrocarbon
_____Pesticides
_____Other _____
_____Herbicides
_____PCBs
_____Metals

5. Volume of IDW Expected:
   - _____Drums
   - _____Cubic Yards
   - _____Tons
   - _____Gallons

6. Compositing Strategy for Sample Collection:_____

7. IDW Storage

   _____As per Master IDW Plan _____Other_____

8. Waste Disposal

   _____As per Master IDW Plan _____Other_____

Site-Specific Quality Assurance Project Plan Checklist

This checklist supplements the Master QAPP with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master QAPP.

Site: _____

1. List sampling tasks:

2. List data quality objectives:

3. Organization:

   LANTDIV IR Section Head _____

   LANTDIV Navy Technical Representative _____

   USEPA Remedial Project Manager _____

   VDEQ Federal Facilities Project Manager _____

   CH2M HILL Activity Manager _____

   CDM Federal Project Manager _____

   Quality Control Senior Review _____

   Technical Project Manager _____

   Field Team Leader _____

4. Table of samples with analyses to be performed and associated QC samples (attached):

5. Analytical Quantitation Limits:

   _____As per Table 8-2 of Master QAPP _____Other (attached)

6. QA/QC Acceptance Criteria (e.g., precision, accuracy)

   _____As per Table 4-1 of Master QAPP _____Other (attached)

7. Data reduction, validation, and reporting:

   _____As per Section 9 of Master QAPP _____Other (attached)

8. Internal QC Procedures (field and laboratory):

   _____As per Section 10 of Master QAPP _____Other (attached)

9. Corrective Action:

   _____As per Section 14 of Master QAPP _____Other (attached)

10. Other deviations from Master QAPP _____

Site-Specific Field Sampling Plan Checklist

This checklist supplements the Master Field Sampling Plan with site-specific information. Once completed for a specific project, it provides necessary field sampling information for each investigation. It is to be taken into the field with the Master FSP.

Site:_____

1. Tasks to be performed:

_____Geophysical surveys
_____Soil gas surveys
_____Surface water and sediment sampling
_____Surface soil sampling
_____Soil boring installation
_____Subsurface soil sampling
_____Monitoring well installation and development
_____Monitoring well abandonment
_____Groundwater sampling
_____In-situ groundwater sampling
_____Aquifer testing
_____Hydrogeologic measurements
_____Biota sampling
_____Trenching
_____Land surveying
_____Investigation derived waste sampling
_____Decontamination
_____Other_____

2. Field measurements to be taken:

_____temperature
_____pH
_____dissolved oxygen
_____turbidity
_____specific conductance
_____organic vapor monitoring
_____geophysical parameters (list):
_____electromagnetic induction
_____ground-penetrating radar
_____surveying
_____magnetometry
_____global positioning system
_____soil gas parameters (list):
_____combustible gases
_____water-level measurements
_____pumping rate
_____other_____

3. Sampling program (nomenclature, etc.):

_____As per Section 3.1 of Master FSP_____Other _____

4. Map of boring and sampling locations (attach to checklist):

5. Table of field samples to be collected:

6. Applicable SOPs (attach to checklist) or references to specific pages in Master FSP:

7. Site-specific procedures or updates to protocols established in the Master FSP:

_____

Site-Specific Health and Safety Plan

This checklist must be used in conjunction with the Master HASP. This checklist is intended for use by CDM Federal and CH2M HILL employees only. All CDM Federal and CH2M HILL employees performing tasks under this checklist must read and sign both this checklist and the Master HASP and agree to abide by their provisions (see EMPLOYEE SIGNOFF attached to the checklist).

Site:_____

Location(s)_____(reference attached map)

This document shall be maintained on site with the Master Health and Safety Plan. It will include as attachments from the Work Plan a site map and the site characterization and objectives for this site.

The procedures described in the Master Health and Safety Plan will be followed unless otherwise specified in this Site-Specific Health and Safety Plan.

1. HAZWOPER-Regulated Tasks

_____Test pit and excavation
_____Soil boring installation
_____Geoprobe boring
_____Geophysical surveys
_____Hand augering
_____Subsurface soil sampling
_____Surface soil sampling
_____Soil gas surveys
_____Sediment sampling
_____Monitoring well/drive point installation
_____Monitoring well abandonment
_____Groundwater sampling
_____Aquifer testing
_____Hydrologic measurements
_____Surface water sampling
_____Biota sampling
_____Investigation-derived waste (drum) sampling and disposal
_____Observation of loading of material for offsite disposal
_____Oversight of remediation and construction
_____Other_____

2. Hazards of Concern: (Check as many as are applicable. Refer to Section 3 of Master H&S Plan for control measures):

_____Heat stress
_____Cold stress
_____Buried utilities, drums, tanks
_____Inadequate illumination
_____Drilling
_____Heavy equipment
_____Working near water
_____Flying debris
_____Gas cylinders
_____Noise
_____Slip, trip, or fall hazards
_____Back injury
_____Confined space entry
_____Trenches, excavations
_____Protruding objects
_____Vehicle traffic
_____Ladders, scaffolds
_____Fire
_____Working on water
_____Snakes or insects
_____Poison ivy, oak, sumac
_____Ticks
_____Radiological
_____Other_____

3. Contaminants of Concern (List if known. Reduce Table 3.8 of the Master HASP to site-specific contaminants, add additional chemicals if necessary, and attach to this checklist):

_____ _____ _____

_____ _____ _____

4. Personnel (List CH2M HILL field team members and telephone numbers):

Field team leader(s) _____ _____

Site safety coordinator(s) _____ _____

Field team members _____ _____

_____ _____

5. Contractors/Subcontractors

_____Procedures as per Master HASP

_____Other_____

Name: _____ _____ _____

Contact:_____ _____ _____

Telephone:_____ _____ _____

6. Level of personal protective equipment (PPE) required:_____
Refer to Table 5.1 of Master HASP, SOPs, and Respiratory Protection, Section 2 of the Site Safety Notebook.

7. Air monitoring instruments to be used:

_____PID _____FID

_____CGI _____Dust monitor

_____O_2

8. Decontamination procedures:

_____As per Section 7 of Master HASP

_____Other _____

9. List any other deviations or variations from the Master HASP:

10. Emergency Response (Check that all names and numbers are correct on page 47 of Master HASP and attach corrected page to this checklist)

11. Map to hospital (Highlight route to hospital from site and attach to this checklist)

12. Emergency Contacts (Check that all names and numbers are correct on page 49 of Master HASP and attach corrected page to this checklist)

13. Approval. This prepared site-specific checklist must be approved Chuck Myers/CDM Federal or other authorized representative

    Name_____Title_____Date_____

14. Employee Signoff. All CDM Federal and CH2M HILL employees working at the site must sign the attached Employee Signoff for the checklist as well as for the Master HASP.

Project Activity Self-Assessment Checklists

CH2MHILL

H&S Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with drilling operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a drilling subcontractor is required (complete entire checklist).

SSC/DSC may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the health and safety manager for review.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling H&S requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-35.

SECTION 1	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Only authorized personnel operating drill rig	☐	☐	☐	☐
2. Personnel cleared during rig startup	☐	☐	☐	☐
3. Personnel clear of rotating parts	☐	☐	☐	☐
4. Personnel not positioned under hoisted loads	☐	☐	☐	☐
5. Loose clothing and jewelry removed	☐	☐	☐	☐
6. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐
7. Smoking is prohibited around drilling operation	☐	☐	☐	☐
8. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
9. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
10. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (3.2.2)				
11. Location of underground utilities identified	☐	☐	☐	☐
12. Safe clearance distance maintained from overhead powerlines	☐	☐	☐	☐
13. Drilling pad established, when necessary	☐	☐	☐	☐
14. Drill rig leveled and stabilized	☐	☐	☐	☐
DRILL RIG TRAVEL (3.2.3)				
15. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
16. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
17. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
18. Safe clearance distance maintained while traveling under overhead powerlines	☐	☐	☐	☐
19. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (3.2.4)				
20. Kill switch clearly identified and operational	☐	☐	☐	☐
21. All machine guards are in place	☐	☐	☐	☐
22. Rig ropes not wrapped around body parts	☐	☐	☐	☐
23. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
24. Drill operation stopped during inclement weather	☐	☐	☐	☐
25. Air monitoring conducted per HSP/FSI for hazardous atmospheres	☐	☐	☐	☐
26. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG MAINTENANCE (3.2.5)				
27. Defective components repaired immediately	☐	☐	☐	☐
28. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
29. Cathead in clean, sound condition	☐	☐	☐	☐
30. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
31. Fall protection used for fall exposures of 6 feet or greater	☐	☐	☐	☐
32. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
33. Good housekeeping maintained on and around rig	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (3.2.6)				
34. Waste disposed of according to HSP	☐	☐	☐	☐
35. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Material Safety Data Sheets

Section 1 - Product and Company Identification
ISOBUTYLENE

Product Identification: ISOBUTYLENE
Date of MSDS: 09/14/1989 **Technical Review Date:** 09/13/1995
FSC: 6830 **NIIN: LIIN:** 00N042744
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: SCOTT SPECIALTY GASES
Manufacturer's Address1: ROUTE 611
Manufacturer's Address2: PLUMSTEADVILLE, PA 18949
Manufacturer's Country: US
General Information Telephone: 215-766-8861
Emergency Telephone: 215-766-8861
Emergency Telephone: 215-766-8861
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 51847
Special Project Code: N

Contractor Information

Contractor's Name: SCOTT SPECIALTY GASES
Post Office Box: 310
Contractor's Address1: 6141 EASTON RD
Contractor's Address2: PLUMSTEADVILLE, PA 18949-0310
Contractor's Telephone: 215-766-8861
Contractor's CAGE: 51847

Section 2 - Composition /Information on Ingredients
ISOBUTYLENE

Ingredient Name: PROPENE, 2-METHYL-; (ISOBUTYLENE)
Ingredient CAS Number: 115-11-7 **Ingredient CAS Code:** M
RTECS Number: UD0890000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 100
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:

DOT Reporting Quantity:
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
ISOBUTYLENE

Health Hazards Acute & Chronic: ACUTE:ASPHYXIANT. SYMPTOMS INCLUDE RAPID RESPIRATION, MUSCULAR INCOORDINATION, FATIGUE, NAUSEA & VOMITING. LOSS OF CONSCIOUSNESS & DEATH MAY OCCUR. CONTACT W/LIQUID MAY RESULT IN SYMPTOMS OF FROSTBITE . CHRONIC:NONE.

Signs & Symptoms of Overexposure:
SEE HEALTH HAZARDS.

Medical Conditions Aggravated by Exposure:
NONE

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:

Inhalation: YES

Skin: NO

Ingestion: NO

Carcenogenicity Indicators

NTP: NO

IARC: NO

OSHA: NO
Carcinogenicity Explanation: NOT RELEVANT

Section 4 - First Aid Measures
ISOBUTYLENE

First Aid:
INGEST:CALL MD IMMED (FP N). INHAL:IMMED REMOVE VICTIM TO FRESH AIR. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN. SKIN:IMMED FLUSH W/ COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAM CLTHG. IF FROSTBITE OCCURS, WARM AFFECTED AREA W/WATER OR TOWEL. EYE:IMMED FLUSH W/COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES.

Section 5 - Fire Fighting Measures
ISOBUTYLENE

Fire Fighting Procedures:
USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). FLAMMABLE HIGH PRESSURE LIQUID OR GAS.
Unusual Fire or Explosion Hazard:
DANGEROUS. VAP MAY TRAVEL CONSIDERABLE DIST TO SOURCE OF IGNIT & FLASH BACK. MAY FORM EXPLO MIXTS W/AIR. CAN REACT VIGOROUSLY W/OXIDIZING MATLS.

Extinguishing Media:
DO NOT EXTING BURNING GAS IF FLOW CANNOT BE SHUT OFF. USE WATER SPRAY TO KEEP FIRE EXPOS CYLS COOL. MOVE CYL (SUPDAT)
Flash Point: Flash Point Text: -105F,-76C

Autoignition Temperature:

Autoignition Temperature Text: N/A

Lower Limit(s): 1.8%

Upper Limit(s): 9.6%

Section 6 - Accidental Release Measures
ISOBUTYLENE

Spill Release Procedures:
EVACUATE & VENTILATE AREA. REMOVE LEAKING CYLINDER TO EXHAUST HOOD OR SAFE OUTDOORS AREA IF THIS CAN BE DONE SAFELY.

Section 7 - Handling and Storage
ISOBUTYLENE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
ISOBUTYLENE

Repiratory Protection:
USE NIOSH/MSHA APPROVED SCBA IN CASE OF EMERGENCY OR NON-ROUTINE USE.
Ventilation:
PROVIDE ADEQUATE & LOCAL EXHAUST VENTILATION TO MAINTAIN CONCENTRATION BELOW EXPOSURE LIMITS.
Protective Gloves:
IMPERVIOUS GLOVES (FP N).
Eye Protection: SAFETY GOGGLES.
Other Protective Equipment: SAFETY SHOES WHEN HANDLING CYLINDERS.
Work Hygenic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Health & Safety Information: EXTING MEDIA:AWAY FROM FIRE IF THERE IS NO RISK. OTHER PREC:HAS NOT BEEN FILLED BY THE OWNER OR W/HIS WRITTEN CONSENT IS A VIOLATION OF FEDERAL LAW (49 CFR).

Section 9 - Physical & Chemical Properties
ISOBUTYLENE

HCC: G2
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 19.6F,-6.9C
Melting/Freezing Point: Melting/Freezing Text: N/K
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 2.65@21.1C **Vapor Density:** 1.947
Percent Volatile Organic Content:
Specific Gravity: 0.588 (H_2O=1)
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: NOT APPLICABLE
Solubility in Water: SLIGHT
Appearance and Odor: COLORLESS, ETHEREAL ODOR.
Percent Volatiles by Volume: 100

Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
ISOBUTYLENE

Stability Indicator: YES
Materials to Avoid:
OXIDIZING MATERIALS.
Stability Condition to Avoid:
NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products:
CARBON MONOXIDE, CARBON DIOXIDE.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT

Section 11 - Toxicological Information
ISOBUTYLENE

Toxicological Information:
N/P

Section 12 - Ecological Information
ISOBUTYLENE

Ecological Information:
N/P

Section 13 - Disposal Considerations
ISOBUTYLENE

Waste Disposal Methods:
DISP MUST BE I/A/W FED, STATE & LOC REGS (FP N). RETURN CYLS TO SUPPLIER FOR PROPER DISP W/ANY VALVE OUTLET PLUGS/CAPS SECURED & VALVE PROT CAP IN PLACE. DO NOT REUSE CYL. EMPTY CYL WILL CONTAIN HAZ R ESIDUE.

Section 14 - MSDS Transport Information
ISOBUTYLENE

Transport Information:
N/P

Section 15 - Regulatory Information
ISOBUTYLENE

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
ISOBUTYLENE

Other Information:
N/P

HAZCOM Label Information

Product Identification: ISOBUTYLENE
CAGE: 51847
Assigned Individual: N
Company Name: SCOTT SPECIALTY GASES
Company PO Box: 310
Company Street Address1: 6141 EASTON RD
Company Street Address2: PLUMSTEADVILLE, PA 18949-0310 US
Health Emergency Telephone: 215-766-8861
Label Required Indicator: Y
Date Label Reviewed: 09/08/1993
Status Code: C
Manufacturer's Label Number:
Date of Label: 09/08/1993
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: N
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: Severe
Reactivity Hazard: None

8/9/2002

MSDS Name: **Nitric Acid**, Reagent ACS

Synonyms: Azotic Acid, Engravers Nitrate, Hydrogen Nitrate.
Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

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2. Composition/Information on Ingredients

CAS#	Chemical Name	%	EINECS#
7697-37-2	Nitric acid	69-71%	231-714-2
7732-18-5	Water	Balance	231-791-2

Hazard Symbols: O C
Risk Phrases: 35 8

---

3. Hazards Identification

EMERGENCY OVERVIEW
Appearance: clear colorless to pale yellow.
Danger! Strong oxidizer. Contact with other material may cause a fire. Corrosive. Causes eye and skin burns. Causes digestive and respiratory tract burns. May be fatal if inhaled. Target Organs: None.
Potential Health Effects
Eye:
Causes severe eye burns. May cause irreversible eye injury.
Skin:
May cause severe skin irritation. Causes skin burns. May cause deep, penetrating ulcers of the skin.
Ingestion:
Causes gastrointestinal tract burns. May cause perforation of the digestive tract.
Inhalation:
May be fatal if inhaled. Effects may be delayed. May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema.
Chronic:
Repeated inhalation may cause chronic bronchitis. Repeated exposure may cause erosion of teeth.

---

4. First Aid Measures

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed.

Skin:
Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse. Destroy contaminated shoes.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting and seek IMMEDIATE MEDICAL ADVICE.

Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. DO NOT use mouth-to-mouth respiration.

Notes to Physician:
Treat symptomatically and supportively.

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5. Fire Fighting Measures

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Strong oxidizer. Contact with combustible materials may cause a fire. Use water spray to keep fire-exposed containers cool. Substance is noncombustible. Containers may explode in the heat of a fire.

Extinguishing Media:
Substance is noncombustible; use agent most appropriate to extinguish surrounding fire. Do NOT get water inside containers. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water. For small fires, use dry chemical, carbon dioxide, sand, earth, water spray or regular foam. Cool containers with flooding quantities of water until well after fire is out.

Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

---

6. Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:
Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Wear a self contained breathing apparatus and appropriate Personal protection. (See Exposure Controls, Personal Protection section). Neutralize spill with sodium bicarbonate. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Use a spark-proof tool.

---

7. Handling and Storage

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Ground and bond containers when transferring material. Keep container tightly closed. Do not get on skin or in eyes. Do not ingest or inhale.
Storage:
Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Corrosives area.

---

8. Exposure Controls/Personal Protection

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Nitric acid	2 ppm ; 5.2 mg/m3; 4 ppm STEL; 10 mg/m3 STEL	2 ppm TWA; 5 mg/m3 TWA 25 ppm IDLH	2 ppm TWA; 5 mg/m3 TWA

OSHA Vacated PELs:
Nitric acid: 2 ppm TWA; 5 mg/m3 TWA
Personal Protective Equipment
Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin:
Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.
Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

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9. Physical and Chemical Properties (Nitric Acid)

Appearance:	clear colorless to pale yellow liquid
Odor:	strong odor, acrid odor
Solubility:	Soluble in water
Density/Spec. Grav:	1.50
pH:	1.0
% Volatiles by volume @ 21C (70F):	Not available
Boiling Point:	72 deg C
Melting Point:	-42 deg C
Vapor Density (Air=1):	Not available
Vapor Pressure (mm Hg):	6.8 mm Hg
Evaporation Rate (Butyl Acetate=1):	Not available
Viscosity:	Not available

Molecular Formula: HNO3
Molecular Weight: 63.0119

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10. Stability and Reactivity

Chemical Stability: Decomposes when in contact with air, light, or organic matter.
Conditions to Avoid: High temperatures, incompatible materials, moisture, reducing agents.
Incompatibilities with Other Materials: Reacts with over 150 chemical combinations. Refer to NFPA Fire Protection Guide for specifics. Reacts explosively with organic materials and combustibles.
Hazardous Decomposition Products: Nitrogen oxides.
Hazardous Polymerization: Has not been reported.

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11. Toxicological Information

RTECS#:
CAS# 7697-37-2: QU5775000 QU5900000
CAS# 7732-18-5: ZC0110000
LD50/LC50:
CAS# 7697-37-2: Inhalation, rat: LC50 =67 ppm(NO2)/4H.
CAS# 7732-18-5: Oral, rat: LD50 = >90 mL/kg.
Carcinogenicity:
Nitric acid -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

Epidemiology:
No information available.
Teratogenicity:
Effects on newborn: biochemical and metabolic, Oral-rat TDLo=2345 mg/kg (female 18D post). Fetotoxicity: Stunted fetus, Oral-rat TDLo=21150 mg/kg (female 1-21D post).
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:
No information available.
Other Studies:
None.

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12. Ecological Information

Ecotoxicity:
Mosquito fish: TLm=72 ppm/96H (fresh water) Cockle: LC50=330-1000 ppm/48H (salt water)
Environmental Fate:
No information reported.
Physical/Chemical:
No information available.
Other:
None.

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13. Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants: None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

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16. Other Information

MSDS Creation Date: 2/01/1996 Revision #4 Date: 12/16/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS Name: **Hydrochloric Acid**, Reagent ACS

Chlorohydric acid, hydrogen chloride, muriatic acid, spirits of salt.
Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

---

2. Composition/Information on Ingredients

CAS#	Chemical Name	%	EINECS#
7647-01-0	Hydrochloric acid, reagent ACS	37%	231-595-7
7732-18-5	Water	Balance	231-791-2

Hazard Symbols: C
Risk Phrases: 34 37

---

3. Hazards Identification

Emergency Overview

EMERGENCY OVERVIEW
Appearance: Clear, colorless to faintly yellow.
Danger! Corrosive. Sensitizer. Causes eye and skin burns. May cause severe respiratory and digestive tract irritation with possible
burns.
Target Organs: None.
Potential Health Effects

Eye:
May cause irreversible eye injury. Vapor or mist may cause irritation and severe burns. Contact with liquid is corrosive to the eyes and causes severe burns. May cause painful sensitization to light. May cause conjunctivitis.

Skin:
May be absorbed through the skin in harmful amounts. Contact with liquid is corrosive and causes severe burns and ulceration. May cause photosensitization in certain individuals.
Ingestion:
May cause circulatory system failure. Causes severe digestive tract burns with abdominal pain, vomiting, and possible death. May cause
corrosion and permanent tissue destruction of the esophagus and digestive tract.
Inhalation:
Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. May cause pulmonary edema and severe respiratory disturbances.
Chronic:
Prolonged or repeated skin contact may cause dermatitis. Repeated exposure may cause erosion of teeth. May cause conjunctivitis and photosensitization.

---

4. First Aid Measures

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed.

Skin:
Get medical aid. Rinse area with large amounts of water for at least 15 minutes. Remove contaminated clothing and shoes.

Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Treat symptomatically and supportively.

---

5. Fire Fighting Measures

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Not flammable, but reacts with most metals to form flammable hydrogen gas. Use water spray to keep fire-exposed containers cool.
Extinguishing Media:
Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

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6. Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:
Large spills may be neutralized with dilute alkaline solutions of soda ash, or lime. Absorb spill using an absorbent, non-combustible
material such as earth, sand, or vermiculite.

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7. Handling and Storage

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Do not get on skin
or in eyes. Do not ingest or inhale.
Storage:
Keep away from heat and flame. Do not store in direct sunlight. Store in a cool, dry, well-ventilated area away from incompatible substances.

---

8. Exposure Controls/Personal Protection

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne
concentrations below the permissible exposure limits.
Exposure Limits
Chemical Name ACGIH NIOSH OSHA - Final PELs
Hydrochloric acid, reagent ACS C 5 ppm; C 7.5 mg/m3 50 ppm IDLH C 5 ppm; C 7 mg/m3
OSHA Vacated PELs:
Hydrochloric acid, reagent ACS:
No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin:
Wear appropriate protective gloves to prevent skin exposure.
Clothing:
Wear appropriate protective clothing to prevent skin exposure.
Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

---

9. Physical and Chemical Properties (Hydrochloric Acid)

Appearance:	Clear, colorless to faintly yellow liquid
Odor:	Strong, pungent
Solubility:	823g/L water at 32F
Density:	1.16-1.19
pH:	1.1 (0.1N sol)
% Volatiles by volume @ 21C (70F):	Not available
Boiling Point:	230 deg F
Melting Point:	-101 deg F
Vapor Density (Air=1):	1.257
Vapor Pressure:	160 mm Hg
Evaporation Rate (Butyl acetate =1):	2.0

Molecular Formula: HCl
Molecular Weight: 36.46

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10. Stability and Reactivity

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, light.
Incompatibilities with Other Materials:
Acetate, acetic anhydride, alcohols + hydrogen cyanide, 2-aminoethanol, ammonium hydroxide, calcium carbide, calcium phosphide, cesium acetylene carbide, cesium carbide, chlorosulfonic acid, 1,1-difluoroethylene, ethylene diamine, ethyleneimine, fluorine, lithium silicide, magnesium boride, mercuric sulfate, oleum, perchloric acid, potassium permanganate, b-propiolactone, propylene oxide, rubidum acetylene carbide, rubidum carbide, silver perchlorate + carbon tetrachloride, sodium, sodium hydroxide, sulfuric acid, uranium phosphide, vinyl acetate. Substance polymerizes on contact with aldehydes or epoxides.
Hazardous Decomposition Products:
Hydrogen chloride, chlorine, carbon monoxide, carbon dioxide,
hydrogen gas.
Hazardous Polymerization: May occur.

---

11. Toxicological Information

RTECS#:
CAS# 7647-01-0: MW4025000
CAS# 7732-18-5: ZC0110000
LD50/LC50:
CAS# 7647-01-0: Inhalation, mouse: LC50 =1108 ppm/1H; Inhalation, rat: LC50 =3124 ppm/1H; Oral, rabbit: LD50 = 900 mg/kg.
CAS# 7732-18-5: Oral, rat: LD50 = >90 mL/kg.

Carcinogenicity:
Hydrochloric acid, reagent ACS -
IARC: Group 3 carcinogen
Epidemiology:
No information available.
Teratogenicity:
Embryo or Fetus: Stunted fetus, ihl-rat TCLo=450 mg/m3/1H Specific Developmental Abnormalities: homeostasis, ihl-rat TCLo=450 mg/m3/1H.
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:
No information available.
Other Studies:
None.

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12. Ecological Information

Ecotoxicity:
Trout LC100=10 mg/L/24H Shrimp LC50=100-330 ppm Starfish LC50=100-330mg/L/48H Shore crab LC50=240 mg/L/48H Chronic plant toxicity=100 ppm
Environmental Fate:
Substance will neutralize soil carbonate-based components.
Physical/Chemical:
No information available.
Other:
None.

---

13. Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants: None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: None listed

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16. Other Information

MSDS Creation Date: 11/09/1995 Revision #4 Date: 4/28/1998

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS Name: **Sulfuric acid**, reagent acs

Synonyms: Hydrogen Sulfate, Oil of Vitriol, Vitriol Brown Oil, Matting Acid, Battery Acid
Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

---

2. Composition/Information on Ingredients

CAS#	Chemical Name	%	EINECS#
7664-93-9	Sulfuric acid	95-98.0%	231-639-5
7732-18-5	Water	Balance	231-791-2

Hazard Symbols: XI C
Risk Phrases: 35 36/38

---

3. Hazards Identification

EMERGENCY OVERVIEW
Appearance: colorless to brown.
Danger! Harmful if inhaled. Corrosive. Hygroscopic. Causes digestive and respiratory tract burns. Causes digestive and respiratory tract irritation. Causes severe eye and skin irritation and burns. Target Organs: None known.

Potential Health Effects

Eye:
May cause irreversible eye injury. Causes eye irritation and burns.

Skin:
Causes severe skin irritation and burns.

Ingestion:
Causes gastrointestinal tract burns.

Inhalation:
Harmful if inhaled. May cause severe irritation of the respiratory tract with sore throat, coughing, shortness of breath and delayed lung edema. Causes chemical burns to the respiratory tract.

Chronic:
Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated inhalation may cause nosebleeds, nasal congestion, erosion of the teeth, perforation of the nasal septum, chest pain and bronchitis. Prolonged or repeated eye contact may cause conjunctivitis.

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4. First Aid Measures

Eyes:
Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed. Extensive irrigation is required (at least 30 minutes).

Skin:
Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. SPEEDY ACTION IS CRITICAL!

Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:
Get medical aid immediately. Remove from exposure to fresh air immediately. If breathing is difficult, give oxygen.

Notes to Physician:
Treat symptomatically and supportively.

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5. Fire Fighting Measures

General Information:
Wear appropriate protective clothing to prevent contact with skin and eyes. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products. Contact with water can cause violent liberation of heat and splattering of the material.

Extinguishing Media:
Do NOT use water directly on fire. Use water spray to cool fire-exposed containers. Use carbon dioxide or dry chemical.

Autoignition Temperature: Not available.
Flash Point: 340 deg C (644.00 deg F)
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

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6. Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:
Cover with sand, dry lime or soda ash and place in a closed container for disposal.

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7. Handling and Storage

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well ventilated area. Do not get in eyes, on skin, or on clothing. Keep container tightly closed. Do not ingest or inhale. Do not allow contact with water. Discard contaminated shoes.
Storage:
Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Corrosives area.

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8. Exposure Controls/Personal Protection

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Sulfuric acid	1 mg/m3; 3 mg/m3 STEL	1 mg/m3 TWA; 15 mg/m3 IDLH	1 mg/m3 TWA

OSHA Vacated PELs:
Sulfuric acid:1 mg/m3 TWA
Personal Protective Equipment
Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.
Clothing:
Wear appropriate protective clothing to prevent skin exposure.
Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

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9. Physical and Chemical Properties ()

Appearance:	colorless to brown liquid
Odor:	Odorless
Solubility:	
Density:	1.8400 g/cm3
pH:	Not available
% Volatiles by volume @ 21C (70F):	
Boiling Point:	280 deg C @ 760.00mm Hg
Melting Point:	3 deg C
Vapor Density (Air=1):	1.2 kg/m3
Vapor Pressure (mm Hg):	< 0.00120 mm Hg
Evaporation Rate:	Slower than ether
Viscosity:	Not available

Molecular Formula: H2O4S
Molecular Weight: 98.08

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10. Stability and Reactivity

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Contact with water, metals, excess heat, combustible materials,
organic materials.
Incompatibilities with Other Materials:
Acids (mineral, oxidizing, e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), alcohols and glycols (e.g. butyl alcohol, ethanol, methanol, ethylene glycol), aldehydes (e.g. acetaldehyde, acrolein, chloral hydrate, formaldehyde), amines (aliphatic and aromatic, e.g. dimethyl amine, propylamine, pyridine, triethylamine), azo, diazo, and hydrazines (e.g. dimethyl hydrazine, hydrazine, methyl hydrazine), caustics (e.g. ammonia, ammonium hydrozide, calcium hydroxide, potassium hydroxide, sodium hydroxide), cyanides (e.g. potassium cyanide, sodium cyanide), dithiocarbamates (e.g. ferbam, maneb, metham, thiram), fluorides (inorganic, e.g. ammonium fluoride, calcium fluoride, cesium fluoride), isocyanates (e.g. methyl isocyanate), metals (alkali and alkaline, e.g. cesium, potassium, sodium), metals as powders (e.g. hafnium, raney nickel), metals and metal compounds (toxic, e.g. beryllium, lead acetate, nickel carbonyl, tetraethyl lead), nitrides (e.g. potassium nitride, sodium n.
Hazardous Decomposition Products:
Oxides of sulfur.
Hazardous Polymerization: Has not been reported.

11. Toxicological Information

RTECS#:
CAS# 7664-93-9: WS5600000
LD50/LC50:
CAS# 7664-93-9: Inhalation, mouse: LC50 =320 mg/m3/2H; Inhalation, rat: LC50 =510 mg/m3/2H; Oral, rat: LD50 = 2140 mg/kg.
Carcinogenicity:
Sulfuric acid -
ACGIH: A2 - Suspected Human Carcinogen
OSHA: Select carcinogen
IARC: Group 1 carcinogen
Epidemiology:
Workers exposed to industrial sulfuric acid mist showed a statistical increase in laryngeal cancer. This data suggests a possible relationship between carcinogenisis and inhalation of sulfuric acid mist.
Teratogenicity:
No data available.
Reproductive Effects:
No data available.
Neurotoxicity:
No data available.
Mutagenicity:
No data available.
Other Studies:
No data available.

12. Ecological Information

Ecotoxicity:
Sulfuric acid is harmful to aquatic life in very low concentrations. It may be dangerous if it enters water intakes. The aquatic toxicity for bluegill in fresh water was 24.5 ppm/24 hr, which was lethal.
Environmental Fate:
Not available.
Physical/Chemical:
Not available.
Other:
Not available.

13. Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants: None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

16. Other Information

MSDS Creation Date: 2/01/1996 Revision #3 Date: 10/01/1997
The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

MSDS: Sodium Hydroxide

HAZARDOUS ACCORDING TO WORKSAFE CRITERIA
Supplied by: Chemical Co.
UN Number: 1823
Dangerous Goods Class: 8
Hazchem Code: 2X
Other Names: Caustic Soda
Soda Lye
White caustic
Properties: White deliquescent crystalline flakes or pearls

Health Hazard Information Acute Health Effects Swallowed:

Ingestion of the substance causes severe burns of the mouth and the oesophagus, nausea, vomiting and edema of the pharynx. In the worst cases perforation of the gastrointestinal tract and heart failure may occur.
Eyes: Contact of this substance with the eyes may cause severe lesions and possible loss of sight.
Skin: Skin contact with this substance causes severe burns and necrosis.
Inhaled: Inhalation of dusts may cause pulmonary congestion with subsequent compromission of respiratory functionality followed by loss of consciousness. Extremely irritative to respiratory tract (including mucous membranes, throat and lungs). Slightly toxic.

Chronic Health Effects

Prolonged and reiterated inhalations of the dusts may cause chronic disturbance of the respiratory routes. May cause dermatitis.

First Aid Swallowed:

Contact a Doctor or the Poisons Information Centre immediately. Give patient 1 - 3 cups of water. DO NOT induce vomiting. Immediately transport to a hospital or doctor.
Eyes: Flood eyes with clean water for 15 minutes - retract eyelids often. Immediately transport to a hospital or doctor **Skin:** Remove all contaminated clothing including footwear. Wash affected areas thoroughly with mild soap and water. Seek medical advice.
Inhaled: Remove from contaminated area immediately; avoid becoming a casualty. If NOT breathing apply artificial resuscitation. Experienced person may administer oxygen if breathing is difficult. Immediately transport to a hospital or doctor.

Safe Handling Information PPE:

Goggles, face screen, rubber or PVC gloves. Acid-proof overalls for operations in which there is a risk of splashes. Avoid contact with skin and eyes. Do not eat, drink or smoke in storage areas or during handling. Wash hands and face thoroughly after handling and before work breaks, eating, drinking, smoking and using toilet facilities.
Storage and Transport: Transport or store in a cool, dry place. Transport or store away from strong acids. The drums must be stored in suitable storage rooms equipped with impermeable floors, eye wash fountains and water inlets for rinsing the floor in case of spills.

Spills and Disposal:

Spills
Clean-up personnel should wear full protective clothing. Prevent product access to rivers and canals. Absorb with sand or soil, scoop up and place in suitable containers for later treatment/disposal.
Disposal
Use very dilute acid for neutralisation. Dispose of in accordance with Local, State and Federal regulations at an approved waste disposal facility. Neutralise aqueous solutions by diluting with very diluted hydrochloric acid. Drain effluent with plenty of water, keeping pH under control. Beware of heat and splashes caused by water reactions (dissolution heat) or neutralisation.

Fire/Explosion Hazard: Fire/Explosion

Generally all the reactions with acids and halogenated substances are strongly exothermic. It forms explosive products (Chloroacetylenic derivatives) by reacting with Trichloroethylene at warm temperatures. It can cause the decomposition of

maleic anhydride at explosive speed. It causes violent polymerisation of acrolein and acrilonitrile. It reacts exothermically with alcohol and chloroform mixtures. Incompatible with strong oxidising agents and strong acids, organic materials, aluminum, tin, zinc and nitro compounds. Absorbs CO_2 from air. Decomposition products: nature of decomposition products not known. Material itself is not flammable or explosive but reactions with metals can generate hydrogen gas, which is flammable in air (between 4% and 75% volume). May start fires in contact with fuels.

Extinguishing Media

Evacuate area - move upwind of fire. Summon Fire Brigade immediately, DIAL 000.

DO NOT USE WATER. Fire-fighters should wear full protective clothing including self-contained breathing apparatus.

Fire Fighting: Keep containers cool, Water spray/fog, Foam-alcohol type

MSDS: METHANOL

HAZARDOUS ACCORDING TO WORKSAFE CRITERIA

Supplied by Chemical Co. **Date:** 7/1/98 UN Number: 1230 Dangerous Goods Class: 3 3(6.1) Hazchem Code: 2WE Poisons Schedule S6
Other Names Methyl alcohol
Properties Liquid. Mixes with water.

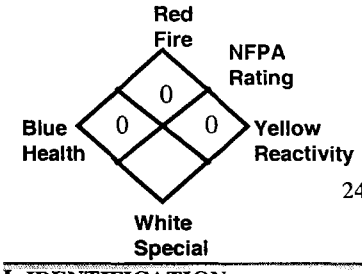
Health Hazard Information Acute Health Effects:
Irritating to eyes.
Vapours may cause dizziness or suffocation.
Ingestion may produce health damage.
Chronic Health Effects: Cumulative effects may result following exposure (limited evidence).

First Aid Swallowed: Contact a Doctor or Poisons Centre. If more than 15 mins from a Doctor, induce vomiting (if conscious). Eyes: Wash with running water (for 15 mins). Seek medical attention. Skin: Remove contaminated clothing. Wash with water and soap. Inhaled: Fresh air. Rest and keep warm. If breathing shallow, give oxygen. Seek medical attention.

Safe Handling Information PPE:
Gloves, rubber or plastic
Goggles or face-shield
Laboratory coat, plastic apron if large quantities are handled
Fume cupboard
Respirator as required when vapours/aerosols generated.
Storage and Transport:
Keep container in a well ventilated place.
Keep away from sources of ignition.
Avoid heating. No smoking.
Store in a cool, dry protected area.
Incompatible with acid halides, alkaline earth metals, oxidising agents.
Spills and Disposal:
Turn off all sources of flame.
Inform others to keep a safe distance.
Consider evacuation if it is a major spill.
Prevent from entering drains.
Contain spillage by any means.
Mop up with plenty of water.
Control vapour with water spray/fog.
Absorb with dry agent.
Fire/Explosion Hazard: Highly flammable. Vapour/air mixture explosive. Fire Fighting:
Keep containers cool.
Water spray/fog.Full protective apparatus and contain.

Warning Signs F = Flammable; T=Toxic

Alconox ®



MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.
pH:	9.5 (1%)

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

Liqui-nox® Material Safety Data Sheet

Alconox, Inc.
30 Glenn Street, Suite 309
White Plains, NY 10603
24 Hour Emergency Number - Chem-Tel (800) 255-3924

I. Identification

Product Name (shown on label): LIQUI-NOX

CAS Registry Number: Not Applicable

Effective Date: January 1, 2001

Chemical Family: Anionic Liquid Detergent

Mfr. Catalog #s for Sizes: 1232, 1201, 1215, 1255

II. Hazardous Ingredients/Identity Information

There are no hazardous ingredients in LIQUI-NOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

National Fire Protection
Association 704 Labeling:

NJTSRN: 1200

III. Physical/Chemical Characteristics

Boiling Point (F): 214°F
Vapor Pressure (mm Hg): No Data
Vapor Density (AIR=1): No Data
Specific Gravity (Water=1): 1.075
Evaporation Rate (Butyl Acetate=1): Slower
Melting Point: No Data
Solubility in Water: Completely soluble in all proportions
Appearance: Yellow liquid, nearly odorless
pH: 8.5 (1%)

IV. Fire and Explosion Data

Flash Point (Method Used): None (Cleveland Open Cup)
Flammable Limits: LEL: No Data
UEL: No Data
Extinguishing Media: Water, dry chemical, CO_2, foam
Special Fire fighting Procedures: Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards: None

V. Reactivity Data

Stability: Stable
Hazardous Polymerization: Will not occur.
Incompatibility (Materials to Avoid): Oxidizing agents.
Hazardous Decomposition or Byproducts: May release SO_2 on burning.

VI. Health Hazard Data

Route(s) of Entry: Inhalation? No
Skin? Yes
Ingestion? Yes

Health Hazards (Acute and Chronic): Skin contact may prove locally irritating, causing drying and/or chapping. Ingestion may cause discomfort and/or diarrhea.
Carcinogenicity: NTP? No
IARC Monographs? No
OSHA Regulated? No
Signs and Symptoms of Exposure: Prolonged skin contact may cause drying and/or chapping.
Medical Conditions Generally Aggravated by Exposure: Not established. Unnecessary exposure to this product or any industrial chemical should be avoided.
Emergency and First Aid Procedures: Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician.
Skin: Flush with plenty of water.
Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. Precautions for Safe Handling and Use

Steps to be Taken if Material is Released or Spilled: Material foams profusely. For small spills recover as much as possible with absorbent material and flush remainder to sewer. Material is biodegradable.

Waste Disposal Method: Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.

Precautions to be Taken in Storing and Handling: No special precautions in storing. Use protective equipment when handling undiluted material.

Other Precautions: No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VII. Control Measures

Respiratory Protection (Specify Type): None Required
Ventilation: Local Exhaust-Normal
Special-Not Required
Mechanical-Not Required
Other-Not Required
Protective Gloves: Impervious gloves are recommended.
Eye Protection: Goggles and/or splash shields are recommended.
Other Protective Clothing or Equipment: Not required
Work/Hygienic Practices: No special practices required.

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Metal Fact Sheets

Lead Fact Sheet

Uses and Occurrences

Lead can be found in the following: construction materials for tank linings and piping; component of lead-acid storage batteries; lead solder; plastics; steel; and pigments for paints. Lead can also be found in waste rock associated with mining activities, wood debris or stock used for electrical co-generation activities, and soil and waste associated with manufacturing activities. Elevated levels of naturally occurring lead may also be found in the soil in certain parts of this country.

Physical Characteristics

Appearance:	Bluish-white, slivery, gray metal. Very soft and easily malleable
Odor:	None
Flammable:	Noncombustible
Flash Point:	Not Applicable
Flammable Range:	Not Applicable
Specific gravity:	11.35
Stability:	very stable
Incompatibilities:	hot nitric acid, boiling concentrated hydrochloric and sulfuric acids
Melting Point:	327°C

Signs and Symptoms of Exposure

Skin and Eye: Irritation

Ingestion and Inhalation (Acute Overexposure): Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise that develops quickly to seizures, coma, and death from cardio-respiratory arrest. A short term dose of lead can lead to acute encephalopathy. Short term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however, arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and chronic effects that take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease that arise after periods of exposure as short as days or as long as several years.

Ingestion and Inhalation (Chronic Overexposure):Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic, there may be severe abdominal pain.

Modes of Exposure

Inhalation: Dusts and fumes

Skin Absorption: None

Ingestion: Dusts and solids

Exposure Limits

Action level	0.03 mg/m^3
PEL	0.05 mg/m^3
STEL	None
PEL-C	None
TLV	0.05 mg/m^3

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL < AL	Maintain exposure as low as reasonably achievable
AL > EL, EL < PEL	Implement portions of the OSHA Lead Standard (i.e., initial medical monitoring) and Training
EL > PEL	Implement all portions of the OSHA Lead Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye: Safety Glasses

Skin: Coveralls or disposable coveralls to keep lead off clothing and to prevent the spread of lead contamination.

Respiratory: Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation: Move to fresh air, contact a physician

Skin: Wash with water

Eyes Flush with water

Ingestion: Contact a physician

2.2.1 Cadmium Fact Sheet

Uses and Occurrences

Coatings on metals; nickel-cadmium storage batteries; power transmission wire; pigments in ceramic glazes, enamels, and fungicides; corrosion-resistant coatings on marine, aircraft, and motor vehicles; manufacture of nuclear reactor rods; and welding electrodes and solder.

Physical Characteristics

Appearance:	Soft, blue-white, malleable, lustrous metal or grayish-white powder; some compounds may appear as a brown, yellow, or red powdery substance.
Odor:	None.
Flammable:	Noncombustible.
Flash Point:	Not Applicable.
Flammable Range:	Not Applicable.
Specific gravity:	8.64 (metal dust).
Stability:	Very stable.
Incompatibilities:	Nitric acid, boiling concentrated hydrochloric and sulfuric acids; contact of cadmium metal dust with strong oxidizers or with elemental sulfur, selenium, and tellurium may cause fires and explosion.
Melting Point:	321°C (metal dust).

Signs and Symptoms of Exposure

Short Term (Acute):	Dust and Fume: Irritation of nose and throat; inhalation may cause a delayed onset of cough, chest pain, sweating, chills, shortness of breath, and weakness. Death may occur. Dust: Ingestion may cause nausea, vomiting, diarrhea, and abdominal cramps.
Long Term (Chronic):	Dust and Fume: Repeated or prolonged exposure may cause loss of sense of smell, ulceration of the nose, shortness of breath (emphysema), kidney damage, and mild anemia. Exposure to cadmium has been reported to cause an increase incidence of cancer of the prostate in men.

Modes of Exposure

Inhalation:	Dusts and fumes.
Absorption:	None.
Ingestion:	Dusts and solids.

Exposure Limits

Action level	2.5 $\mu g/m^3$.
PEL	5.0 $\mu g/m^3$.
STEL	None.
PEL-C	None.
TLV	10.0 $\mu g/m^3$; 2.0 $\mu g/m^3$ (respirable fraction).

Exposure Level vs. Regulatory Requirements

EXPOSURE LEVEL (EL)	REGULATORY REQUIREMENTS
EL < AL	Maintain exposure as low as reasonable achievable
AL > EL, EL < PEL	Implement portions of the OSHA Cadmium standard and Training
EL > PEL	Implement all portions of the OSHA Cadmium Standard including training, medical surveillance, engineering controls, establishment of work areas, etc.

PPE

Eye:	Splash proof or dust resistant goggles; face shield.
Skin:	Protective coveralls, gloves, and footwear.
Respiratory:	Air purifying respirators and supplied air respirators, depending on the exposure.

First Aid

Inhalation:	Move to fresh air; seek medical attention immediately.
Skin:	Remove clothing and shoes; wash with soap or mild detergent and large amounts of water.
Eyes	Flush with water immediately, lifting the upper and lower eyelids; seek medical attention immediately.
Ingestion:	Under no circumstances should therapeutic chelation be administered; seek medical attention immediately.

Arsenic Exposure Instructions

This module was designed for employees who work in areas with percent levels of inorganic arsenic or areas where there is a potential arsenic exposure above the action level of 5μ g/m³.

Arsenic Exposure Training Program

The OSHA arsenic standard (29 CFR 1910.1018), requires employers to provide arsenic training for those employees who may be exposed to inorganic arsenic above the action level of 5μ g/m3. This training program satisfies this OSHA requirement and is provided to assist employees in recognizing arsenic exposure hazards and understanding the procedures to be followed to minimize exposure.

Objectives

1. Inform employees of the possible adverse health effects of arsenic exposure
2. Inform employees of the regulatory requirements when working with or around arsenic
3. Identify how arsenic exposures could occur on CH2M HILL projects

How to complete this training

Employees are required to read the training materials that follow and complete a short quiz. The training materials must be read thoroughly and understood before completing the quiz; you will have only one chance at answering each question.

Quiz scores will automatically be sent electronically to the Health and Safety Training Administrator. A minimum score of 70% must be obtained to receive credit for this training. If a passing score is obtained, the H&S Training Administrator will issue you a certificate of completion. If a passing score is not obtained, you are required to contact your regional health and safety program manager to discuss the training material directly.

Arsenic Exposure Training

1. Use And Occurrences

Arsenic is a naturally occurring element found in the earth's crust. In industry, it is usually associated with the smelting of lead and copper. It was also used in various types of pesticides, but most arsenic-containing pesticides are now banned in the U.S. It continues to have limited use in the semiconductor industry, as a wood preservative, a corrosion inhibitor and a hardener in lead and copper metal. It is a frequent contaminant at hazardous waste sites. It can also be found in well water where there is naturally high amounts of arsenic in the soil.

2. Physical Characteristics

Arsenic exists as a gray solid as elemental arsenic, a white solid, as arsenic trioxide, an orange-red solid as arsenic disulfide. Arsenic compounds are generally insoluble in water.

3. Toxicity And Hazards

Arsenic is a well-known poison that causes a variety of adverse health effects from both acute and chronic exposures. Exposure can be by inhalation of arsenic-containing dust or by ingestion of arsenic-contaminated water. It causes various skin lesions including skin cancer, damage to the nervous system and the brain, and lung cancer. It can also cause birth defects to the offspring of both men and women. The highly toxic gas arsine can be formed if arsenic comes in contact with an acid. Some common symptoms of chronic overexposure include weakness, loss of appetite, nausea, vomiting, diarrhea and a sense of heaviness in the stomach.

4. Regulations

Arsenic has been specifically regulated by OSHA since 1978 (29 CFR 1910.1018). The 8-hour permissible exposure limit (PEL) is 10 micrograms per cubic meter of air (10 μg/m3). OSHA has specified an action level of 5 μg/m3. There is no short term exposure limit (STEL), but 5000 μg/m3 is considered immediately dangerous to life or health (IDLH). Initial air monitoring must be done whenever there are indications of arsenic exposure above the action level. If the action level is not exceeded, air monitoring can cease. If the action level is exceeded, arsenic training must be provided. If the action level is exceeded for more than 30 days in a year, medical surveillance must be provided which includes a medical history and physical examination (chest x-ray, skin and nasal exam, and a sputum cytology test for detection of lung cancer). If the PEL is exceeded, engineering controls must be implemented to reduce exposure. If engineering controls are not feasible or ineffective, respirators must be provided and worn. Air-purifying respirators with high-efficiency (HEPA) filters can be worn when airborne levels are as high as 100μg/m3. If levels exceed that amount, supplied air respirators must be worn. In addition, if the PEL is exceeded, OSHA requires the establishment of regulated areas, showers and change rooms, separate clean lunchrooms and warning signs. Regulated areas are demarcated from the rest of the workplace to limit access to authorized personnel who have received arsenic training. To enter a regulated area you must also wear protective clothing (coveralls, gloves and eye protection).

5. How Exposures Can Occur At Ch2m Hill Projects

Most exposures to elemental arsenic or arsenic trioxide would occur at hazardous waste sites where arsenic is found in soil or groundwater. Exposure to arsenic-containing dust could occur during drilling, heavy equipment movement or other soil-disturbing activities. Dust formation can be minimized by wetting soils. Exposure to arsenic in groundwater would be hazardous only if ingested. Exposure could also occur during project work at smelters, mines or at an industrial plant where arsenic is part of the manufacturing process.

6. Additional Information

If you have information or suspect you have been exposed to arsenic above the action level, contact a health and safety manager to determine if medical monitoring is needed or other regulatory requirements apply. 1% (10,000 ppm) or greater levels of arsenic in soils at a hazardous waste site would normally require air sampling and blood testing.

MEC / UXO Avoidance Plan

MEC / UXO AVOIDANCE PLAN

1.0 INTRODUCTION

This UXO Avoidance plan has been developed as an attachment to the Health and Safety Plan for CH2M HILL personnel.

1.1 Plan Objective

This plan is designed to inform CH2MHILL employees of the specific hazards and procedures when performing operations in or around areas where Munitions & Explosives of Concern (MEC) /Unexploded Ordnance (UXO) materials may be encountered. All CH2M HILL employees who are not UXO qualified must become familiar with the sections of this plan, and all requirements of the subcontractors specific Safety & Health Plan while on site. Any discrepancies in the directives of this plan, and that of the subcontractor should be brought to the immediate attention of the CH2M HILL RHSM or MEC Health & Safety Staff for resolution.

1.2 General Safety Requirements

MEC/UXO may be present and may be encountered during site activities. All CH2MHILL non-UXO qualified personnel will follow the safe work practices listed below:

- Non-UXO qualified personnel will receive site-specific UXO recognition briefing prior to participation in site activities.
- No soil penetrating activities will be allowed without the area first being cleared by UXO qualified personnel.
- Non-UXO qualified personnel will not touch or disturb any object which could potentially be UXO/MEC-related, and will immediately notify the nearest UXO qualified person of the presence of the object.
- All CH2MHILL employees will be at least 200 feet from any excavation activities. After the intrusive excavation has been completed, and the removed soil screened for MEC / UXO, CH2M HILL employees may return to the site to perform their sampling procedures.
- Immediately notify the UXO qualified escort of any suspicious items or possible MEC / UXO in the area of operation.
- If the UXO qualified escort finds an item of MEC / UXO and must uncover it for identification or marking, all CH2MHILL employees will depart the area in the same direction they entered to a distance of 200 feet, and remain there until notified by the UXO qualified escort that it is safe to return.

Information on the exact types and density of MEC is vague. Projectile cartridge casings, propellant, and primers are the most likely items to be encountered. Should anything more hazardous be encountered, plans and procedures will be updated to accommodate safety requirements for more hazardous UXO/MEC.

1.3 UXO Recognition and Safety

As part of the site-specific training, project Non-UXO personnel will receive Unexploded Ordnance Recognition and Safety training. Training will include a review of the MEC Removal Action Explosive Safety Submission Addendum, UXO terms and definitions, ordnance identification, and reporting and specific safety procedures.

2.0 HAZARD/RISK ANALYSIS

Unexploded ordnance is a safety hazard that may constitute an imminent and substantial danger to the personnel performing environmental investigation and removal action activities and the public in general. UXO contamination must be considered a possibility on all formerly used defense sites (FUDS) and active military installations. The surface danger zone of a range (active or inactive), the target area, impact area, ricochet area and the secondary danger zones may be contaminated with UXO (both surface and/or subsurface contamination). The varying types of ammunition, angle of fire, and soil types preclude the accurate estimation of the depth of any subsurface UXO.

2.1 Site Tasks and Operations

CH2MHILL will perform or have subcontractors perform the following tasks where MEC / UXO may be encountered:

- Near Surface (less than 2 feet) soil sampling
- Soil sampling from excavated areas
- Drilling of environmental sampling wells
- Surface water sampling
- Sampling from environmental sampling wells

2.1.1 Near Surface Soil Sampling

The collection of near surface soil sampling will be conducted utilizing the following general requirements:

- The access routes have been surface cleared and marked to allow safe entrance and exit of employees
- All CH2M HILL employees are escorted by a UXO qualified individual
- The area to be sampled has been determined free of anomalies by the use of subsurface detection equipment by a UXO qualified individual, and a recheck is accomplished prior to digging the sample
- No sample will be taken deeper than 2 feet without the area being re-checked for anomalies with the subsurface detection equipment
- If significant resistance is encountered while taking a sample, remove the sample tool and inform a UXO qualified individual

2.1.2 Soil Sampling Excavated Areas

- Stay 200 feet from the work site while excavations are being accomplished, and until the soil has been emptied from the bucket and screened for MEC / UXO
- Do not enter an excavation unless it has been properly shored or sloped
- Do not enter an excavation until a UXO qualified individual has entered the area and performed a surface and subsurface search for MEC / UXO items
- No sample will be taken deeper than 2 feet without the area being re-checked for anomalies with the subsurface detection equipment

2.1.3 Drilling of Environmental Sampling Wells

- The route into the site for the drill rig will be surface and sub surface cleared by UXO qualified personnel. The lanes will be clearly marked for all personnel to see
- There will be adequate surface and subsurface clearance to allow the drill rig movement around the area to be sampled
- During the intrusive operation, all non-essential personnel will be evacuated to a distance of 200 feet
- The bore hole will be checked by MEC detection instrument at 2-foot intervals until the final depth is reached.
- Hard hats will be worn in the working area of the drill rig by all personnel, including the UXO qualified personnel

2.1.4 Surface Water Sampling

- The access routes to the sampling area will be surface cleared by UXO qualified personnel prior to CH2MHILL employees entering the area
- If the water area to be sampled does not allow for an easy observation of what is below the surface, care should be taken when inserting instruments or equipment into the water for sampling. MEC / UXO items may be located below the surface

2.1.5 Sampling from Environmental Wells

- Ensure to stay on the cleared pathways when approaching the well site. Weather and other conditions may uncover MEC / UXO items that were previously unseen
- CH2MHILL employees should be escorted by UXO qualified personnel when entering a potentially contaminated MEC /UXO area that has not already been cleared

Attachment B
USA Environmental's Work Plan and Health & Safety Plan

UXO AVOIDANCE AND CONSTRUCTION SUPPORT

WORK PLAN

Support Services Expanded Remedial Investigation and Site Investigation for Sites 2, 19, and 21 at St. Juliens Creek Annex Chesapeake, VA.

CH2MHILL

Prepared for CH2M Hill

Under the Navy C.L.E.A.N. III

CTO-014

Prepared by:
USA Environmental, Inc
Tampa, FL
July 12, 2004

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Appendix A: UXO Site Specific Safety and Health Plan

OE AVOIDANCE/CONSTRUCTION SUPPROT PLAN

1.0 PURPOSE

This plan outlines the procedures USA Environmental, Inc. (USA) will use to perform Ordnance and Explosives (OE) Avoidance Support Services at St. Juliens Creek Annex (SJCA), Sites 2, 19, & 21, Chesapeake, Virginia. This plan is based on information provided by the prime contractor, CH2M HILL.

1.1 GENERAL

USA will perform operations at SJCA in a systematic manner using proven operating techniques and methods. USA operations will be executed in three distinct phases: Phase 1: Mobilization, Phase 2: - Operations, and Phase 3: Demobilization. This plan describes the activities USA will accomplish during each phase and the methodology USA will use to accomplish these activities.

1.2 SCOPE OF WORK

USA will provide will provide a two-person OE/UXO team to provide on-site OE/UXO Avoidance support for sampling locations and monitoring well locations. The following describe the activities to be performed during the performance of this effort:

- **Site 2**
  - Advancement of approximately 20 membrane interface probe (MIP) locations using direct push technology (DPT).
  - Installation of 3 to 5 shallow groundwater monitoring wells to a depth of approximately 15-20 ft bgs.
  - Installation of 1 deep groundwater monitoring well to a depth of 50 ft.
  - Collection of 3 sediment samples by hand auger from 0 to 6 inches bgs.
- **Site 19-Wharf Area Bldg 190**
  - Surface and subsurface soil sampling at approximately nine locations by DPT, soil borings will be advanced from ground surface to approximately 1 ft. bgs.
  - Groundwater sampling at one location by DPT advancing to 1`5-20 ft. bgs.
- **Site 21-Building 187 Soil Staining**
  - Installation of 5 shallow groundwater monitoring wells to a depth of roughly 15-20 ft. bgs, 3 of these will be installed within a building with a slab on grade construction.

1.3 PHASE 1: MOBILIZATION

USA will begin mobilization following notification in writing of approval of this work plan and receipt of notification to proceed from CH2M HILL. The goal of this phase of mobilization is to ensure that the proper attention is dedicated to coordinating with the prime contractor and moving to the operational phase as soon as practical. Actions performed during this phase include:

- Identify/procure, package, ship, and inventory project equipment;
- Coordinate with the prime contractor's project manager for communications and other support;
- Finalize operating schedules;

- Conduct site-specific training if required.

1.4 PERSONNEL

USA will deploy a UXO Technician III and a UXO Technician II. All USA UXO personnel working at this site have completed Naval Explosive Ordnance Disposal (USNAVSCLEOD) training which details procedures for evaluation and disposal of OE. All USA employees at this job site will have completed a training program, prior to beginning work on site, which complies with OSHA Regulations 29 CFR 1910.120e(9). All USA employees who work on hazardous sites receive training, which includes an equivalent of 40 hours of training off-site and actual field experience under the direct supervision of a trained, experienced Supervisor. Management and Supervisors receive an additional 8 hours training on program supervision. Each employee receives 8 hours of OSHA refresher training annually.

1.5 PROJECT EQUIPMENT

USA has thoroughly assessed the equipment requirements for this project. During mobilization, USA will:

- Package and ship corporate equipment items to SJCA;
- Perform maintenance and quality checks of the equipment to ensure that it is operationally ready;
- Coordinate with CH2M HILL for communications and other support equipment;
- Prepare and issue purchase orders for support equipment items that are not on-hand.

1.6 SITE SPECIFIC TRAINING

As part of the mobilization process, USA will perform site-specific training for all personnel assigned to this project. The purpose of this training is to ensure that all personnel fully understand the procedures and methods USA will use to perform operations at SJCA, their individual duties and responsibilities, and any and all safety and environmental practices/procedures associated with operations. All personnel will be trained as they arrive. Training topics/issues and training responsibilities are as follows:

- The UXO Technicians and support personnel will receive operational briefings and training on their duties and responsibilities. If required by the Navy USA will provide a UXO Briefing. All personnel, to include CH2M HILL crews and subcontractors, will receive ordnance recognition and UXO safety precautions. This training will be performed by the UXO Technician III;
- All personnel will receive training on the individual equipment they will operate while on-site;
- All site personnel will receive detailed training on CH2M HILL's Site Safety and Health Plan (SSHP) and Environmental Protection Plan (EPP);
- Prior to mobilization, all USA personnel will receive HAZWOPER 40 hours (or eight hour refresher) training as required.

1.7 PHASE 2: OPERATIONS

Upon completion of Phase 1 activities, USA will begin Phase 2. The following sub-paragraphs describe the general work practices that USA will follow during all operations and the specific procedures and methods USA will use during this project.

1.8 GENERAL SITE PRACTICES

All operational activities at SJCA will be performed under the supervision and direction of qualified UXO personnel. Non-essential personnel will be prohibited from entering the UXO operations area or performing operations unless they are accompanied and/or supervised by a UXO Technician. Throughout operations, USA will strictly adhere to the following general practices.

1.8.1 WORK HOURS

Operations will be conducted during daylight hours only. USA will work to CH2M HILL's schedule.

1.8.2 SITE ACCESS

USA, in conjunction with CH2M HILL, will control access into operating areas and will limit access to only those personnel necessary to accomplish the specific operations or who have a specific purpose and authorization to be on the site. No hazardous UXO operations will be conducted when unauthorized persons are in the vicinity.

1.8.3 HANDLING OF UXO

UXO items will be handled by qualified UXO personnel only. Non-UXO site personnel will be emphatically instructed and closely supervised to ensure they do not handle any UXO. OE scrap will not be handled or touched unless a UXO Technician has first checked it.

--THIS POLICY WILL BE STRICTLY ENFORCED--

1.8.4 SAFETY TRAINING/BRIEFING

USA will routinely conduct two distinct safety meetings and briefings: daily tailgate safety briefings, and weekly safety meetings. In addition, the UXO Technician III may hold a safety stand-down at any time he notes any degradation of safety or a safety issue that warrants a review.

1.8.4.1 Daily Tailgate Briefing

The UXO Technician III will conduct tailgate safety briefings. A written record of this training and the signatures of personnel attending the training will be maintained. The training will focus on the specific hazards anticipated at each work site during that day's operations and the safety measures that will be used to eliminate or mitigate those hazards. It will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and the team's location changes within a site, or from site-to-site, any corresponding changes in ingress/egress routes and emergency evacuation routes will also be reviewed during this tailgate briefing.

1.8.4.2 Weekly Safety Meeting

The UXO Technician III will hold a weekly safety briefing for all personnel. This training will focus on safety issues observed during the past week; any newly identified safety issues, and any needed/required safety or operational refresher training. Although scheduled weekly, these training briefings will be held anytime there is a significant change in site hazards or upon modification of site safety procedures.

1.8.4.3 Visitor Safety Briefing

Site visitors must receive a safety briefing prior to entering the operating area and must be escorted at all times by the UXO Technician III or the CH2M HILL Representative. All visitors entering must sign in at the CH2M HILL field office.

1.8.5 ENVIRONMENTAL AWARENESS

The promotion of environmental awareness will be ongoing as part of safety and operational briefs.

1.8.6 SAFETY AND ENVIRONMENTAL VIOLATIONS

Safety violations or unsafe acts will be immediately reported to the UXO Technician III. Failure to comply with safety rules/regulations or failure to report violations may result in immediate termination of employment. Reckless interference with sensitive species or blatant disregard for environmental issues will likewise not be tolerated and may lead to termination of employment.

1.8.7 WORK CLOTHING AND FIELD SANITATION

Work clothing will be appropriate for the conditions encountered. In most cases this will be Level D PPE. During intrusive operations the PPE will be in accordance with CH2M HILL's Safety and Health Plan.

- Footwear will be sturdy work boots with toe protection;
- Hand protection will consist of leather or canvas work gloves. Rubber inner or outer gloves may be required where increased protection is needed;
- Safety glasses with side shields, hearing protection, and hard hats will be available and worn when engaged in activities where their use is required;
- Clothing will be full-length pants; long or short sleeve shirt (depending on the weather) and a reflective safety vest. In no case will tennis/running shoes or abbreviated attire such as tank tops or shorts be permitted.
- The team will be outfitted with field decontamination equipment, which will consist of portable eye-wash kits, containers of wash water, paper towels and soap. Prior to commencing operations each day, these facilities will be in place and ready for use in the vicinity of the team's work area as needed. Good housekeeping and decontamination measures will be practiced.

1.8.8 COMPLIANCE WITH PLANS AND PROCEDURES

USA will conduct operations at SJCA in a systematic manner using proven operating methods and techniques. All activities will be conducted under the direction, supervision and observation of the UXO Technician III. All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted by on-site supervisory personnel in close liaison with the CH2M HILL representative. Any new course of action or desired change in procedures will be submitted with justification for approval as required. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality on the part of the UXO team.

1.8.9 FIELD SANITATION AND WASH POINT

The work team will utilize existing field sanitation stations.

1.9 OE AVOIDANCE AND REMOVAL OF UXO

Throughout this operation, the UXO Technician III will closely monitor performance to ensure these procedures are being performed with due diligence and attention to detail. USA will perform UXO visual detection and avoidance operations as described below.

1.10 PREPARATION OF WORK AREAS

Prior to drilling or sampling crews going on site, the OE team will conduct a reconnaissance of the approach route to work sites. The reconnaissance will include locating a clear path for the crews, vehicles and equipment. The approach paths, at a minimum, will be twice the width of the widest vehicle. The boundaries of the approach path will be clearly marked to prevent personnel from straying into un-cleared areas. If UXO is encountered, the UXO team will mark and report the item, and divert the approach path around the UXO. Personnel will be instructed to remain within the marked boundary limits. A magnetometer will be used to search for near surface anomalies within the approach path. If an magnetic anomaly is encountered, it will be assumed to be a possible UXO, it will be marked, the approach path diverted, and reported. UXO or OE encountered will be handled in accordance with Paragraph 1.13 below.

1.11 DRILLING SITES

Prior to drilling equipment being moved to the proposed well location, the OE team will locate a subsurface anomaly free site. The cleared area will be marked and as a minimum, the cleared area will be a square, with a side dimension equal to twice the length of the largest vehicle or piece of equipment to be brought on site. Personnel will be warned to stay within the marked boundaries. If subsurface anomalies are detected they will be assumed to be UXO/OE and an anomaly free location selected.

1.12 PROCEDURES

During all intrusive operations, such as soil sampling and well installation, the proposed location will be checked with a magnetometer. If subsurface anomalies are detected they will be assumed to be UXO/OE and an anomaly free location selected. CH2M HILL may start well locations with a hand or powered auger or the drill rig. At a depth of not more than two (2) feet the auger or drill bit will be withdrawn and the hole checked with a downhole magnetometer. This procedure will be used to insure that smaller items of UXO, undetectable from the surface, can be detected. If no anomalies are detected, the procedure will be repeated at two-foot intervals to the maximum depth of the auger, but not less than six (6) feet. If a subsurface anomaly is detected the well site will moved to another location and the process repeated.

If the proposed well location is free of anomalies the drilling equipment will be brought on site and utilized. Downhole monitoring with the magnetometer will continue at two-foot intervals until installation of the monitoring well is complete.

1.13 SOIL BORING SITES

Prior to soil sampling the UXO Technician will clear the proposed location in accordance with paragraph 1.10 above. At the sample site the UXO Technician will check for subsurface anomalies and locate an anomaly free location. If, during sampling, UXO is encountered it will be handled in accordance with paragraph 1.13 below. If UXO is encountered that is not safe to move, it will be marked and a new location chosen.

1.14 LIVE AND SUSPECT OE

UXO or OE items encountered a will be inspected by the UXO Technicians. Items that are safe to move may be relocated to a bermed or sandbagged area a safe distance from ongoing operations. No items will be moved unless positively identified and determined safe to move. The item(s) will be marked and reported to CH2M HILL. OE encountered that is *not* safe to move will be marked in place and operations will be moved to another location. UXO will be marked by installing four (4) wooden stakes and encircling the stakes with flagging tape (see Table 1). Prior to installing stakes the location will be checked with a magnetometer to avoid driving the stake into a subsurface anomaly. All live and suspect live items will be

inspected and identified by two UXO Technicians. If the item cannot be positively identified and determined to be inert and safe to move, it will be marked and reported.

If during identification of UXO or OE it becomes necessary to move or handle the item, non-UXO qualified personnel will withdraw to a safe distance.

1.15 OE RELATED MATERIAL

Adjacent to each operating area, the UXO Technicians will establish an OE scrap collection point. During operations OE items that are free of explosive contamination (i.e., fragments, parachutes, etc.) will be placed into these collection points and marked (see table 1). Upon completion of operations the materials in these temporary collection points will be transferred to a central collection point for disposal by CH2M HILL. As the material is being loaded, the UXO Technicians will perform a second inspection of the material to ensure it is free of explosives and other hazardous materials.

1.16 HEAVY EQUIPMENT OPERATION

Heavy equipment safety will be in accordance with the CH2M HILL SSHP.

1.17 EQUIPMENT

The equipment requirements for this activity include:

- Well drilling equipment;
- Schonstedt GA-52CX Magnetometer;
- Foerster MK-26 downhole magnetometer;
- Marking material listed in table 1;
- Miscellaneous common hand tools (e.g. hand trowel, shovel, etc.).

Table 1: Color Codes, UXO Avoidance

Color	*Used to Mark*
Red/Orange Tape	*Danger, identified suspect UXO, special precaution required*
White Pin Flag	*Boundary or temporary marker*
Green Paint	*Marking OE-related scrap*

1.18 DISPOSAL OPERATIONS

All UXO and OE-related material containing explosives or hazardous material will be disposed of by other than USA. All hazardous material encountered will be reported to CH2M HILL for disposition.

1.19 RECORDS

The UXO Technician III will prepare and maintain a daily journal that includes a detailed accounting of all UXO and OE encountered and non-hazardous OE related scrap recovered. The inventory will include information pertaining to the following:

- The number, type, and description of UXO items recovered and disposition;

- The number, type, and description of non-hazardous items recovered and stockpiled, and an estimated weight, in pounds, of the scrap remaining for CH2M HILL disposal.

1.20 PHASE 3: DEMOBILIZATION

During this phase, USA will remove its operational capability from the area. All USA owned equipment will be shipped to corporate headquarters and all leased equipment will be returned.

1.21 SUMMARY

USA has developed a comprehensive plan to locate, identify, and avoid OE and OE-related material in the operational areas located at SJCA. Our approach is systematic and the methodology proposed is technically sound and operationally safe.

Appendix A

UXO Site Specific Safety and Health Plan

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2.0 SITE SAFETY AND HEALTH PLAN

The purpose of this Site Safety and Health Plan (SSHP)is to establish general guidelines and procedures to ensure protection of USA Environmental, Inc. (USA) personnel and the public while performing operations at the St. Juliens Creek Annex, Chesapeake, VA. This SSHP addresses safety for ordnance and explosives/unexploded ordnance (OE/UXO) avoidance operations and is to be incorporated into the Work Plan. The objective of this SSHP is to provide supervisors and workers the necessary tools to maintain a safe and healthy work place and to protect the environment. USA places safety and accident prevention above operations, and places the burden of responsibility on all employees. A copy of this SSHP is available for review by all employees, and visitors upon request. All supervisors and workers will be required to review the SSHP and sign the log prior to performing any work at the site. Personnel that violate policies contained in this SSHP may be dismissed from the work site and considered for termination.

2.1 SITE DESCRIPTION

2.1.1 ST. JULIENS CREEK ANNEX, CHESAPEAKE, VA.

Refer to the CH2M Hill Work Plan (WP) for a complete description or the site.

2.1.2 SPECIFIC WORK SITES

USA Environmental, Inc. will provide UXO Avoidance and Construction Support services at locations within the project site as directed by contract requirements and CH2M Hill personnel. Soil sampling will take place at locations designated by CH2M Hill personnel. Construction Support for trenching will take place at Landfills 2, 3, 5, and 6.

2.2 OBJECTIVE

The objective is for USA Environmental, Inc. to provide UXO Avoidance and Construction Support services for OE/UXO found within the project site during soil sampling operations and the characterization of approximately 2,000 linear feet of trenches/pits. Depths will coincide with the groundwater table.

2.3 ORGANIZATION STRUCTURE AND RESPONSIBILITIES

2.3.1 GENERAL

Ensuring the safe and healthful conduct of site operations is the responsibility of everyone assigned to the site, therefore, all USA personnel involved in site activities will be responsible for the following:

- Complying with the SSHP and all other required safety and health guidelines;
- Taking all necessary precautions to prevent injury to themselves and to their fellow employees;
- Continually being alert to any potentially harmful situation and immediately informing the UXO Technician III or UXO Safety Officer (UXOSO) of any such identified conditions;
- Performing only those tasks that they believe they can do safely and have been trained to do;

- Notifying the UXO Technician III or UXOSO of any special medical conditions (i.e., allergies, contact lenses, diabetes) which could affect their ability to safely perform site operations;
- Notifying the UXO Technician III or UXOSO of any prescription and/or over-the-counter medication which they are taking that might cause drowsiness, anxiety or other unfavorable side affects;
- Preventing spillage and splashing of materials to the greatest extent possible;
- Practicing good housekeeping by keeping the work area neat, clean and orderly;
- Immediately reporting all injuries, no matter how minor to the Technician III or UXOSO;
- Maintaining site equipment in good working order, and reporting defective equipment to the Technician III or UXOSO; and
- Properly inspecting and using the PPE required by the SSHP, UXO Technician III or UXOSO.

2.3.2 ORGANIZATION

The Safety and Health (S&H) requirements listed in this plan may change as work progresses at the site, however, no changes will be made without approval of the USA Safety and Health Manager. The safety organizational structure and responsibilities for USA personnel operating at the project site are described in the following paragraphs. USA's Organizational Structure is depicted in Figure A-1 below:

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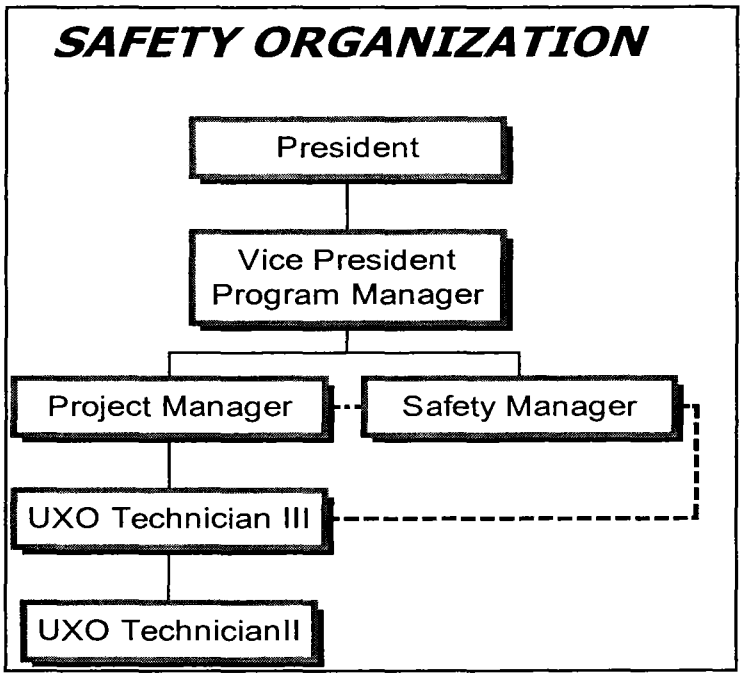


Figure A-1

2.3.3 PRESIDENT

Mr. Jonathan Chionchio is the President of USA Environmental, Inc. He has made safety a priority issue at USA. He has designated each and every USA employee as a Safety Officer and charged each employee with the responsibility for stopping unsafe acts before an accident occurs. USA takes safety seriously and Mr. Chionchio's personal involvement in safety is a reflection of USA's commitment to worker safety.

2.3.3.1 Vice President/Program Manager

Mr. John Adams is the Vice President/Program Manager for USA Environmental, Inc. He is responsible for the effective and efficient operation of all USA OE contracts.

2.3.3.2 Safety and Health Manager

Mr. Robert Crownover is the Safety and Health Manager (SHM) for USA Environmental, Inc. He is the primary point of contact for safety and health issues at the corporate level. The SHM will have the following responsibilities:

- Reports directly to the Vice President/Program Manager of USA Environmental, Inc. for all safety and health matters;

- Assists in preparation and conducts a final review of the SSHP;
- Provides UXO safety and health consultation to site personnel;
- Coordinates with the Certified Industrial Hygienist (CIH) to ensure site compliance with the SSHP and the USA Corporate Safety and Health Plan (CSHP); and
- Maintains an alternate line of communication with the President of USA Environmental, Inc.

2.3.3.3 Project Manager

Mr. George Spencer is the Project Manager for USA Environmental, Inc. During the execution of this contract he will monitor performance and act as the primary point of contact for operational issues at the corporate level.

2.3.3.4 UXO Technician III

The UXO Technician III is responsible for the direct supervision and safety of the personnel under their control and reports to the USA Corporate Project Manager. The Technician III is responsible for ensuring that all work accomplished and all personnel comply with the WP, SSHP, and all applicable federal, state, and local regulations. The UXO Technician III may conduct additional safety meetings and training as needed and reports all safety violations and accidents/injuries to the appropriate personnel. The Technician III will have the following responsibilities:

- Reports directly to the USA Corporate Project Manager;
- Managing the funding, manpower and equipment necessary to safely conduct site operations;
- Reviewing and becoming familiar with the site Work Plan (WP) and SSHP;
- Furnishes copies of the WP and SSHP to site personnel for their review;
- Reviewing the scope of work (SOW) and ensuring that the required safety and health elements are addressed in the SSHP and/or WP;
- Coordinating the assignment of personnel and ensuring that the personnel and equipment provided meet the requirements of the WP and SSHP;
- Ensuring implementation of project quality and safety and health procedures;
- Early detection and identification of potential problem areas, including safety and health matters, and instituting corrective measures;
- Directly interfacing with the CH2M HILL Site Manager and advising him/her of safety and health matters related to conduct of site operations; and
- Acts as the alternate On-Scene-Incident-Commander (OSIC) in the event of an emergency, notifying and coordinating with off-site emergency and medical response agencies.

2.3.3.5 Project UXO Safety Officer (UXOSO)

The UXOSO responsibilities for this project will be performed by the UXO Technician III. The UXO Technician III will assume all duties of the UXOSO position and oversee all safety and health aspects of this contract. The UXOSO will have the following responsibilities:

- Has ***STOP WORK*** authority for safety and health reasons;
- Complete Personnel Data Sheets on all site personnel;
- Implement and enforce the SSHP, and report safety violations to the appropriate personnel;
- Establishing work zones and controlling access to these zones;
- Confirm all contractor and subcontractor personnel's suitability for work, based upon OSHA and site specific medical and training requirements;
- Conduct daily General Safety Briefings;
- Implement and document the Site Specific Hazard Information Training Program (as specified by 29 CFR 1910.120);
- Ensure proper condition, maintenance, storage, and use of PPE;
- Consulting with the appropriate personnel prior to downgrading or altering monitoring or PPE requirements;
- Assisting in the continued development of the SSHP and other safety and health procedures;
- On-site enforcement of the Alcohol/Drug Abuse Policy;
- Investigate accidents/incidents and "near misses";
- Conduct visitor orientation;
- Enforce the "buddy" system;
- Conduct and document daily safety inspections, and weekly safety audits;
- Maintain and calibrate safety monitoring equipment, and document calibration data in the monitoring or safety log;
- Restrict site personnel from site activities if they exhibit symptoms of alcohol or drug use or illness, and continually monitor site personnel for signs of environmental exposure or physical stress;
- Maintain the site safety and monitoring logs;
- Act as the On-Scene-Incident-Commander (OSIC) in the event of an emergency, notify and coordinate off-site emergency and medical response agencies;
- Post the descriptions and maps associated with hospital and emergency evacuation routes; and
- Conduct on-site safety orientation and operational review. The orientation and review will be accomplished during the first working day at the project site.

2.3.3.6 UXO Technician II

The UXO Technician II is required to comply with the provisions of this SSHP, the WP and all applicable Federal, State and local laws and regulations. The Technician II will report to the UXO Technician III.

2.3.4 RESPONSIBILITIES OF ALL SITE PERSONNEL

Ensuring the safe and healthful conduct of site operations is the responsibility of everyone assigned to the site, therefore, all USA and subcontractor personnel involved in site activities will be responsible for the following:

- Complying with the SSHP and all other required safety and health guidelines;
- Taking all necessary precautions to prevent injury to themselves and to their fellow employees;
- Continual alertness to any potentially harmful situation and the need to immediately inform the Technician III of any such conditions;
- Performing only those tasks that they believe they can do safely and have been trained to do;
- Notifying the Technician III of any special medical conditions (i.e., allergies, contact lenses, diabetes) which could affect their ability to safely perform site operations;
- Notifying the Technician III of any prescription and/or over-the-counter medication which they are taking that might cause drowsiness, anxiety or other unfavorable side affects;
- Preventing spillage and splashing of materials to the greatest extent possible;
- Practicing good housekeeping by keeping the work area neat, clean and orderly;
- Immediately reporting all injuries, no matter how minor to the Technician III;
- Maintaining site equipment in good working order, and reporting defective equipment to the Technician III;
- Reporting to work clean shaven, if required to use respiratory protection; and
- Properly inspecting and using the PPE required by the SSHP, Technician III.

2.4 SITE CONTROL

The Technician III coordinates access control and security on-site. Due to the hazardous nature of OE/UXO only authorized personnel will be allowed in the exclusion zone (EZ). The EZ is the work site, encompassing an area large enough to prevent personnel injuries from fragmentation resulting from either unintentional or intentional detonations of UXO. During all operations the EZ will be a radius of 200 feet from the operating team for all essential personnel. The limits of the EZ will be marked with visual, suitable marking material. During UXO operations, only UXO trained or authorized essential personnel are allowed in the EZ (unless escorted by the Technician III). Authorized personnel are those that have completed the required training and meet medical requirements.

Visitors will report to the Technician III. During all operations on individual sites, the site UXO Technician III will cease operations if non-essential personnel are observed within the operating area. During duty hours USA personnel will provide security at the individual sites. Equipment will be returned to a designated area and secured at the end of the workday.

Representatives from regulatory agencies will be permitted to enter the site at any time during business hours or any other reasonable times provided they have completed the required training and meet medical requirements. Further site controls to ensure safety are as follows:

- Eating, drinking, and smoking are prohibited except in designated areas;
- OE/UXO operations will cease if non-UXO trained personnel are present;
- The Technician III will escort all authorized visitors to the site;
- All personnel entering the site, including visitors, will be in the proper PPE;
- The Technician III will maintain the site entry control log to ensure accurate accountability for personnel;
- The Technician III will brief this SSHP to all personnel entering the site to inform them of the potential site hazards. All personnel will acknowledge this briefing by signing the SSHP briefing log; and
- In case of an emergency, personnel will exit the site and move to the designated safe area. The safe area will be located upwind of the site outside of the fragmentation area. The Technician III will determine the severity of the emergency. If the emergency warrants evacuation, the Technician III will notify the CH2M HILL Site Manager.

2.5 HAZARD/RISK ANALYSIS

USA has analyzed the scope of work tasking to determine the work risk hazards associated with each task. The tasks consist of direct tasks and the implied tasks, or sub tasks, to accomplish the work. Task hazard analyzes sheets are in section A-46 Table A-5 of this plan. USA has identified the following hazards/risks for the project site:

2.5.1 PERFORM OE/UXO AVOIDANCE AND CONSTRUCTION SUPPORT

- Exposure to hazards associated with surface and subsurface OE/UXO. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel;
- Heavy Equipment operation hazards inherent in the use of EMM;
- Lifting hazards, such as back strain , associated with handling OE scrap;

- Biological hazards: exposure to irritating or toxic plant life; exposure to wildlife, rodents, insects, ticks, and snakes which present the possibility of bites and associated diseases; and
- Potential trip hazard associated with ground cover, irregular terrain, and vegetation;
- Heat/Cold Stress.

2.6 HAZARD CONTROL, ACCIDENT PREVENTION

2.6.1 GENERAL

USA personnel will follow the below listed procedures to mitigate the hazards/risks outlined in paragraph A-5 of the SSHP:

- Any approach to a suspected OE/UXO will be conducted in accordance with procedures outlined in the U.S. Army Engineering and Support Center (CEHNC) Safety Concepts and Basic Considerations Unexploded Explosive Ordnance (UXO), 22 May 2000 (located at the end of this appendix);
- Any OE/UXO found within the confines of the work area will be positively identified by two UXO qualified technicians;
- OE/UXO items will only be moved or handled (when necessary) by qualified UXO/EOD technicians;
- All personnel will wear as a minimum Level D PPE, sleeves rolled down when in heavy vegetation, leather or canvas work gloves and sturdy work boots. This will minimize contact with potentially irritating and/or toxic plants. In addition to these measures, any person known to have allergic reactions to insect bites or exposure to toxic plants will be identified and will carry appropriate first aid materials at all times;
- While on the job, all personnel will move at a moderate pace and stay alert for possible trip hazards;
- Personnel will avoid, to the maximum extent possible, contact with any wildlife. Should a person become bitten he/she will receive immediate first aid;
- Personnel working in vegetated areas will be reminded to check themselves for ticks and insect bites after leaving the work area; and
- While working on site all personnel will use the "buddy" system. Buddies will be assigned each day prior to beginning work. They will remain in sight of each other at all times to ensure safe working practices. During hazardous operations one buddy will act as a safety observer.

2.6.2 OE/UXO

These basic safety precautions are the minimum OE/UXO safety requirements required of all personnel on site. Other precautions and requirements are in the CEHNC Safety Concepts and Basic Considerations Unexploded Explosive Ordnance (UXO) at the end of this appendix and other applicable OE/UXO manuals referenced in this SSHP.

2.6.2.1 Basic Considerations

The following should be taken into consideration when planning or conducting OE/UXO operations:

- SAFETY IS PARAMOUNT;
- Do not move or disturb unidentified items.
- All OE/UXO will be identified independently by two (2) UXO technicians;
- Do not collect souvenirs;
- Do not smoke except in designated areas;
- Do not carry fire or spark producing devices into the site;
- All OE/UXO operations will use the "Buddy" system; and
- Prohibit unnecessary personnel from visiting the site.

2.6.2.2 Basic Safety Precautions:

The following safety precautions are applicable to all OE/UXO:

- Suspend all operations immediately upon approach of an electrical storm;
- Observe the hazards of electromagnetic radiation (EMR) precautions when working in the vicinity of electrically initiated or susceptible OE/UXO;
- Do not handle any OE/UXO unnecessarily;
- Avoid inhalation and skin contact with smoke, fumes, dust, and vapors of detonations and OE/UXO residue;
- Do not attempt to extinguish burning explosives or any fire which might involve explosive materials;
- Incorporate appropriate property and personnel protective measures for shock and fragmentation when conducting OE/UXO operations;
- Do not subject OE/UXO to rough handling;
- Avoid unnecessary movement of armed or damaged OE/UXO;
- Avoid the forward portions of munitions employing proximity fuzing; and
- Assume unknown fuzes contain cocked strikers or anti-disturbance features.

2.6.2.3 General Safety Precautions

2.6.2.1.3 Projectiles

- Determine if the projectile has been fired and if so consider it armed;
- Check for the presence of unburned tracers; and

- Avoid the rear and front of rocket assisted and base ejecting projectiles.

2.6.2.2.3 Grenades

- Do not attempt to re-install safety pins on a dud fired grenade; and
- Do not attempt to withdraw impinged firing pins from the fuze of a dud fired grenade.

2.6.2.3.3 Rockets

- Approach and work on rockets from the side;
- Do not dismantle or strip dud fired rockets or rocket motors; and
- Do not expose electrically fired munitions to radio transmissions within 25 feet.

2.7 CHEMICAL HAZARDS

No chemical munitions have been identified as present on this site. If, during site operations, USA personnel encounter a suspected toxic chemical munition or Recovered Chemical Warfare Material (RCWM) they will immediately withdraw upwind along cleared paths, outside of the fragmentation zone of the ordnance, to a safe location and contact CH2M HILL.

2.8 BIOLOGICAL HAZARDS

Biological hazards, which may be found on site include insects, such as ticks, mosquitoes, spiders, centipedes, snakes, and hazardous plants. Depending on the season and weather the hazards will vary. For instance, during certain seasons many animals and insects are not active and many plants are dormant. Employee awareness and the safe work practices outlined in the following paragraphs should reduce the risk associated with these hazards.

2.8.1 HAZARDOUS PLANTS

During the conduct of site activities, contact with hazardous plants may be encountered. The ailments associated with these plants may range from mild hay fever to contact dermatitis to carcinogenic affects. However, the plants which present the greatest degree of risk to site personnel (i.e., potential for contact vs. affect produced) are those which produce skin and tissue injury and skin reactions.

Contact with splinters, thorns and sharp leaf edges is of special concern to site personnel. This concern stems from the fact that punctures, cuts and even minor scrapes caused by accidental contact may result in non-infectious skin lesions, and the introduction of fungi or bacteria through the skin or eye. Personnel receiving any of the injuries listed above, even minor scrapes, should report immediately to the Technician III for initial and continued observation and care of the injury.

2.8.2 REPTILES AND ANIMALS

2.8.2.1 Snakes

When site activities are conducted in warm weather on sites that are located in vegetated or rocky environments, the potential for contact with snakes becomes a possibility. Normally, if a person is approaching a snake, the noise created by the person is usually sufficient to frighten the snake off. However, during the warm months, extreme caution must be exercised when conducting site operations around areas where snakes might be found (i.e., rocks, bushes, or in holes, crevices, and abandoned

pipes). If poisonous snakes are identified on-site, USA will have available for use protective clothing, such as snake leggings, for site personnel. The rules to follow if someone is bitten by a snake are:

- Do not cut "Xs" over the bite area as this will intensify the effect of the venom;
- Do not apply suction to the wound since this has a minimal effective in removing venom;
- Do not apply a tourniquet since this will concentrate the venom and increase the amount of tissue damage in the immediate area;
- If possible, kill the snake without risk to other personnel, bag it and transport it with the victim or try to identify it so proper selection of anti-venom can be made;
- Do not allow the victim to run for help since running increases the heart rate and will increase the spread of the venom throughout the body;
- Keep the victim calm and immobile;
- Have the victim hold the affected extremity lower than the body while waiting for medical assistance;
- Transport the victim for medical attention immediately.

2.8.2.2 Other Animals

Normally wildlife avoid people and areas where activities are ongoing. Small animals may become aggressive when cornered, injured, or infected with rabies. When working remain alert for likely locations that animals inhabit. Avoid nests, dens, and holes in the ground that may be the animal's home. If bitten by an animal, seek medical attention immediately. Do not try to capture the animal, this may result in additional personnel becoming bitten.

2.8.3 Tick Bites

The Center for Disease Control (CDC) has noted that Lyme Disease and Rocky Mountain Spotted Fever (RMSF) which are caused by bites from infected ticks that live in and near vegetated areas, have been identified within the state of Virginia. Ticks are small, ranging from the size of a comma up to about one quarter inch. They are sometimes difficult to see. The tick season extends from spring through summer. When embedded in the skin, they may look like a freckle.

2.8.3.1 Treatment

If you believe you have been bitten by a tick contact the Technician III, who will authorize you to visit a physician for an examination and possible treatment.

2.8.3.2 Protective Measures

Standard field gear (work boots, socks, and work uniform) provide good protection against tick bites, particularly if the openings are taped. However, even when wearing field gear, the following precautions should be taken when working in areas that might be infested with ticks:

- When in the field, check yourself often for ticks, particularly on your lower legs and areas covered with hair;

- Spray outer clothing, particularly your pant legs and socks, ***BUT NOT YOUR SKIN***, with an insect repellant that contains permethrin;
- When walking in vegetated areas, avoid contact with bushes, tall grass, or brush as much as possible;
- If you find a tick, remove it by pulling on it gently with tweezers;
- If the tick resists, cover the tick with salad oil for about 15 minutes to asphyxiate it, then remove it with tweezers;
- Do not use matches, a lit cigarette, nail polish or any other type of chemical to "coax" the tick out; and
- Be sure and remove all parts of the tick's body, and disinfect the area with alcohol or a similar antiseptic after removal.

2.8.4 BEES, HORNETS AND WASPS

Contact with stinging insects like bees, hornets and wasps may result in site personnel experiencing adverse health affects that range from being mild discomfort to life threatening. Therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded, grassy areas where many waste sites are located;
- The nests can be situated in trees, rocks, bushes or in the ground, and are usually difficult to see;
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active;
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention;
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock;
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages; and
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure; therefore, even if someone has been stung previously, and has not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction upon receipt of another sting.

With these things in mind and with the high probability of contact with stinging insects, all site personnel will comply with the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp or hornet stings, they must inform the Technician III of this condition prior to participation in site activities;

- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the Technician III if a stinging insect nest or presence of a swarm of bees is located or suspected in the area;
- Any nests located on-site will be flagged off and site personnel will be notified of its presence;
- If stung, site personnel will immediately report to the Technician III to obtain treatment and to allow the Technician III to observe them for signs of allergic reaction; and
- Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times.

2.8.5 BITING INSECTS

Many types of biting insects such as mosquitoes, flies and fleas may be encountered on-site. The use of insect repellents will be encouraged by the Technician III if deemed necessary. The biting insects of greatest concern are spiders, especially the black widow and the brown recluse. These spiders are of special concern due to the significant adverse health effects that can be caused by their bite.

2.8.5.1 Black Widow Spider

The black widow is a coal-black bulbous spider ¾ to ½ inches in length, with a bright red hour-glass on the under side of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite;
- Appearance of small punctures (but sometimes none are visible); and
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils and generalized swelling of face and extremities.

2.8.5.2 Brown Recluse Spider

The brown recluse is brownish to tan in color, rather flat, 2 to 5/8 inches long with a dark brown "violin" shape on the underside. It may be found in trees, or in dark locations. Victims of a brown recluse bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite;
- Formation of a large, red, swollen, pustulating lesion with a bull's-eye appearance;
- Systemic affects may include a generalized rash, joint pain, chills, fever, nausea and vomiting; and pain may become severe after 8 hours, with the onset of tissue necrosis.

2.8.5.3 Tegenaria (Hobo/Aggressive House Spider)

The Tegenaria spider is brown without any distinguishing marks. It measures 10-15 mm in diameter including the legs. The Tegenaria is an indoor spider, referred to as a funnel spider, for the shape of its web. Victims of a Tegenaria Spider bite may exhibit the following signs or symptoms:

- Sensation of pinprick at the location of the bite.;
- Formation of a hard lesion surrounded by a pale halo (similar to a brown recluse bite);
- Ensuing blister will measure two to six inches and take months to heal; and
- Bite may leave permanent scar.

2.8.5.4 Treatment For Spider Bites

There is no effective first aid treatment for any of these bites. Except for very young, very old or weak victims, these spider bites are not considered to be life threatening, however medical treatment must be sought to reduce the extent of damage caused by the injected toxins. If any of these spiders are suspected or known to be on-site, the Technician III will brief the site personnel as to the identification and avoidance of the spiders. As with stinging insects, site personnel should report to the Technician III if they locate these spiders on-site or notice any type of bite while involved in site activities.

2.9 DRUG AND ALCOHOL

USA is committed to having a drug free work place. The unlawful manufacture, distribution, dispensation, purchase, or sale of illegal drugs or alcohol at work is prohibited. Violation of this rule will result in employee termination. In accordance with the Drug-Free Workplace Act of 1988, any employee convicted of a violation of criminal drug statutes while in the employ of USA must notify the USA Human Resources Manager or the subsidiary Human Resources Representative within 5 days of the conviction.

2.10 SUBSTANCE ABUSE

2.10.1 GENERAL CONDITIONS

All employees and subcontractors shall at all times comply with all aspects of USA's Substance Abuse Prevention Program. A copy of the Program is available upon request and is included in this section on the following pages. Employees, or agents, who fail to comply with the program will be prohibited from entering the site.

2.10.2 DRUG SCREENING TEST

All USA employees or agents of subcontractors, or independent contractors hired by subcontractor to perform any of the work under the subcontract who participate in this subcontract, will be required to participate in a Drug Screening Test prior to commencing work on the project, excluding orientation, and after any project related accident that they may be involved in. Employees will be considered probationary workers until Drug Screen Test results are received by the individual's employer and such results are certified to the Technician III by an officer of the employer. The Drug Screening Test will require the production of a urine sample. The urine sample will be tested as a minimum for the following substances:

- Cocaine Metabolite;
- Amphetamines;
- Opiates;
- Phencyclidine;

- Cannabinoids.

Any USA employee, person employed or hired by any subcontractor or contractor who receives a confirmed positive test result will be permanently prohibited from entering project property.

2.10.3 SUBSTANCE ABUSE PREVENTION PROGRAM

The use of illegal drugs, on or off duty is inconsistent with law biding behavior expected of all citizens. The use of illegal drugs, or abuse of alcohol or prescription drugs, on or off duty, may impair the ability of project employees to perform tasks that are critical to proper work performance. The result is an increase in accidents and failures which pose a serious threat to the safety of all employees, visitors and the general public. Impaired employees also tend to be less productive, less reliable and prone to greater absenteeism resulting in the potential for increased cost and delays in the timely completion of our contracts.

Furthermore, employees have the right to work in a drug-free environment and to work with persons free from the effects of drugs and alcohol. Employees who abuse alcohol or drugs are a danger to themselves and to other employees. In addition, drug and alcohol abuse inflicts a terrible toll on the nation's resources and the health and well-being of workers and their families.

2.10.3.1 Program Objectives

The substance abuse prevention program has the following objectives and goals:

- To assist in maintaining a safe and healthful working environment for our employees, our customers, visitors, vendors, suppliers, trade/subcontractors and members of the general public;
- To minimize absenteeism and tardiness; to improve productivity; and to ensure quality workmanship; and
- To comply with contractual obligations.

2.10.3.2 Program Application

This program will apply to all regular full-time, probationary, casual or contract employees and applicants of USA. This program will be applied to USA on-site personnel. Compliance with this program will be required by USA. Entry onto the Owner's property constitutes consent to the right of USA, or its authorized representatives, to enforce any aspect of this Substance Abuse Prevention Program.

2.10.3.3 Company Premises for Property Defined

For the purpose of this program the term "Owner's property" includes property, offices, facilities, land, buildings, structures, fixtures, installations, automobiles, vessels, trucks and all other vehicles and equipment, whether owned, leased or used. This also includes all areas under control, or any other work locations or mode of transportation to and from those locations (parameters of job site) during working time and while in the course and scope of company employment, or pay status or while the person is on company business during regular work hours.

2.10.3.4 Unauthorized Drugs, Alcoholic Beverages and Other Items

All USA employees, applicants, suppliers, vendors and visitors that use, abuse, or have presence in the body or reporting to work under the influence, bringing onto company property, unlawful manufacture, distribution, dispensation, possession, transfer, storage, concealment, transportation, promotion or sale of the following illegal and unauthorized drugs, controlled substances, alcoholic beverages, drug-related paraphernalia or weapons by employees and others is strictly prohibited from the company premises, or while on company business and/or during working time.

2.10.3.5 Illegal Drugs

Illegal drugs include:

- Marijuana - pot, dope, hash or hashish;
- Cocaine - coke, rock, crack or base;
- LSD - acid;
- PCP - angel dust, crystal;
- MDMA - ecstasy;
- Heroin - smack, black tar;
- Opium - morphine, white stuff, tar, black stuff; and
- Any other unauthorized drugs and abnormal or dangerous substances which may affect an employee's/person's mood, responses, motor functions or alter or affect a person's perception, performance, judgment, reactions, or senses while working.

The foregoing list is provided by way of example only and is not to be considered as all inclusive. This policy prohibits the presence of any confirmed detectable amount of these drugs in the employee/person while on the Owner's Property regardless of when or where the substance entered their body.

2.10.3.6 Prescription Drug Abuse

Employees and others may possess prescription drugs and "over the counter" medications provided:

- The prescription drugs are prescribed by an authorized medical practitioner for current use (within the past 12 months) of the person in possession and the medicine is in its original container and in the employee's/person's name;
- Employees must not consume prescribed drugs more often than as prescribed by the employee's physician, and they must not allow any other person to consume the prescribed drug;
- Any employee who has been informed that the medication could cause adverse side effects while working or where medication indicates such warning, must inform his or her supervisor prior to using such substances on the job; and
- The use of drugs/medicine prescribed by a licensed physician for the individual employee is permitted provided that it will not affect work performance. However, the Technician III reserves the right to have a licensed physician determine if use of a prescription drug or medication by an employee may produce effects which increase the risk of injury to the employee or others while working. If such a finding is made, the Technician III may limit or suspend the work activity of the employee during the period that the physician advises that the employee's ability to perform his/her job safely may be adversely affected by the consumption of such medication. Any employee who has been suspended or limited may seek substitute medication from his/her physician and if determination is made that the substitute medication will not adversely affect the employees' performance, then the suspension of limitations will be lifted.

2.10.3.7 Prohibited Material

The following materials are prohibited by this program:

- Drug related paraphernalia is unauthorized material or equipment or item used or designed for use in testing, packaging, storing, injecting, ingesting, inhaling, or otherwise introducing into the human body a controlled substance;
- Unauthorized Possession of firearms, weapons, or explosive (incendiary) materials including, but not limited to: brass knuckles, illegal knives and other dangerous instruments; and
- No firearms are allowed on the Owner's Property (loaded or unloaded), except when authorized for security purposes.

2.10.3.8 Program Enforcement Activity

(Work place searches, certified urine, drug and/or breathalyzer testing). USA also reserves the right to require all USA project site employees and applicants to undergo medical or physical examinations or tests at any time as a condition of employment or continued employment, including NIDA certified urine drug tests and breathalyzer tests to determine the use of any illegal or unauthorized drugs or substances prohibited in this program or to determine the employee's satisfactory fitness for duty. These tests, through the employee's direct employer, will be utilized under the following circumstances:

- Pre-employment/pre-placement testing will be required of any qualified applicant or candidate as a condition of consideration for employment with USA and trade contractors/subcontractors.
- If an employee suffers an occupational on-the-job injury: (requiring treatment from a doctor) or following a serious or potentially serious accident or incident in which safety precautions were violated, equipment or property was damaged, unusually careless acts were performed, or where the cause was due to an employee's or other person's failure to wear prescribed personal protective equipment or follow prescribed safety rules while working on the Owner's Property.

2.10.3.9 Searches

Whenever the Technician III has a reasonable basis to suspect that an employee's work performance or on-the-job behavior may have been affected by alcohol or drugs, or that the employee has sold, purchased, used or possessed alcohol, drugs, or drug paraphernalia on Owner's Property, or at all times while entering, departing, or on property, properties, or work areas, the Technician III may search the employee, the employee's locker, desk or other property under the control of the employee, as well as the employee's personal effects or automobile on the Owner's Property. *AT NO TIME WILL EMPLOYEE OR OTHERS BE TOUCHED*; only outer clothing will be required to be removed during these searches and inspections. Wherever deemed appropriate, the Technician III may use trained dogs to detect illegal drugs on personnel or on the site.

2.10.3.10 Notice of Disciplinary Action for Program Violations

The Technician III will require employees and others to participate in such Urinalysis, Breathalyzer or search activity as may be necessary to assist in providing a safe, healthful and productive working environment and to comply with Federal Laws. *NO EMPLOYEE OR PERSONS SEARCH, URINALYSIS, BREATHALYZER OR INSPECTION WILL BE CONDUCTED WITHOUT THE EMPLOYEE'S CONSENT*, and whenever practicable, the Technician III will request the employee's written consent. However, failure to comply with the provisions of this program or failure to provide consent when requested shall be grounds for removal from the job site.

2.10.3.11 Offense Discharge

An employee shall be subject to removal from the job site for the following:

- The employee refuses to submit to a search or inspection, urinalysis or breathalyzer when requested by the Technician III. Refusal to submit to a search, inspection or test will be considered sufficient cause for removal from the job site;

- While on the site, the employee was using, manufacturing, distributing, dispensing, selling, or possessing any illegal or unlawful drug; and
- The employee has failed his/her Substance Abuse Test.

2.11 SAFE WORKING PRACTICES (SWP)

All personnel on-site will be required to follow the SWPs contained in this Section and the work plan, and will immediately report to the Technician III any conditions which do not comply with this section. The provisions outlined in this section are intended to be the minimum SWPs which site personnel will follow.

2.11.1 POWER AND HAND TOOL OPERATION

2.11.1.1 Power Tools

By their very nature, power tools have great capability for inflicting serious injury upon site personnel if they are not used and maintained properly. Power tools must be manufactured by companies with a listing by an accepted testing laboratory to be authorized for use. To control the hazards associated with power tool operation, the requirements outlined in EM 385-1-1, Section 13, the manufacturers instructions and recommendations, and the safe work practices listed below shall be observed when using power tools:

- Operation will be conducted by authorized personnel familiar with the equipment, its operation, and safety precautions;
- Power tools will be inspected prior to use and on a continued periodic basis, defective equipment will be removed from service until repaired;
- Power tools designed to accommodate guards will have such guards properly in place prior to use;
- Loose fitting clothing or long hair will not be permitted around moving parts;
- Hands, feet, etc., will be kept away from all moving parts;
- Maintenance and/or adjustments to equipment will not be conducted while it is in operation; the power will be disconnected prior to maintenance activities;
- An adequate operating area will be provided, allowing sufficient clearance and access for operation; and
- Personnel will use all required PPE, such as gloves, glasses, and hearing protection.

2.11.1.2 Hand Tools

Use of improper or defective tools can contribute significantly to the occurrence of accidents on site. Therefore, the requirements of EM 385-1-1, Section 13 and the safe work practices listed below shall be observed when using hand tools:

- Hand tools will be inspected for defects prior to each use and on a continued basis;
- Defective hand tools will be removed from service and repaired or properly discarded;
- Tools will be selected and used in the manner for which they were designed;
- Be sure of footing and grip before using any tool;
- Do not use tools that have split handles, mushroom heads, worn jaws, or other defects;

- Gloves will be worn to increase gripping ability and/or if cut, laceration or puncture hazards exist during the use of hand tools;
- Safety glasses or a face shield will be used if use of tools presents an eye/face hazard;
- Do not use makeshift tools or other improper tools;
- When working overhead, tools will be secured to ensure they cannot fall on someone below; and
- Use non-sparking tools in the presence of explosive vapors, gases, or residue.

2.11.2 MATERIAL LIFTING

Many types of objects are handled in normal day-to-day operations. Care should be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. The requirements of EM 385-1-1, Section 14 and the following fundamentals address the proper lifting of materials to avoid joint and back injuries:

- The size, shape and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably;
- A firm grip on the object is essential, therefore the hands and object shall be free of oil, grease and water, which might prevent a firm grip;
- The hands, and especially the fingers shall be kept away from any points that cause them to be pinched or crushed, especially when setting the object down;
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces and pinch points, and gloves shall be used, if necessary, to protect the hands;
- Use powered lifting devices if possible;
- The feet will be placed far enough apart for good balance and stability;
- Personnel will ensure that solid footing is available prior to lifting the object;
- When lifting, get as close to the load as possible, bend the legs at the knees, and keep the back as straight as possible;
- To lift the object, the legs are straightened from their bending position;
- Never carry a load that you cannot see over or around;
- When placing an object down, the stance and position are identical to that for lifting: with the back kept straight and the legs bent at the knees, the object is lowered; and
- If needed, USA will provide back support devices to their personnel to aid in preventing back injuries during lifting activities.

When two or more people 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 individuals carrying the load. When carrying the object, each person, if possible, shall face the direction in which the object is being carried.

2.11.3 FIRE HAZARDS

2.11.3.1 Causes of Fires and Explosions

Although fires and explosions may arise spontaneously, they are more commonly the result of carelessness during the conduct of site activities, such as moving drums, mixing/bulking of site chemicals and during refueling of heavy or hand held equipment. Personnel will review EM385-1-1, Section 9 for additional fire prevention and protective measures. Some potential causes of explosions and fires include:

- Mixing of incompatible chemicals, which cause reactions that spontaneously ignite due to the production of both flammable vapors and heat;
- Ignition of explosive or flammable chemical gases or vapors by external ignition sources;
- Ignition of materials due to oxygen enrichment;
- Agitation of shock or friction-sensitive compounds; and
- Sudden release of materials under pressure.

2.11.3.2 Fire Prevention

Explosions and fires not only pose the obvious hazards of intense heat, open flames, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel on-site and members of the general public living or working nearby. Site personnel involved with potentially flammable material or operations will follow the requirements of EM 385-1-1, Section 09.B, and the guidelines listed below to prevent fires and explosions:

- Potentially explosive/flammable atmospheres involving gases or vapors will be monitored using a combustible gas indicator;
- Prior to initiation of site activities involving explosive/flammable materials, all potential ignition sources will be removed or extinguished;
- Non-sparking and explosion-proof equipment will be used whenever the potential for ignition of flammable/explosive gases/vapors/liquids exists;
- Dilution or induced ventilation may be used to decrease the airborne concentration of explosive/flammable atmospheres;
- Smoking is prohibited at OE/UXO work sites, or in the vicinity of, operations which may present a fire hazard, and the area will be conspicuously posted with signs stating "No Smoking or Open Flame Within 50 Feet";
- Flammable and/or combustible liquids must be handled only in approved, properly labeled metal safety cans equipped with flash arrestors and self-closing lids;
- Transfer of flammable liquids from one metal container to another will be done only when the containers are electrically interconnected (electrically bonded);

- Equipment fueling points will be in an approved location and a safe distance from ongoing operations;
- Equipment fueling points will have spill containment/absorbent material available;
- Equipment fueling points and storage areas will have the appropriate type and size fire extinguisher ready for use;
- The motors of all equipment being fueled will be shut off during the fueling operations; and
- Metal drums used for storing flammable/combustible liquids will be equipped with self-closing safety faucets, vent bung fittings, grounding cables and drip pans, and will be stored in an area approved by the Technician III.

2.11.3.3 Fire Protection

The following safe work practices will be used to protect against fires:

- Vehicles and equipment will not be fueled while running;
- Flammable/combustible liquid storage areas will have at least one 3A:40:B:C: fire extinguisher located within 25-75 feet, marked with the appropriate fire symbol and no smoking signs;
- Temporary offices will be equipped with a fire extinguisher of not less than 2A:10B:C; and
- At least one portable fire extinguisher having a rating of not less than 2A:20B:C will be located at each work site.

2.11.4 EXCAVATIONS AND CONFINED SPACES:

Excavation activities will be conducted in accordance with 29 CFR 1926, and the USA SHP. The guidelines below are intended to reflect minimum requirements to be followed on this site:

- Prior to initiation of any excavation or trenching activity, the location of underground installations will be determined if applicable;
- When the excavation/trench achieves a depth of greater than four feet, the Technician III will determine the type of soil being excavated and designate the slope which will be used;
- The excavation(s) will be inspected daily by a competent individual prior to commencement of work activities;
- Evidence of cave-ins, slides, sloughing, or surface cracks will be cause for work to cease until necessary precautions are taken to safeguard workers;
- Excavations 5 feet or deeper, which cannot be slopped at a 1.5 to 1 ratio, will require a competent individual to design and install a protective system;
- Protective systems shall be selected from OSHA 29 CFR 1926 Subpart P and/or designed by a registered professional civil engineer;

- Spoils and other materials will be placed 2 feet. or more from the edge of the excavation;
- Materials used for sheeting, shoring, or bracing will be in good condition;
- Timbers will be sound, free of large or loose knots, and of appropriate dimensions for the excavation;
- Safe access will be provided into the excavation(s) by means of a gradually sloped personnel access/egress ramp, or ladders or stairs will be provided;
- Ladders used will extend 3 feet above grade level and be secured from movement;
- Excavations 4 feet or more in depth will have a means of egress at a frequency such that lateral travel to the egress point does not exceed 25 feet;
- Walkways or bridges with standard guardrail will be provided where employees are required or permitted to cross over excavations;
- If the depth of an excavation is greater than 4 feet, it will be inspected by the Technician III to determine if it meets the criteria for a confined space;
- If an excavation is determined to be a Confined Space the requirements set forth in the Confined Space Program found in the USE SHP will apply; and
- IAW the requirements of 29 CFR 1926.651(g), if an excavation is greater than 4 feet in depth, and the potential for having a hazardous atmosphere inside the excavation exists, then the atmosphere shall be tested for oxygen deficiency and toxicity prior to entry by site personnel.

According to 29 CFR 1910.146, a confined space is defined as having all of the following criteria:

- It is large enough and so configured that an employee can bodily enter and perform assigned work;
- Is not designed for continuous human occupancy; and
- Has limited or restricted means for entry or exit.

If an excavation meets all three of the criteria listed above, it must be defined as a confined space, and the provisions and safety precautions of the USA SHP will apply. To avoid classifying an excavation as a confined space, it is imperative that one of the requirements listed above be removed or avoided. The easiest requirement to remove is the one related to limited means of entry and exit. Entry/exit points must be designed and maintained which allow for easy entry and exit from the excavation. This can be accomplished through the construction of gently sloping entry and exit ramps which are located such that lateral travel to an exit is no greater than 25 feet from the work area in the excavation. If this can not be accomplished, then the excavation must be classified as a confined space and the appropriate safety precautions implemented.

2.12 BLOODBORNE PATHOGEN PROGRAM AND TRAINING

Due to the nature of OE/UXO work there is the potential for exposure to blood pathogens as a result of an accident or injury. Typically, work sites are in remote areas and first aid and/or initial emergency first aid is provided on site by other employees. Personnel will receive training on bloodborne pathogens prior to beginning work at the site.

2.12.1 DEFINITIONS

- Bloodborne Pathogens: Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).
- Exposure Incident: A specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.
- Other Potentially Infectious Materials: The following human body fluids:
  - Semen, vaginal secretions, cerbro-spinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.
  - Any unfixed tissue or organ (other than intact skin) from a human living.
- Parenteral: Piercing mucous membranes or the skin barrier through such events as needle sticks, human bites, cuts, and abrasions.
- Work Practice Controls: Controls that reduce the likelihood of exposure by altering the manner in which a task is performed.
- Universal Precautions: An approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other Bloodborne pathogens.

2.12.2 EXPOSURE CONTROL PLAN:

2.12.2.1 Exposure Determination

Due to the hazardous nature of OE/UXO work there is the potential for accidents and the exposure to blood pathogens. USA employees will be required to perform emergency first aid and/or CPR in the event of an accident or injury.

2.12.2.2 Work Practice Controls

PPE (CPR Pocket Mask and disposable surgical gloves) are available in all first aid kits on site. Hand washing facilities are available in the EZ and SZ. Personnel performing first aid and/or CPR will comply with the following:

- Personnel that provide any first aid will wear disposable latex gloves if there is any visible body fluids;
- The CPR Pocket mask will be used when performing CPR and disposed of after use;
- Personnel will change clothing immediately, or as soon as feasible, that becomes contaminated with body fluids as a result of performing first aid;
- Personnel will immediately wash their hands after performing first aid procedures; and
- Contaminated clothing and equipment will be bagged in red BIO-Hazard bags, labeled as to date and contents, and deposed of as infectious waste.

2.12.2.3 Post-Exposure Evaluation and Follow-Up

Following an exposure incident, USA will make available, to the exposed employee, a confidential medical evaluation and follow-up containing the following elements:

- Documentation of the routes(s) of exposure, and the circumstances under which the exposure incident occurred;
- The source individual's and exposed employee's blood will be collected as soon as feasible and tested after consent is obtained; and
- The results of the source individual's testing will be made available to the exposed employee, and the employee will be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

2.12.2.4 Information and Training

Training will be provided as initial site training prior to beginning work at the site. The training will be documented on the USA *ON-SITE SAFETY MEETING RECORD* on file as part of initial training. This training will be provided and documented annually for all employees.

2.13 QUALIFICATION TRAINING

All USA UXO personnel working on site have completed Naval Explosive Ordnance Disposal (USNAVSCLEOD) training which details procedures for evaluation and disposal of OE/UXO. All

employees at this job site will have completed a training program, prior to beginning work on site, which complies with OSHA Regulation 29 CFR 1910.120e (1), (4) and/or (9). All USA employees who work on hazardous sites receive training, which includes an equivalent of 40 hours of training off-site and 3 days of actual field experience under the direct supervision of a trained, experienced Supervisor. Management and Supervisors receive an additional 8 hours training on program supervision. Each employee receives 8 hours of OSHA refresher training annually. Copies of training and qualifications will be on file at the Corporate Headquarters or other designated location.

2.14 SITE SPECIFIC TRAINING

The Technician III will give site-specific training to all UXO and non-UXO personnel prior to initial site entry. The training will include:

- Project scope to include: organization and responsibilities; site orientation, facilities, access, egress, evacuation routes, and other general information; and
- Safety, to include: safe work practices; physical hazards, PPE; on/off-site emergencies; evacuation routes; emergency agencies/numbers; emergency equipment; medical emergencies; Drug and Alcohol; Bloodborne pathogens; and other pertinent safety information.

2.15 ADDITIONAL TRAINING/MEETINGS

2.15.1 DAILY SAFETY MEETING

Safety training will be provided each morning on-site at the daily safety meeting. The safety and health considerations for the day's activities will be reviewed. Additional training will be conducted when circumstances dictate. The daily meeting will address that day's activities; safety issues; specific hazards; and emergency procedures, to include:

- Notification procedures and phone numbers;
- Rally points, and safe areas;
- Hospital and evacuation routes; and
- Emergency equipment.

2.15.2 TAILGATE SAFETY MEETING

The Tailgate Safety meeting is conducted by the Technician III. The safety and health considerations for the task being performed by the individual team members will be reviewed. Additional task specific training may be conducted as required. The tailgate safety meeting will address the specific task and activities being performed at the teams location and entries made on the Tailgate Safety Meeting form.

2.15.3 WEEKLY SAFETY MEETING

The weeks safety and health considerations for the site will be reviewed. Changes, recommendations, concerns or violations will be briefed by the Technician III. This meeting is documented and shall include subjects covered and personnel attending.

2.16 PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE required at the site will be at a level necessary to protect personnel and IAW EM 385-1-1, Section 5. Normal work clothing will be level D. During OE/UXO operations a hard hat is not required unless a

possible head injury could result from the use of equipment or overhead hazards. Steel toe footwear will not be used while operating magnetometers or geophysical instruments.

2.16.1 LEVEL D PPE

The minimum level of protection required of all personnel at the site is level D. The following is level D protection:

- Short or long sleeve cotton coveralls or work clothing;
- Sturdy work boots;
- Safety glasses with side shields or goggles when an eye hazard exists;
- Hard hat (when required);
- Leather or canvas work gloves; and
- Hearing protection, when working around equipment or powered hand tools producing a noise hazard.

The level of protection is based on what is known about the site. The levels of protection may change as site conditions change. The Technician III will monitor site conditions and provide information to the CH2M HILL Site Manager as necessary. The Technician III may increase the levels of protection when necessary but will not downgrade the level without approval from the USA SHM.

2.17 MEDICAL

All personnel on site have completed a pre-placement or annual physical examination that complies with the requirements of EM 385-1-1, Section 3 and29 CFR 1910.120 and have been certified as fit to work by an Occupational Physician certified in Occupational Medicine by the American Board of Preventive Medicine, or who by necessary training and experience is board eligible. All USA UXO personnel on-site are in the USA medical surveillance program. Documentation as to the medical qualifications of personnel are on file on site and available to the Contracting Officer. All personnel are screened for drugs in accordance with the USA

Drug/Alcohol Abuse Program.

2.18 EXPOSURE MONITORING/AIR SAMPLING

While OE/UXO investigation may result in emissions of inhalable particulates and other criteria pollutant, these activities are not expected to adversely affect air quality. Engineering controls, such as wetting, may be used to eliminate the suspension of dust and other particulates that may become airborne and migrate off-site.

2.19 COLD AND HEAT STRESS

During activities conducted on OE/UXO sites, extreme temperature conditions can create serious safety and health threats to site workers. The concern at the project site will initially be heat stress as cold stress conditions are not anticipated. The Technician III will identify and monitor personnel that have had previous problems with heat stress. This section addresses the potential hazards associated with heat stress, and outlines the procedures for monitoring and controlling those hazards.

2.19.1 COLD STRESS

The affects experienced by site personnel when working in cold environments depend upon many environmental and personal factors such as ambient air temperature, wind speed, duration of exposure,

type of protective clothing and equipment worn, type of work conducted, level of physical effort and health status of the worker. In cold environments, overexposure can cause significant stress on the body which can lead to very serious and permanent injury. Cold may affect just the exposed body surfaces and extremities or may affect down to the deeper body tissues and the body core. Presented below is information about the most common cold stress disorders and their signs, symptoms, affects and control techniques.

TABLE A-1: WIND CHILL

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS EQUIVALENT TEMPERATURE												
ACTUAL TEMPERATURE READING (° F)												
ESTIMATED WIND SPEED (in mph)	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (° F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-	-	-	-

2.19.1.1 Hypothermia/Frostbite

Hypothermia results when the body loses heat faster than it can produce it. When this occurs, the blood vessels in the skin and extremities constrict, reducing the flow of warm blood to those areas, thereby reducing the rate of heat loss. This reduction in blood flow usually affects the peripheral extremities first. Ears, fingers and toes begin to experience chilling then pain and finally numbness due to loss of both blood flow and heat. Shivering begins as the body's core temperature begins to drop and the body uses the shivering to compensate and create metabolic heat. Shivering is often the first sign of hypothermia. The pain and numbness in the extremities is an indication that the heat loss is increasing, and when shivering becomes uncontrollable, the heat loss in the body core has become extreme. Further heat loss produces speech difficulty, forgetfulness, loss of manual dexterity, collapse and finally death.

Frostbite usually occurs on exposed skin and the extremities, such as face, hands and feet. There are several degrees of injury from frostbite ranging from mild to severe: frost nip or incident frostbite is

characterized by sudden blanching or whitening of the skin; with superficial frostbite the skin has a waxy or white appearance and is firm to the touch but the tissue beneath is resilient; the most serious is deep frostbite where the tissues are cold, pale, and solid.

2.19.2 Treatment of Cold Stress Disorders

The intent of all cold stress treatment is to bring the deep body core temperature back to its normal temperature of about 98.6°F. Work performed in cold environments should be discontinued for any worker who exhibits the signs or symptoms associated with hypothermia or frost bite. Workers exhibiting those symptoms are brought to a warm area and allowed to rest and warm up. If a worker's clothing becomes wet, reducing its insulating effect, it should be removed and replaced by dry clothing or allowed to dry before resuming work. A warm, non-alcohol, de-caffeinated drink (not coffee) or soup may be given. Re-warming should be gradual. For frostbite the victim should be sheltered from the wind and cold and given warm drinks. If the frostbite is superficial the frozen part should be covered with extra clothing or blankets or warmed against the body. **Do not use direct heat, and do not pour hot water over or rub the affected area.** Warming should be gentle and gradual. Failure to do this could lead to bleeding in the tissues and increase the possibility of infection. If the frostbite is deep, i.e. the affected area is frozen and hard to the touch, immediate medical attention should be obtained. The safe thawing of deep frostbite is beyond the expertise and facilities found on-site.

2.19.3 Prevention of Cold Stress Disorders

During work in cold environments the UXOSO uses the tailgate safety briefing to inform site personnel of the measures to be utilized in the prevention and control of cold stress. The UXOSO also uses meteorological data and Table A-1 to inform site personnel of the combined temperature/wind chill affect to be expected during the day's activities. At air temperatures below 45 degrees F the temperature will be monitored. At temperatures below 30 degrees F the dry bulb temperature and wind speed will be measured every four hours to determine the wind-chill. When the temperature/wind-chill is expected to be below freezing, personnel will take more frequent breaks. Prevention methods which site personnel utilize include:

- Buddy system: Personnel monitor their buddy for signs of cold stress;
- Wearing adequate, appropriately layered clothing, including a water repellant outer layer if precipitation is forecasted;
- Layered clothing includes an innermost layer, such as cotton to trap heat and absorb perspiration, an insulating layer of wool or synthetic fiberfill (such as polypropylene), a layer of work weight clothing, and an outer protective layer designed to be wind/water proof, such as nylon or Gortex™;
- Wearing a hat and gloves and socks that are synthetic or wool insulated to help retain body heat and prevent its loss;
- Removing outer layers of clothing during breaks in heated shelters to prevent excessive sweating;
- In windy, cold conditions, covering all exposed skin;
- Eating well-balanced meals and maintaining adequate intake of non-alcoholic, decaffeinated fluids;
- Seeking shelter in a warm protected area when signs and symptoms of cold stress become evident; and

- Protecting clothing from getting wet; this includes keeping clothing from getting wet with sweat, so remove outer layers if work activities cause excessive sweating.

TABLE A-2: TLV WORK/WARM-UP

Air Temperature— Sunny Sky		No Wind		5 MPH Wind		10 MPH Wind		15 MPH Wind		20 MPH Wind	
^{0}C approx.	^{0}F approx.	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26^0 to -28^0	-15^0 to -19^0	Normal	1	Normal	1	75 min	2	55 min	3	40 min	4
-29^0 to -31^0	-20^0 to -24^0	Normal	1	75 min.	2	55 min.	3	40 min	4	30 min	5
-32^0 to -34^0	-25^0 to -29^0	75 min.	2	55 min.	3	40 min.	4	30 min	5	Non-emergency work should cease	
-35^0 to -37^0	-30^0 to -34^0	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38^0 to -39^0	-35^0 to -39^0	40 min.	4	30 min.	5	Non-emergency work should cease					
-40^0 to -42^0	-40^0 to -44^0	30 min.	5	Non-emergency work should cease							
-43^0 & below	-45^0 &	Non-emergency work should cease									

Air Temperature— Sunny Sky		No Wind	5 MPH Wind	10 MPH Wind	15 MPH Wind	20 MPH Wind
	below					

Notes for Table:

1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35^{0}C (-30^{0}F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step5).

2. The following is suggested as a guide for estimating wind velocity if accurate information is not available:

5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.

3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be:

special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2;

all non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general, the warm-up schedules provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.

4. TLVs apply only for workers in dry clothing.

*Adapted from the " Threshold Limit Values and Biological Exposure Indices,

American Conference of Governmental Industrial Hygienist, Cincinnati, OH.

USA assists in the prevention of cold stress by providing sheltered, warm areas where site personnel can rest and regain body heat during breaks (see Table A-2: Warm-up Schedule). When conditions warrant USA will provide hot water for personnel to prepare their cocoa, soup, etc. If approved by USACE, a

heated shelter may be provided inside the EZ, upwind from the work area, where site personnel can rest and warm-up.

- Warm fluids, such as soup or decaffeinated tea and cocoa, will be provided as needed;
- A minimum of one fifteen minute break in a heated shelter every two hours;
- A heated shelter may be provided inside the EZ, upwind from the work area, where site personnel can rest and warm-up after having processed through a limited PDS consisting of glove wash and removal, respirator wash and removal, and hand washing.

2.19.4 HEAT STRESS

Heat stress is one of the most common (and potentially serious) illnesses that can affect hazardous waste site workers. The most common cause of heat stress during site activities is the affect that PPE has on the bodies natural cooling mechanism. Individuals will vary in their susceptibility and degree of response to the stress induced by increased body heat. Factors which may predispose a worker to heat stress include: lack of physical fitness; lack of acclimatization to hot environments; degree of hydration; level of obesity; current health status (i.e.,. having an infection, chronic disease, diarrhea, etc.); alcohol or drug use; and the worker's age and sex. For the remainder of this Section, reference to "liquids" will indicate water or an electrolyte replacement solution - not tea, coffee or soft drinks.

2.19.4.1 Heat Stress Disorders

2.19.4.1.1 Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

- Symptoms: Mild red rash, especially in areas of the body which sweat heavily.
- Treatment: Decrease amount of time in protective gear and provide powder such as corn starch or baby powder containing corn starch to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

2.19.4.2.1 Heat Cramps

Heat cramps are caused by a rate of perspiration that is not balanced by adequate fluid and electrolyte intake. The occurrence of heat related cramps are often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke.

- Symptoms: Acute, painful spasms of voluntary muscles such as the back, abdomen and extremities.
- Treatment: Remove victim to a cool area and loosen restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Consult with

physician if condition does not improve. If available, an electrolyte replacement solution should be taken along with water. Consumption of soft drinks will not be adequate and may aggravate the condition.

2.19.4.3.1 Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by excessive loss of fluids from the body. This condition leads to inadequate blood supply and cardiac insufficiency. Heat exhaustion is less dangerous than heat stroke, but nonetheless must be treated. If allowed to go untreated, heat exhaustion can quickly develop into heat stroke.

- Symptoms: Pale or flushed, clammy, moist skin, profuse perspiration, and extreme weakness. Body temperature is basically normal or slightly elevated, the pulse is weak and rapid, and breathing is shallow. The individual may have a headache, be dizzy or nauseated.
- Treatment: Remove the individual to a cool, air-conditioned place, loosen clothing, elevate feet and allow individual to rest. Consult physician, especially in severe cases. Have patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Total liquid consumption should be about one to two gallons per day. If the signs and symptoms of heat exhaustion do not subside, or become more severe, immediate medical attention will be required.

2.19.4.4.1 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body. The failure of the individual's temperature control mechanism causes the perspiration system to stop working correctly. When this occurs, the body core temperature rises very rapidly to a point where brain damage and death will result if the person is not cooled quickly.

- Symptoms: The victims skin is hot, and may or may not be red and dry, due to the fact that the individual may still be wet from having sweat while wearing protective clothing earlier; nausea; dizziness; confusion; extremely high body temperatures, rapid respiratory and pulse rate; delirium; convulsions; unconsciousness or coma.
- Treatment: Cool the victim immediately. If the body temperature is not brought down quickly, permanent brain damage or death may result. Cool the victim by either sponging or immersing the victim in very cool water to reduce the core temperature to a safe level. If conscious, give the victim cool liquids to drink. Observe the victim and obtain immediate medical help. Do not give the victim caffeine or alcoholic beverages.

2.19.5 PREVENTATIVE MEASURES

In order to avoid heat related illnesses, proper preventative measures will be implemented whenever environmental conditions dictate the need. Heat stress monitoring will begin at +75 degrees Fahrenheit. The preventative measures listed in this paragraph represent the minimal steps to be taken and will include the following procedures:

- The Technician III will examine each site worker prior to the start of daily operations in order to determine the individuals susceptibility to heat stress. Workers exhibiting factors which make them susceptible to heat stress will be closely monitored by the Technician III;
- Site workers will be trained to recognize and treat heat related illnesses. This training will include the signs, symptoms and treatment of heat stress disorders;
- Workers will be encouraged to drink a minimum of sixteen ounces of liquids prior to start of work in the morning, after lunch and prior to leaving the site at the conclusion of the days activities. Acceptable liquids will include water and an electrolyte replacement solution, with the intake of each being equally divided. Liquids containing caffeine are to be avoided;
- When ambient conditions and site workload requirements dictate, as determined by the Technician III, workers will be required to drink a minimum of sixteen (16) to thirty-two (32) ounces of liquids during each rest cycle;
- A shelter or shaded area will be provided where workers may be protected from direct sunlight during rest periods;
- Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat induced stress; and
- Site workers will be given time to acclimatize to working in hot environments. Acclimatization usually takes two to six days and allows the worker's body to become adjusted to working in hot environments.

2.19.6 ADDITIONAL PREVENTATIVE MEASURES

When possible and/or feasible, the following measures will also be implemented to aid in prevention or reduce the affects of heat induced stress:

- Designated rest areas should be out of the direct sun and the number and frequency of breaks increased;
- Depending on the severity of the heat exposure some form of artificial cooling may be required to ensure protection of the workers; and
- Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy work loads. In comparison to an unfit person, a fit person will have: less physiological strain; a lower heart rate and body temperature; and a more efficient sweating mechanism.

2.20 PERSONNEL HYGIENE AND DECONTAMINATION

Site sanitation will be established and maintained in accordance with 29 CFR 1910.120(n).

2.21 POTABLE WATER SUPPLY

An adequate supply of potable (drinkable) water, coolers, and ice will be provided on site at all times in accordance with 29 CFR 1910.120. Potable water will also be used for the washing of personnel.

2.22 NON-POTABLE WATER

Containers of water, clearly marked non-potable water, will be available to teams for washing of equipment in accordance with 29 CFR 1910.120. Non-potable water will not be used for the washing of skin surfaces on personnel.

2.23 TOILET FACILITIES

To maintain sanitation, established toilet facilities will be utilized on site if available. If established facilities are not available, portable toilet facilities will be made available on-site in accordance with 29 CFR 1910.120.

2.24 WASHING FACILITIES

Hand and face washing facilities are available at the site support vehicles, and will be utilized by all personnel during breaks or upon exiting the EZ prior to eating, drinking, tobacco use, or other hand to face activities. Washing facilities in the EZ will consist of potable water containers, buckets, soap, and drying towels. These facilities will be in accordance with 29 CFR 1910.120.

2.25 SITE HOUSEKEEPING

All work areas will be maintained in a clean/neat fashion, free of loose debris and scrap. Any materials/equipment not being used will be removed and stored or disposed of accordingly. All work areas will be supplied with a trash receptacle with lid, the contents of which will be emptied daily.

2.26 ILLUMINATION

Personnel will only work during the hours of daylight, and no field activities will be scheduled during the period of thirty minutes before dusk to thirty minutes after dawn.

2.27 COMMUNICATIONS

On and off site communications will be provided using radios and/or cellular telephones. Communication of evacuation routes and assembly points will occur daily during the tailgate safety briefing. All communications will be tested daily. When emergency services are requested from any agency, the caller will remain available to provide information and directions to responding personnel.

2.28 OFF-SITE COMMUNICATIONS

Off-site communication will be available at all times. Site operations will not be conducted unless off-site communications are available.

2.29 TELEPHONE NUMBERS

The telephone numbers for all emergency services, including the telephone numbers for the USA SHM, are listed in Table A-3. These phone numbers will be posted in the vehicles and all site personnel (teams) will be aware of the location of the closest telephone or will have direct communications to someone with telephone service available.

2.30 ON-SITE COMMUNICATIONS

Communication between personnel in the SZ and personnel in the EZ will be maintained at all times. Personnel in the EZ should remain in constant communication with the Technician III. Any failure of communication requires an evaluation of whether personnel should leave the EZ. A repeated long horn blast (15 sec or longer) on the support vehicle is the emergency signal to indicate that all personnel should leave the EZ and proceed to the rally point.

2.31 LOGS, REPORTS, AND RECORD KEEPING

2.31.1 SAFETY LOG

The Technician III will maintain a safety log of all safety related site activity. The Technician III is responsible for ensuring that safety and health activities and events for the day are part of the log. The log may include the minutes of the tailgate safety meeting, or the meeting may be documented on the Tailgate Safety Briefing form. As a minimum, the safety log should reference the tailgate safety briefing, and mention: accidents, near misses, internal and external audits, the reason for and duration of safety related "stop work" orders, and any other issues pertaining to site or personnel safety or health.

2.31.2 INJURY/ILLNESS/ACCIDENT REPORTS

In the event that a reportable injury/illness/accident occurs at the job site, the USA accident report will be completed and forwarded within two working days to the USA home office. All job related injuries and illnesses will be recorded on an OSHA 300 Log. This log will be maintained on site by the Technician III. If a near miss occurs the Technician III will investigate the near miss and report the results of the investigation to the appropriate personnel or agencies.

2.31.3 TRAINING LOG

The Technician III is responsible for ensuring that all training conducted relative to job site activities is documented in the Training Log and/or on the appropriate training forms. This log will include the initial site specific training conducted prior to the start of site activities. The Technician III will maintain this log and any associated training forms on-site so they will be available for inspection.

2.31.4 EQUIPMENT MAINTENANCE LOG

Required scheduled maintenance and Calibration of equipment performed will be annotated in the Daily Journal.

2.31.5 VISITOR LOG

The Technician III will be responsible for maintaining the visitor log which will be used to record the entry and exit of all visitors, including Federal, state or local officials who visit

the site. This log will reflect name, organization, date and time of visitor entry/exit. Visitors will be briefed on:

- The St. Juliens Creek SSHP;
- Restricted and safe areas;
- Site hazards and risks to include OE/UXO, biological, heat, and trip hazards;
- PPE required and use;
- Fire and OE/UXO safety requirements; and
- Site evacuation and emergency procedures.

2.32 DAILY AND WEEKLY SITE INSPECTIONS

Daily Safety and Health inspections will be conducted by the Technician III and the results will be recorded in the Safety Log. The results of the inspection will be reported to the Technician III on a weekly basis, the Technician III will conduct a compliance audit of the site and complete the Weekly Inspection form. The daily Safety and Health inspections will include:

- Scope of operations;
- Personnel assignments;
- Safety precautions on OE/UXO expected to be encountered;
- Equipment to be used;
- Emergency procedures to include requests for support; and
- Communication procedures.

2.33 REGULATIONS AND REFERENCES

The safety and health of on-site personnel and the local community will be ensured by following all applicable requirements and regulations listed in the following publications:

- OSHA Occupational Safety and Health Standards, 29 CFR 1910;
- OSHA Construction Standards, 29 CFR 1926;
- Applicable sections of EPA 40 CFR Parts 260 to 299;
- Applicable sections of DOT 49 CFR Parts 100 to 199;
- CEHNC Safety Concepts and Basic Considerations for Unexploded Explosive Ordnance (UXO), dated. 22 May, 2000;
- USA Safety and Health Program (SHP);
- 2003 Threshold Limit Values and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists;
- DOD 6055.9-STD, DOD ammunition and Explosives Safety Standards;
- DOD 4160.21-M, Defense Reutilization and Marketing Manual.

2.34 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

This section details the procedures that USA will implement in the case of an emergency.

2.34.1 GENERAL

The frequency and severity of emergency situations can be dramatically reduced through proper implementation of the SSHP. However, if an emergency does occur, quick, decisive action will be required since delays in minutes can create or escalate life-threatening situations. In an emergency situation, site personnel involved in emergency response and rescue must be prepared to respond immediately and all required equipment must be on hand, in proper working order and ready to use. To ensure rapid, effective response to a site emergency, the procedures and contingency plans outlined in this Section and EM 385-1-1, Section 28 J, will be implemented prior to and during the conduct of any site activities involving exposure to safety and health hazards.

2.35 PRE-EMERGENCY PLANNING

2.35.1 IDENTIFICATION OF LOCAL EMERGENCY SERVICES

Prior to the conduct of site operations, USA site representatives will meet with the appropriate local authorities. The purpose of this meeting is to inform local authorities of the nature of the site activities to be performed under this SSHP, and the potential hazards that the conduct of these activities pose to site personnel, the environment, and the general public. In the unlikely event that the evacuation of the general public is required due to either normal site operations or an emergency event, USA will be responsible for contacting the appropriate personnel who will execute and coordinate the evacuation. The phone numbers for pre-notified local emergency services are listed in Table A-3 or refer to the CH2M HILL Safety and Health Plan.

TABLE A-3

EMERGENCY CONTACT	TELEPHONE NUMBER
Fire/Ambulance/Police (Emergency)	911
Chesapeake General Hospital	1-757-312-6128 (ER)
Poison Control Center	1-800-552-6337
USA Safety and Health Office	(813)-884-5722 ext.140
CH2M HILL Site Manager	See CH2M HILL S&H Plan

2.35.2 IDENTIFICATION OF POTENTIAL EMERGENCIES

During the development of this SSHP, great attention has been given to identifying potential safety and health hazards associated with the conduct of site activities. Once identified, these hazards were

assessed to determine the risk that these hazards could result in an emergency situation. Contingency plans for responding to the potential emergency situations have been developed and are included in this section. The potential emergencies which may result during the conduct of site activities are as follows:

- Injury or illness;
- Fire/explosion; or
- Inclement weather.

2.35.3 OTHER HAZARD INFORMATION

In the event that additional site or task hazard information becomes available during the conduct of site activities, this information will be assessed by the appropriate authorities to determine if the contingency plans in this section will need to be updated.

2.36 EMERGENCY RESPONSE RESPONSIBILITIES

2.36.1 ON-SCENE INCIDENT COMMANDER (OSIC)

In the event of an emergency, the Technician III will assume the responsibility of being the On-scene Incident Commander (OSIC). The alternate person to assume this role, in the event that the Technician III is unavailable or incapacitated, will be the CH2M HILL Site Manager or other designated person. The OSIC will have the responsibility of directing all on-site and off-site response personnel, and will, as soon as possible, advise the appropriate authorities of the emergency situation.

2.36.2 ON-SITE EMERGENCY RESPONSE SERVICES

USA personnel will provide First Aid treatment for minor injuries. At least two personnel on-site will be First Aid and CPR certified. The Technician III will determine if the injury requires further treatment. If necessary the Technician III will contact medical personnel to determine if additional treatment is required.

2.36.3 OFF-SITE EMERGENCY RESPONSE SERVICES

The off-site emergency response services which may be needed in the event of a emergency include fire and law enforcement personnel. Fire Protection and emergency medical services (EMS) can be obtained by dialing 911 while on-site. All requests for emergency service will go through the CH2M HILL Site Manager. The CH2M HILL Site Manager will notify the required emergency services.

2.36.4 MEDICAL EVACUATION (MEDEVAC)

Medical evacuation will be determined by the emergency first responder. The emergency first responder will determine and coordinate medical evacuation if required.

2.37 EMERGENCY TRAINING

All site personnel will receive specialized training which will be given by the Technician III and conducted prior to initiating site activities involving safety and health hazards. The content of this training will include the items listed below, and will be documented using the site Training Log.

- USA's SSHP requirements;
- Emergency chain-of-command;
- Communication methods and signals;
- Emergency equipment and PPE;

- Removing injured personnel from the site; and
- Emergency contacts, phone numbers.

2.38 EMERGENCY SITE CONTROL AND SECURITY

In an emergency, it is imperative that site control and security be maintained. To control site personnel, the OSIC will utilize the Site Entry/Exit Log to ensure all personnel are present or accounted for at the assembly point(s). Depending upon site size and configuration, weather and wind conditions and the nature of the emergency, the following will, as applicable, be used to maintain site security:

- Close, but do not lock, gates as evacuation occurs;
- Erect flagging or barrier tape to prevent accidental entry;
- Use a megaphone to alert personnel to stay clear of the site; and
- Use vehicles to block access routes to the site, but ensure they can be moved rapidly if emergency vehicles must use the access route.

2.39 EVACUATION ROUTE

The map showing the location and evacuation route to the emergency treatment facility are located in the CH2M HILL Safety and Health Plan. The route will be briefed to all site personnel prior to start of site activities to familiarize them with the route.

2.40 GENERAL EMERGENCY PROCEDURES

Emergency response procedures include all steps to be taken for notifying, evaluating, reacting to, documenting and following-up on a given emergency situation. To ensure all necessary elements are covered, the procedural steps outlined in this paragraph will be implemented for each emergency, regardless of its nature.

2.40.1 NOTIFICATION

Once the OSIC has been informed of the emergency, the OSIC will alert site personnel to the presence of the emergency by radios. This will be done in order to:

- Notify personnel and to get their attention;
- Stop all work activity as required;
- Lower noise levels in order to speed and simplify communication; and
- Begin emergency and/or evacuation procedures.

If on-site USA personnel or off-site emergency personnel are to enter the site in response to the emergency, the OSIC will to the extent possible, notify the response personnel about the nature of the emergency, to include:

- What happened and when it happened;
- Where on-site the emergency situation occurred;
- Who is involved and, if possible, the cause of the emergency;
- The extent of damage and what hazards may be involved; and
- What actions should be taken.

2.40.2 ASSESSING THE EMERGENCY

Available information related to the emergency and the on-site response capabilities should be evaluated and the information listed below obtained to the extent possible:

- What happened:
  - Type of incident;
  - Casualties involved;
  - Victims (number, location and condition);
  - Treatment required; and
  - Missing personnel.
- Cause of incident;
- Extent of damage to structures, equipment and terrain;
- What could happen from this point; consider:
  - Potential for fire or explosion;
  - Location of all personnel in relation to hazardous areas; and
  - Potential for emergency affecting the general public or the environment.
- What can be done to remediate the situation; consider:
  - Equipment and personnel needed for rescue and hazard mitigation;
  - Number of uninjured personnel available for response;
  - Resources available on-site;
  - Resources available from off-site response groups and agencies;
  - Time needed for off-site response resources to reach the site; and
  - Hazards involved in rescue and response.

2.40.3 RESCUE AND RESPONSE ACTIONS

Based on the information collected during the emergency assessment, the general actions listed below will be taken, with some actions being conducted concurrently. No one will attempt emergency response/rescue until the situation has been assessed and the appropriate response outlined by the OSIC.

- Enforce the Buddy System:
  - Allow no one to enter a hazardous area without a partner; and
  - Personnel in the EZ should be in line-of-sight or in communication with the OSIC or his designee.
- Survey Casualties:
  - Locate all victims and assess their condition;
  - Determine resources needed for stabilization and transport;
  - Assess Existing and Potential Hazards and Determine;
  - Whether and how to respond;
  - The need for evacuation of site personnel and off-site population;

- The resources needed for evacuation and response.
- Request Aid:
  - Contact the required off-site/on-site personnel or facilities, such as ambulance, fire department, police, etc.
- Allocate Resources:
  - Allocate on-site personnel and equipment to rescue and initiate incident response operations;
  - Control the site; and
  - Assist in bringing the hazardous situation under complete or temporary control and use measures to prevent the spread of the emergency, i.e. control fire, secure site, etc.
- Extricate:
  - Remove or assist victims from the area.
- Stabilize:
  - Administer any medical procedures that are necessary before the victims can be moved;
  - Stabilize or permanently fix the hazardous condition; and
  - Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums, tanks).
- Transport:
  - Using either on-site or off-site assets;
  - Casualty Logging; and
  - Record who, time, destination and condition upon transport.
- Evacuate:
  - Move site personnel to the rally point, a safe distance upwind of the incident; and
  - Monitor the incident for significant changes; the hazards may diminish, permitting personnel to re-enter the site, or hazards may increase and require public evacuation.
- Casualty Tracking:
  - Record disposition, condition and location.

2.40.4 POST EMERGENCY FOLLOW-UP

Before normal site activities can resume, the site and personnel must be prepared and equipped to handle another emergency. It is also imperative that all Federal, state and local regulatory agencies be notified of the emergency. Therefore, the following activities must be conducted prior to re-start of site activities:

- Notify all appropriate governmental agencies as required (i.e. OSHA must be notified if there have been any fatalities or three or more personnel hospitalized);
- Restock and clean all equipment and supplies utilized or damaged in the emergency;*

- Conduct an accident investigation to determine the cause of the emergency and what preventative measures could be taken to ensure the emergency does not occur again; *
- Complete the USA accident and/or insurance forms; and
- Review and revise, as needed, the site operational procedures, and if necessary update the SSHP to reflect the new procedures.

*To be accomplished prior to re-starting site activities

2.40.5 DOCUMENTATION

Documentation related to the emergency will be recorded in an accurate, authentic and complete fashion. Documentation shall be recorded as soon as possible after the emergency to ensure it is recorded while the events are vivid in the minds of the personnel involved. The information recorded will include:

- A chronological record of events;
- A listing of the personnel involved, including personnel on-site, site personnel who responded, personnel in charge, and off-site groups or agencies that responded;
- A listing of the actions taken to minimize the effects of or mitigate the emergency;
- An assessment of the potential exposures received by site personnel and the surrounding public; and
- A recording of the injuries or illnesses which occurred as a result of the emergency.

2.41 ON-SITE EMERGENCY EQUIPMENT

The emergency equipment listed below in Table A-4 will be on-site, stored in the location indicated, and available for use during the operation specified. The Support Vehicle EZ will be on the work site with each team. The team support vehicle will be designated as an emergency vehicle. All emergency equipment will be maintained in proper working order and inspected by the Technician III at least weekly to ensure completeness and proper working order. The results of the inspection will be documented on the Safety Inspection Control Log. In the event that any of the disposable items are utilized, the Technician III will ensure they are replaced immediately. Site operations will not be conducted if the required emergency equipment is not available on-site.

2.42 CONTINGENCY PLANS

The following paragraphs contain emergency specific contingency plans. These plans outline the procedures for mitigating each of the potential emergency situations that were identified in the pre-emergency planning. These contingency plans specify the minimum emergency procedures and may be subject to alteration by the Technician III, based on actual or changing site conditions. Any changes to these contingency plans will be approved by the appropriate authorities.

2.43 INJURY OR ILLNESS

In the event of an emergency involving personal injury or illness, immediate response will be key in preventing further injury/illness and providing comfort to the affected party. When EZ personnel are injured or overcome by illness, the following procedure will be followed:

- Upon notification of the occurrence and nature of the injury/illness the OSIC will, if deemed necessary, summon emergency personnel;

- EZ personnel will transport the injured/ill victim to the rally point using the stretcher;
- The OSIC will assess the severity of the injury/illness, direct the EZ personnel to provide immediate life support if required; and
- If immediate life support is not required, or once the victim is stabilized, and if required, transport victim to the appropriate medical facility for further attention.

TABLE A-4

Emergency Equipment	Number per Location	Location Stored	Operation Where Emergency Equipment is Required
First Aid/Burn Kit, (16 unit minimum)	1 ea.	Team Support Vehicle, EZ.	Each team has complete sets of first aid equipment.
Eye Wash	1 ea.	All First Aid Kits	
CPR Pocket Mask	1 ea	All First Aid Kits	
Disposable latex Gloves	5 ea.	All First Aid Kits	
Fire Extinguisher 2A:10 BC rated	1 ea.	All Vehicles.	All operations.

To ensure that adequate first aid supplies are available, the size (16 unit minimum) and number of first aid kits will be sufficient to accommodate the maximum number of people (including government personnel and visitors) on-site at any given time. The kits will be located at each EZ work site and the location of the kit will be made known to all EZ personnel. Additional kits may also be maintained in each vehicle and in the SZ. Kit locations will be provided with adequate water and other supplies necessary to cleanse and decontaminate burns, wounds or lesions.

2.44 FIRES AND EXPLOSIONS

2.44.1 FIRE EXTINGUISHERS

The occurrence of a fire on-site can present a serious threat to all site personnel, the environment and the general public. To ensure immediate, aggressive response is possible, dry-chemical-type fire extinguishers will be available at each individual work site. Dry chemical fire extinguishers (3A:40B:C)will

also be provided at any other site location where flammable materials may present a fire risk, such as the petroleum, oil and lubricant (POL) storage area. Additionally, a fire extinguisher rated at least 2A:10B:C will be located with each piece of heavy equipment and in each site vehicle. Fire extinguishers will be inspected, and the results recorded weekly by the Technician III.

2.44.2 SMALL FIRES

A small fire is defined as a fire that can be extinguished with a 2A:10B:C type fire extinguisher. In the event of a small fire, site personnel will take the following actions:

- All unnecessary personnel will be evacuated from the immediate area, to an upwind location;
- Extinguish the fire using portable fire extinguishers or by smothering from an upwind location;
- Request emergency response assistance (fire, ambulance, police) as needed;
- Do not attempt to extinguish a fire, even a small one, involving explosives; and
- Notify the Technician III.

2.44.3 LARGE FIRES

In the event of a large fire or small fire which cannot be extinguished, the following actions will be taken:

- All unnecessary personnel will be evacuated from the site, to an upwind location;
- The Emergency Response Services (fire, police, ambulance, hospital, etc.) will be notified as required;
- If it can be conducted safely, the OSIC will direct personnel to move vital equipment/supplies from the fire path;
- The OSIC will order the appropriate level of protective clothing to be worn by personnel fighting the fire;
- To the extent possible, and with available resources, fight the fire from an upwind location;
- At no time, will attempts be made to extinguish a fire involving explosives; and
- Notify the Technician III.

2.44.4 EXPLOSION

In the event of an explosion, all nonessential personnel will evacuate and help secure the site, the OSIC will request the required support equipment and personnel, and ensure proper authorities are notified. It is essential that the site be evacuated and no one is allowed to re-enter, except to possibly save a life, until at least 30 minutes, or longer if necessary, after the explosion. The OSIC will determine what actions, if any, are appropriate.

2.45 INCLEMENT WEATHER

In the event of inclement weather: high winds, electrical storms, extremely hot weather (>100 F) it may be necessary to cease operations and evacuate the site. The Technician III will be responsible for contacting the weather service on a daily basis. If necessary, the weather service will be contacted on a more frequent basis.

2.46 HAZARD ANALYSIS

The following Hazard Analysis worksheets were used to identify hazards associated with operations at the St. Juliens Creek project site and the safety methods that would be used to mitigate, eliminate, or control exposure to hazards.

TABLE A-5: HAZARD ANALYSIS

PROJECT NAME: St. Juliens Creek, Chesapeake, VA **CUSTOMER:** CH2M HILL **ACTIVITY**: OE/UXO Avoidance and Construction Support Services		
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Locate, identify and mark UXO and anomalies.	Potential OE; unplanned detonation. Wildlife, insects. Toxic Plants. Slips, trips, falls. Heat/Cold Stress. Sunburn/Windburn. Unauthorized personnel.	UXO safety precautions IAW the WP and SSHP. UXO qualified personnel will accompany all non-UXO qualified personnel. Establish an EZ for site control. Check for subsurface anomalies prior to driving stakes or excavating samples Do Not handle UXOs. Mark UXO IAW the WP. Do not subject UXO to heat, shock or friction. Avoid toxic plants. Do not handle wildlife. Wear Level D PPE. Use insect repellent/barrier cream as necessary. Be alert, watch for slip/trip/fall hazards. Dress for the weather. Use Buddy system monitoring. Use Sunscreen as necessary. No Smoking except in designated areas.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Vehicle.	Daily PMCS vehicle. Daily check of First Aid	Current state driver license.

First Aid kit. Fire extinguisher. Communications equipment. Hand tools. Flagging material.	Kit contents. Check extinguisher. Calibration checks. Communications check.	OSHA Qualifications. UXO personnel are EOD trained. Safe work practices and hazard protection IAW the SSHP. Daily tailgate safety briefings to include evacuation and notification procedures. UXO identification and safety precautions training for non-UXO trained personnel.

2.47 ATTACHMENT 1: CEHNC SAFETY CONCEPTS

The following pages contain the U.S. Army Engineering and Support Center, Huntsville, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations, dated 22 May 2000.

CH2MHILL

Drilling
Standard of Practice HSE-35

1.0 Applicability and Scope

1.1 Applicability

This Standard of Practice (SOP) applies to: 1) CH2M HILL employees who are potentially exposed to hazards associated with drilling operations because of their proximity to the drilling work location, and/or 2) CH2M HILL Safety Coordinators (SCs) who may be responsible for providing oversight of a drilling subcontractor's operation. This SOP is applicable to all forms of drilling activities, including cable tool, rotary, geo-probe, rotosonic, and hollow-stem auger drilling. Drilling is defined as any man-made boring of holes in hard materials or an earth surface, usually by rotating abrasion or repeated blows.

1.2 Scope

This SOP provides information regarding the spectrum of hazards and issues to be addressed during each phase of a project associated with drilling operations. Drilling hazards addressed in this SOP include contacting overhead powerlines, masts acting as lightning rods, overturning because of top-heavy configuration and poor footing, drilling into underground utilities or structures, catching persons in rotating parts of the drill equipment and drilling operations in areas with known or potential Ordnance Explosives (OE)/Unexploded Ordnance (UXO) hazards (HSE-91). CH2M HILL employees who work in proximity to drilling activities must take precautions to avoid these hazards and be aware of associated safe work practices.

As described in the "Subcontractor, Contractor, and Owner" SOP HSE-55, responsibilities for health and safety (HS&E) are expressly defined through the subcontract terms and conditions, and CH2M HILL's HS&E practices in the field are determined based on these defined responsibilities. Consistent with HSE-55, drilling subcontractors must determine how to drill safely and in compliance with applicable HS&E regulations and industry standards, and how to correct deficiencies. CH2M HILL employees shall not direct the means and methods of safe drilling operations or details of corrective actions.

1.3 Regulatory Review

There are no Occupational Safety and Health Administration (OSHA) regulations specific to drilling activities; however, OSHA has authority to issue citations for unsafe and/or unhealthful conditions based on failure to comply with established industry standards.

2.0 Project Planning

2.1 Training Requirements

CH2M HILL employees who work on projects that involve only drill rigs or earthmoving equipment used for the purpose of moving earth or lifting underground objects (Level 2 construction projects) are required to complete either the CH2M HILL Drilling/Excavating

Construction Safety training course or the CH2M HILL 10-Hour Construction Safety Awareness training course. The 10-Hour course was developed for Level 1 construction projects, but covers the necessary information for Level 2 construction projects.

CH2M HILL employees who work on projects involving construction, renovation/ modification, or demolition of a structure, building, and/or facility; or projects involving heavy equipment, other than drill rigs or earthmoving equipment (Level 1 construction projects) are required to complete the CH2M HILL 10-Hour Construction Safety Awareness training course.

Additional information regarding construction training requirements may be found in the "Frequently Asked Questions: Construction Safety Training" document.

Waste management training is required where waste streams (e.g., drill cuttings, purge water, decontamination water, PPE) will be generated.

Drilling subcontractors are responsible for complying with all applicable HS&E training requirements and for providing the training necessary to complete their tasks safely.

Drilling activities that are performed at hazardous waste projects also require hazardous waste training. Subcontractors are responsible for ensuring their employees have received hazardous waste training.

CH2M HILL employees and subcontractors who work on projects that involve OE must complete the additional training requirements and provide qualified UXO technicians as described in HSE-91.

2.2 Medical Surveillance Requirements

There are no medical surveillance requirements specific to drilling activities; however, locations that involve toxicological (HS-65-70) or OE/UXO (HSE-91) hazards or respiratory protection (HS-08) may require medical surveillance. Subcontractors are responsible for ensuring their employees receive medical surveillance as required.

2.3 Competent Person Requirements

Drilling subcontractors shall provide a competent person to inspect the drill rig and associated equipment and to oversee all drilling activities. The competent person shall be capable of identifying drilling hazards and have the authority to take corrective actions to eliminate the hazards.

CH2M HILL employees and subcontractors who work on projects that involve OE are responsible for providing a competent person to oversee OE operations as described in HSE-91.

2.4 Safety Equipment

Drilling subcontractors are responsible for providing all personal protective equipment (PPE) necessary for its employees. CH2M HILL shall provide PPE only for its own employees. Other safety equipment shall be provided as delineated in the subcontract and referenced documents.

- Detection equipment shall be provided if the exact location of underground utilities cannot be determined.
- Air monitoring instruments shall be provided if the potential for a hazardous atmosphere exists within the drilling location.
- High-visibility warning vests should be provided when personnel are exposed to public vehicular traffic.
- Minimum PPE includes safety-toed shoes/boots, hard hats, safety glasses, and hearing protection. Body protection (such as gloves, coveralls, or Tyvek) and respirators may be needed when chemical hazards exist.
- Fall protection shall be provided when personnel are exposed to a fall of 6 feet or greater. This includes individuals climbing the drill rig mast.
- Lockout/tagout devices may be required for on-the-job maintenance of equipment.
- Adequate supplies of first aid materials should be available at the work site.

2.5 Subcontractor Selection

Drilling subcontractors are selected as described in the "Subcontractor, Contractor, and Owner" SOP HSE-55. The "Subcontractor Safety Procedure Criteria - Drilling" found in Attachment 1 provides the minimum criteria for drilling safety procedures. These criteria shall be used by the Health and Safety Manager (HSM) to review subcontractor drilling procedures submitted when CH2M HILL oversight is required by SOP HSE-55.

OE/UXO subcontractors are selected as described in the "Subcontractor, Contractor, and Owner" SOP HSE-55 and Ordnance Explosives (OE) Standard of Practice HSE- 91. These criteria shall be used by the UXO Safety Officer (UXOSO) to review subcontractor OE/UXO procedures.

2.6 Planning Activities

The exact location of underground utilities and structures must be identified. Many states have a one-call phone number for locating underground utilities (refer to the project's written safety plan). The party responsible for this action shall be delineated in the subcontract.

Drilling subcontractors shall determine the safest drilling location based on topography and location of utility lines, both underground and overhead. It may be necessary for the subcontractor to contact the utility company to deenergize and ground the powerlines when safe clearance distances cannot be maintained from overhead lines.

Subcontractor training and current medical examinations (when required) shall be verified prior to the start of field operations.

Determine if the aquifer is designated as a sole source aquifer, if the project is located near water wells or "well fields" supplying public water systems, or if the project will require

withdrawals of large amounts of water. The Environmental Compliance Coordinator (ECC) can determine if these conditions require a permit (see Section 3.3).

Drilling activities that are performed on sites with known or potential Ordnance Explosives (OE) hazards must implement OE/UXO avoidance during access, setup and drilling operations as described in Section 3.2.8 and HSE-91. Subcontractors are responsible for ensuring qualified UXO technicians provide OE/UXO avoidance support (HSE-91).

3.0 Project Execution

3.1 Safe Work Practices

The requirements of this section shall be followed by CH2M HILL employees who are potentially exposed to hazards associated with drilling activities, regardless of the company performing the drilling operation. These requirements also pertain to drilling subcontractor personnel when CH2M HILL is providing oversight.

- Only authorized personnel are permitted to operate drill rigs. Drilling subcontractors shall ensure that each drill rig operator is qualified to safely operate the specific equipment through appropriate training and/or experience.
- Personnel shall be cleared from areas surrounding drill rigs during every startup.
- Personnel shall stay clear of the rotating augers and other rotating components of drill rigs.
- Personnel shall stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel.
- Personnel shall not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Individuals with long hair should have it restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have line deenergized prior to approaching the equipment.
- Smoking around drilling operations is prohibited.
- Personnel shall wear the appropriate PPE. Minimum protection includes safety-toed shoes/boots, hard hats, safety glasses, and hearing protection. Gloves, coveralls, Tyvek, and respirators may also be required based on the chemical hazards (refer to the project's written safety plan).

3.2 Regulations/Industry Standards

The following subsections provide the minimum regulatory and industry standard requirements pertaining to drilling operations. Drilling subcontractors are responsible and accountable for implementing these requirements as well as requirements established in their own safety procedures.

As described in the "Subcontractor, Contractor, and Owner" SOP HSE-55, CH2M HILL's project SC may be required to provide oversight of a drilling subcontractor. The following subsections are provided to inform the SC of established regulations and industry standards so that an appropriate level of oversight may be provided. Subcontractors retain control over their practices, and CH2M HILL's oversight does not relieve them of their own responsibility for effective implementation and enforcement of HS&E requirements.

3.2.1 General

- A daily safety briefing/meeting should be conducted with all drilling personnel to discuss the work planned for the day and the HS&E requirements to be followed.
- The drill rig and associated equipment should be inspected each day, before use, to ensure safe operational condition. This inspection should include, at a minimum, the "kill" switch, cathead, ropes, hoses, pressurized lines, operator controls, and drilling tools.

3.2.2 Drill Rig Placement

- The location of underground utilities such as electric, fuel, water, cable, telephone, and sewer either in service or abandoned shall be identified before drilling is permitted. Utility companies and/or installation owners shall be contacted for exact location. When the exact location cannot be identified, detection equipment or other acceptable means of locating the utility lines shall be used before drilling.
- Safe clearance distances shall be maintained between overhead powerlines and any part of the drill rig unless the powerlines have been deenergized and grounded or where insulating barriers have been installed to prevent physical contact. To avoid physical contact and potential arcing from the powerline to the drill rig, rigs shall remain at least 10 feet from overhead powerlines for voltages of 50 kV or less and 10 feet plus ½ inch for every 1 kV over 50 kV. When it is difficult for the drill rig operator to maintain the safe clearance distance, a person shall be designated to observe the clearance and warn the operator.
- Drilling pad preparation is recommended, particularly on steep slopes or areas that are covered with dry dead grass and weeds. Clean fill or gravel can be brought in to cover areas with surface contamination and to construct a relatively level work surface. Care should be taken in constructing pads if extensive cutting into existing slopes or surfaces is required to level the area. Areas in which extensive fill is required should be avoided. Compaction is recommended if significant amounts of fill are needed.
- The drill rig should be leveled and stabilized with jacks and adequate cribbing before raising the mast and during drilling operations. Cribbing materials should be made from materials that are capable of supporting the weight of the rig. Care should be taken in muddy, soggy soils, or partially frozen areas. In addition to cribbing, guy wires should be used to improve stability if the rig is located on wet, partially frozen ground, or in areas with loose, caving soil, or in an area subject to frequent gusty winds.

3.2.3 Drill Rig Travel

- The drill rig should be shut down and the mast lowered and secured prior to moving.
- All tools and equipment should be securely stowed before the drill rig is moved.

- Only personnel in the drill rig cab are permitted to ride the rig.
- The following safe clearance distances shall be maintained while traveling under overhead powerlines with the mast lowered: 4 feet for voltages less than 50 kV, 10 feet for voltages between 50 kV and 345 kV, and 16 feet for voltages between 346 kV and 750 kV.
- A backup alarm or spotter shall be used when backing the drill rig.

3.2.4 Drill Rig Operation

- The drill rig should be provided with a "kill" switch, which, when activated, will shut down the rig. The switch should be clearly identified and tested daily to confirm operational status. All drilling crew members should be made aware of the location and purpose of this switch.
- All machine guards shall be in place while the rig is in operation.
- The rope, wire rope, or cable on the drill rig should never be wrapped around any part of the body.
- Pressurized lines and hose connections should be secured together to prevent whipping. These connections should be inspected daily.
- The drill rig should not be operated during severe inclement weather such as during lightning storms, high winds, or severe rain. The mast should be lowered during these conditions.
- When the potential exists for hazardous atmospheres to develop within the drilling location, air monitoring shall be conducted to ensure it is safe to continue drilling operations (refer to the project's written safety plan).
- The drill gear boxes (transmission for rotary drive, feed control, etc.) should be placed in neutral while an operator is not at the controls. The operator should shut down the rig engine prior to leaving the immediate vicinity of the drill rig.

3.2.5 Drill Rig Maintenance

- Components found to be in defective condition during inspections or during rig operation should be repaired immediately.
- Rig maintenance shall only be performed after appropriate lockout/tagout procedures have been implemented.
- The cathead should be kept clean and free of rust, oil, and grease. The cathead should be cleaned with a wire brush if it becomes rusty. Should the rope "grab" the cathead or otherwise become tangled in the drum, the operator should release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear.
- Clean, dry, and sound rope should be used. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast, where the rope will often break, releasing the tools. If the rope does not break, personnel should be

instructed to stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should back away after turning off the engine. The rope should always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope.

- Drilling operations may require repair or disentanglement of wire rope on the mast while it is raised. Fall protection shall be used when personnel are exposed to a fall of 6 feet or greater.
- Augers should be cleaned only when the drill rig is in neutral and the augers have stopped rotating. Hands or feet should not be used to move cuttings away from the auger.
- All work areas, platforms, walkways, scaffolding, and other accessways should be maintained free of materials, debris, obstructions, and substances such as ice, grease, or oil.

3.2.6 Drilling Waste Management

Drill cuttings and purge water where no soil or groundwater contamination shall be managed in accordance with HSE-81 (Non-hazardous Waste Management) and HSE-89 (Wastewater/Storm Water).

3.2.7 Drilling at Hazardous Waste Sites

The Environmental Compliance Coordinator (ECC) shall be consulted on proper evaluation, disposal, and decontamination procedures involving potential hazardous waste.

- All wastes generated shall be evaluated for appropriate disposal (see HSE-78, Waste Analysis and Characterization), HSE-79 (On-site Waste Management) and HSE-80 (Off-site Waste Management).
- If drilling involves hazardous wastes, HSE-13 (Decontamination) shall be followed. No potentially contaminated equipment shall be permitted to leave the work site.

3.2.8 Drilling at Potential OE Sites

If the project site is suspected of OE contamination, the UXO team will conduct a reconnaissance and OE avoidance to provide clear access routes to each site prior to drilling crews entering the area. The following procedures will be implemented:

- Drilling operations on OE sites will not be conducted until a complete plan for the site is prepared and approved by CH2M HILL EE&SBG UXOSO. OE/UXO avoidance must be conducted during drilling operations on known or suspect OE sites (HSE-91).
- The UXO team will identify, and clearly mark the boundaries of a clear approach path for the drilling crews, vehicles, and equipment to enter the site. This path will be, at a minimum, twice the width of the widest vehicle. No personnel will be allowed outside any marked boundary.
- If OE is encountered on the ground surface, the UXO team will clearly mark the area where it is found, report it to the proper authorities, and divert the approach path around it.
- The UXO team will conduct an access survey using the appropriate geophysical instrument over the approach path for avoidance of OE that may be in the subsurface. If a magnetic anomaly is encountered, it will be assumed to be OE and the approach path will be diverted

around the anomaly. UXO personnel only will operate the appropriate geophysical instrument and identify OE.

- An incremental geophysical survey of the drill hole location(s) will be initially accomplished by the UXO team using a hand auger to install a pilot hole. If OE is encountered or an anomaly cannot be positively identified as inert material, HTRW sampling personnel will select a new drill hole location.
- Once a drilling site has been surface cleared and a pilot hole established as described above, the drilling contractor will be notified that the site is available for subsurface drilling.

3.3 Forms/Permits

There are no CH2M HILL forms or permits required for drilling activities.

The following permits and notifications may be required, depending on state or local requirements. The ECC should be contacted to determine applicability.

- Well driller's license/certification or Professional Geologist requirements. Subcontractors are required to submit copies of licenses/certifications prior to subcontract award.
- Drill rig permit.
- Well installation or abandonment notification. Submittal of well log or inventory may be required after installation or abandonment.
- A groundwater withdrawal permit may be required for large water withdrawals in some states. Check with the ECC for specific requirements.
- A "dig permit" may be required at certain client facilities.

3.4 Self-Assessment Checklists

The "HS&E Self-Assessment Checklist - Drilling" found in Attachment 2 is provided as a method of verifying compliance with established safe work practices, regulations, and industry standards pertaining to drilling operations. CH2M HILL's project SC shall use this checklist when: 1) CH2M HILL employees are potentially exposed to hazards associated with drilling operations, and/or 2) CH2M HILL oversight of a drilling subcontractor is required by the "Subcontractor, Contractor, and Owner" SOP HSE-55. The HSM shall specify the frequency in which this checklist shall be completed and provide this information in the project's written safety plan. Completed checklists shall be sent to the HSM for review. The HSM shall assist the SC in resolving any deficiencies identified during the self-assessment. This SOP may be used to clarify checklist questions.

4.0 Attachments

Attachment 1: Subcontractor Safety Procedure Criteria - Drilling

Attachment 2: HS&E Self-Assessment Checklist - Drilling

Drilling
Standard of Practice HSE-35
Attachment 1

Subcontractor Safety Procedure Criteria - Drilling

CH2MHILL

Subcontractor Safety Procedure Criteria - Drilling

The following criteria are not intended to be all inclusive, but are provided as a tool to facilitate development and review of subcontractor safety procedures. Subcontractors are expected to address the following items, at a minimum, in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Drilling Safety Procedures:

1 Provide name and qualifications of the drilling "competent person" responsible for drilling (years and type of experience, training background, etc.):

2 Describe drill rig and equipment inspection criteria or procedures (frequency of inspections, visual vs. written inspections, items that are inspected):

3 Describe methods of identifying underground utilities (contacting utility companies, detection equipment):

4 Describe methods of avoiding contact with overhead powerlines (deenergizing and grounding, insulating, safe clearance distances):

5 Describe methods to identify hazardous atmospheres and controls used to eliminate (detection equipment and controls):

6 Describe leveling and stabilizing methods of drill rig (drilling pad, jacks, cribbing, guy wires):

7 Verify that rig equipment is in good operational condition (including, "kill" switch, cathead, ropes, pressurized hoses and lines, operator controls, machine guards, and drilling tools):

8 Describe procedures for operating in inclement weather, including lightning, high winds, severe rain storms:

9 Describe other safe work practices for equipment operation (drill rig, equipment, tools, rig transportation, rig travel):

10 Describe on-the-job maintenance procedures, including lockout/tagout:

11 Describe safe work practices for other activities to be performed during this project (use of ladders, fall protection, use of electrical power tools, use of personal protective equipment, etc.):

12 Describe methods for disposal of non-hazardous drill cuttings and purge water (including accumulation, transport and disposal):

13 If hazardous waste project, provide documentation of hazardous waste worker training and medical surveillance records for all project personnel (40-hour or 24-hour training, 8-hour refresher training) and describe methods of hazardous waste management (including accumulation, transport and disposal):

14 Submit a copy of drilling license/certification and drill rig permit.

15 Describe methods and responsibilities for submittal of notifications and logs:

16 Complete the Waste Subcontractor Qualification Form for each proposed transport and disposal facility.

17 Describe procedures for OE avoidance, identification and marking the boundaries of a clear approach path and work site for the sampling crews, vehicles, and equipment to enter the site. (HSE-91

18 If this is an OE project, provide documentation of UXO qualifications, hazardous waste worker training and medical surveillance records for all project personnel (40-hour or 24-hour training, 8-hour refresher training) for review by the CH2M HILL EE&SBG UXOSO (HSE-91).

19 Describe the procedures for drilling, monitoring and process for encountered OE. (HSE-91)

Attachment 2

HS&E Self-Assessment Checklist - Drilling

CH2MHILL

HS&E Self-Assessment Checklist - DRILLING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with drilling operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a drilling subcontractor is required (complete entire checklist).

SC may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the health and safety manager for review.

Project Name: __Site 3 Delineation/Confirmation Sampling Event_____ Project No.: 138804.CI.FS_____

Location: St. Julians Creek Annex, Chesapeake VA_____ PM: __William Friedmann____

Auditor: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards
X Evaluate a CH2M HILL subcontractor's compliance with drilling HS&E requirements
Subcontractors Name: _____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-35.

SECTION 1	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Only authorized personnel operating drill rig	☐	☐	☐	☐
2. Personnel cleared during rig startup	☐	☐	☐	☐
3. Personnel clear of rotating parts	☐	☐	☐	☐
4. Personnel not positioned under hoisted loads	☐	☐	☐	☐
5. Loose clothing and jewelry removed	☐	☐	☐	☐
6. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐
7. Smoking is prohibited around drilling operation	☐	☐	☐	☐
8. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐
9. OE/UXO avoidance provided, ,routes and boundaries cleared and marked	☐	☐	☐	☐
10. OE sites, Initial pilot hole established by UXO technician with hand auger.	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
11. Aquifer evaluated for contamination, sole source and wellhead protection	☐	☐	☐	☐
. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
14. Approved OE/UXO plan utilized on site	☐	☐	☐	☐
DRILL RIG PLACEMENT (3.2.2)				
12. Location of underground utilities identified	☐	☐	☐	☐
13. Safe clearance distance maintained from overhead powerlines	☐	☐	☐	☐
14. Drilling pad established, when necessary	☐	☐	☐	☐
15. Drill rig leveled and stabilized	☐	☐	☐	☐
DRILL RIG TRAVEL (3.2.3)				
16. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
17. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
18. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
19. Safe clearance distance maintained while traveling under overhead powerlines	☐	☐	☐	☐
20. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (3.2.4)				
21. Kill switch clearly identified and operational	☐	☐	☐	☐
22. All machine guards are in place	☐	☐	☐	☐
23. Rig ropes not wrapped around body parts	☐	☐	☐	☐
24. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
25. Drill operation stopped during inclement weather	☐	☐	☐	☐
26. Air monitoring conducted per HSP/FSI for hazardous atmospheres	☐	☐	☐	☐
27. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG MAINTENANCE (3.2.5)				
28. Defective components repaired immediately	☐	☐	☐	☐
29. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
30. Cathead in clean, sound condition	☐	☐	☐	☐
31. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
32. Fall protection used for fall exposures of 6 feet or greater	☐	☐	☐	☐
33. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
34. Good housekeeping maintained on and around rig	☐	☐	☐	☐
DRILLING WASTE MANAGEMENT (3.2.6)				
35. Drill cuttings and purge water managed and disposed properly	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (3.2.7)				
36. Waste disposed of according to HSP and RCRA regulations	☐	☐	☐	☐
37. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐
FORMS/PERMITS (3.3)				
38. Driller license/certification and drill rig permit obtained	☐	☐	☐	☐
39. Well development/abandonment notifications and logs submitted and in project files	☐	☐	☐	☐
40. Water withdrawal permit obtained, where required	☐	☐	☐	☐
41. Dig permit obtained, where required	☐	☐	☐	☐

SECTION 3

Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Principal Steps	Potential Safety/Health Hazards	Recommended Controls
Surveying and establishing boundaries and grids.	Accidental detonation of explosives	Personnel involved will attend a site-specific OE/Unexploded Ordnance (UXO) recognition class prior to the commencement of site activities.
		Observe the Basic Safety Concepts and Considerations for UXO Operations.
		UXO personnel will escort non-UXO personnel at all times.
		Mark and avoid UXO. Only UXO personnel will handle OE.
		Check location with magnetometer prior to driving stakes.
Clearing and grubbing	Accidental detonation of explosives.	Observe the Basic Safety Concepts and Considerations for UXO Operations.
		Personnel involved will attend a site-specific OE/UXO recognition class prior to the commencement of any site activities.
		Be alert and mark all OE located.
		Only clear and grub to within four inches of the ground surface.
		UXO trained personnel will escort non-UXO personnel at all times.
		Surface sweeps will be conducted with magnetometers or other suitable geophysical instrumentation to identify potential OE.
OE Related Scrap Demilitarization	Accidental detonation of explosives	Observe the Basic Safety Concepts and Considerations for UXO Operations.
		Only UXO technicians will perform explosive demilitarization of OE related scrap.
	Shredder Operations	Stay clear of moving mechanical parts.
		Insure only inspected scrap is fed into shredder.
Inspection/Certification of OE Related Scrap	Accidental detonation of explosives	Observe the Basic Safety Concepts and Considerations for UXO Operations.
		Only UXO technicians will inspect OE related scrap.
		Personnel in the immediate vicinity of OE related scrap inspections will be kept to the minimum necessary for safe operations but no less than two UXO technicians.
		Observe requirements of DOD 4160.21-M-1.

CH2MHILL

Ordnance Explosives (OE) Standard of Practice HSE- 91

1.0 Applicability and Scope

1.1 Applicability

This Standard of Practice (SOP) applies to: 1) CH2M HILL employees who enter areas known or suspected of having Ordnance Explosives (OE) and 2) CH2M HILL Safety Coordinators (SCs) and CH2M HILL EE&SBG Unexploded Ordnance Safety Officers (UXOSO) who may be responsible for providing oversight of a subcontractors OE operations. OE operations may be conducted on active, inactive, closed, transferring, or transferred ranges; former battlefields; disposal sites; or munitions manufacturing and storage sites.

1.2 Scope

This SOP provides information regarding the spectrum of hazards and issues to be addressed during each phase of a project associated with OE operations. OE hazards addressed in this SOP include exposure to Unexploded Ordnance (UXO), Chemical Warfare Material (CWM), explosives contaminated soil and groundwater, and the hazards associated with operations to locate, identify, remove, and dispose of OE. CH2M HILL employees who enter OE areas must take precautions to avoid these hazards and be aware of associated safe work practices.

As described in the "Subcontractor, Contractor, and Owner" SOP HSE-55, responsibilities for health, safety and environment (HS&E) are expressly defined through the subcontract terms and conditions, and CH2M HILL's HS&E practices in the field are determined based on these defined responsibilities. Consistent with HSE-55, the subcontractor must determine how to operate safely and in compliance with applicable HS&E regulations and industry standards, and how to correct deficiencies. CH2M HILL employees shall not direct the means and methods of OE operations nor direct the details of corrective actions.

1.3 Regulatory Review

OE projects are often complex and have a myriad of regulatory requirements to ensure safety. Support for determining the governing laws and regulations for any specific OE project must be reviewed by the EE&SBG UXOSO to ensure compliance and safety.

Department of Defense (DOD) Ammunition and Explosives Safety Standards, DOD 6055.9-STD, establishes uniform safety standards applicable to ammunition and explosives, to associated personnel and property, and to unrelated personnel and property exposed to the potential damaging effects of an accident involving ammunition and explosives during their development, manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal.

The U.S. Environmental Protection Agency (EPA) regulates the disposal of military munitions and waste containing military munitions through the Military Munitions Rule (RCRA; 40 CFR part 266, subpart M). The rule 1) identifies when conventional and chemical military munitions become a solid waste and 2) provides criteria for storage and transportation of such waste, including a conditional exemption if the munitions are managed under DOD rules.

2.0 Project Planning

2.1 Training Requirements

CH2M HILL employees and subcontractors who work on projects that involve OE must complete the following training:

- 40-hour hazardous waste comprehensive course with training in hazard recognition and basic health and safety issues, as required by the occupational safety and health regulations contained in 29 CFR 1910.120(e)
- Annual 8-hour hazardous waste refresher course
- Hazardous waste supervisory training as specified in 29 CFR 1910.120(e) [only required for management and supervisors]
- All UXO personnel will be graduates of one of the following: U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD; U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, MD; U.S. Naval EOD School, Eglin Air Force Base, FL; EOD Assistants Course, Redstone Arsenal AL; EOD Assistant Course at Eglin Air Force Base, FL; or a U.S. DOD-certified equivalent course

The EE&SBG UXOSO can provide assistance in reviewing subcontractor personnel qualifications.

2.2 Medical Surveillance Requirements

All CH2M HILL employees who work on OE sites must be on a medical surveillance program consisting of a baseline health assessment that includes a medical and occupational history review, blood and urine tests for contaminants of interest, electrocardiogram, slit-lamp corneal examination, pulmonary function tests, chest x-ray, respiratory fit test, and a general physical examination that includes hearing and vision.

Employees who terminate employment and who have worked at OE project sites may be required to undergo an exit examination equivalent to the baseline health assessment.

Subcontractors are responsible for ensuring that their employees receive medical surveillance as required.

2.3 Drug Abuse Surveillance Requirements

CH2M HILL employees who perform OE operations and oversight are subject to the provisions contained in HSE-76.

2.4 Competent Person Requirements

OE/UXO subcontractors are responsible for providing a competent person to oversee OE operations. A competent person may be a Senior UXO Supervisor, UXO Safety Officer, UXO Quality Control Specialist, or a UXO Technician III. The competent person must meet the following minimum qualification requirements:

- Be a graduate of either of one of the following: U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD; U.S. Naval Explosive Ordnance Disposal (EOD) School, Indian Head, MD; U.S. Naval EOD School, Eglin Air Force Base, FL; EOD Assistants Course, Redstone Arsenal Alabama; EOD Assistant Course at Eglin Air Force Base, FL; or a U.S. DOD-certified equivalent course
- Have at least 10 years of combined active duty military EOD and contractor UXO experience
- Have experience in OE clearance operations and supervising personnel

CH2M HILL competent person requirements are the same as for a subcontractor.

2.5 Safety Equipment

OE subcontractors are responsible for providing all personal protective equipment (PPE) necessary for their employees. CH2M HILL will provide PPE only for its own employees. Other safety equipment will be provided as delineated in the subcontract and referenced documents. The EE&SBG UXOSO must review subcontractor work plans and health and safety plans to ensure that appropriate safety equipment has been included to meet the scope of work requirements.

2.6 Subcontractor Selection

OE subcontractors are selected as described in the "Subcontractor, Contractor, and Owner" SOP HSE-55. The "Subcontractor Safety Procedure Criteria - OE Operations" found in Attachment 1 provides the minimum criteria for OE operations. Additional criteria may be developed dependent upon the specific OE scope of work requirements for the subcontractor. These criteria shall be used by the CH2M HILL EE&SBG UXOSO to review subcontractor OE procedures submitted when oversight is required by HSE-55.

2.7 Planning Activities

Assistance for planning OE operations is available from the CH2M HILL EE&SBG UXOSO for planning and executing OE support for Hazardous Toxic Radiological Waste (HTRW) support activities, construction support activities, OE response actions, CWM activities, explosive contaminated soils, and ordnance demilitarization. The following types of support may be needed for OE operations:

- On a HTRW site with known or suspected OE, UXO support refers to the anomaly avoidance techniques implemented to avoid any potential surface UXO and any subsurface anomalies.
- On a construction site with known or suspected OE, UXO support is provided by qualified UXO personnel during construction activities. The level of UXO support

required is dependent on the probability of encountering UXO, as determined on a project-by-project basis.

- OE response actions in which location, identification, excavation, removal, and disposal of UXO is accomplished require qualified UXO personnel, including a Senior UXO Supervisor, UXO Safety Officer, and UXO Quality Control Specialist to provide oversight for UXO Teams performing operations.
- On an OE site that has OE contamination of soils and/or groundwater, UXO support may include both anomaly avoidance techniques and OE construction support for excavation and/or treatment of OE contaminated soil and groundwater.
- On ordnance demilitarization and CWM projects, OE support may be needed for identification, handling, disassembly, processing, transportation, and treatment or disposal of munition components.
- On projects where OE waste (OEW) is transported or disposed off-range, the UXO and Environmental Compliance Coordinator (ECC) may assist in identifying the applicable regulations and permits required.
- On projects where Ordnance Related Scrap (ORS) or inert ordnance is recovered and processed for disposal as scrap, UXO and ECC support may determine if incineration and certification is required, along with any permitting requirements for portable incinerator operation.

The CH2M HILL EE&SBG UXOSO or EE&SBG UXO Quality Control Specialist shall verify subcontractor training and current medical examinations prior to the start of field operations.

3.0 Definitions

3.1 Active Range. A military range that is currently in use and being regularly used for range activities.

3.2 Anomaly. Any item that is seen as a subsurface irregularity after geophysical investigation. This irregularity should deviate from the expected subsurface ferrous and nonferrous material at a site.

3.3 Anomaly Avoidance. Techniques employed by EOD or UXO personnel at sites with known or suspected OE to avoid any potential surface UXO or subsurface anomalies. This usually occurs at mixed hazard sites when HTRW investigations must occur prior to execution of an OE removal action. Intrusive anomaly investigations are not authorized during ordnance avoidance operations.

3.4 Chemical Warfare Materials (CWM). An item configured as a munition containing a chemical substance that is intended to kill, seriously injure, or incapacitate a person through its physiological effects. Also includes V- and G-series nerve agents, H-series blister agent, and lewisite in other-than-munition configurations. Due to their hazards, prevalence, and military-unique application, chemical agent identification sets (CAIS) are also considered CWM. CWM does not include: riot control agents, chemical herbicides, smoke and flame producing items, or soil, water, debris, or other media contaminated with a chemical agent.

3.5 OE Construction Support. Support provided by qualified UXO personnel during construction activities at potential OE sites to ensure the safety of construction personnel from the harmful effects of UXO. When a determination is made that the probability of encountering UXO is low (current or previous land use leads to a determination that OE may be present), a two person UXO team will stand by in case the construction contractor encounters a suspected UXO. When a determination is made that the probability of encountering a UXO is moderate to high (current or previous land use leads to a determination that OE was employed or disposed of in the parcel of concern, e.g., open burn and open detonation areas), UXO teams are required to conduct subsurface UXO clearance for the known construction footprint either in conjunction with the construction contractor or prior to construction.

3.6 EOD Personnel. EOD personnel are those active duty military individuals performing EOD operations.

3.7 Explosive Ordnance Disposal (EOD). EOD includes the detection, identification, field evaluation, rendering safe, and final disposal of OE.

3.8 Explosive Safety Submission (ESS). The document that serves as the specifications for conducting work activities at the project. The ESS details the scope of the project, the planned work activities, and potential hazards and the methods for their control.

3.9 Explosive Soil. Refers to mixtures of explosives in soil, sand, clay, or other solid media at concentrations such that the mixture itself is explosive.

(a) The concentration of a particular explosive in soil necessary to present an explosion hazard depends on whether an explosive is classified as "primary" or "secondary."

(b) Primary explosives are those extremely sensitive explosives (or mixtures thereof) that are used in primers, detonators, and blasting caps. They are easily detonated by heat, sparks, impact, or friction. Examples of primary explosives include lead azide, lead styphnate, and mercury fulminate.

(c) Secondary explosives are bursting and boostering explosives (i.e., they are used as the main bursting charge or as the booster that sets off the main bursting charge). Secondary explosives are much less sensitive than primary explosives.

(d) Soil containing 10 percent or more by weight of any secondary explosive mixture of secondary explosives is considered "explosive soil."

(e) Soil containing propellants (as opposed to primary or secondary high explosives) may also present explosion hazards.

3.10 Inactive Range. A military range that is not currently being used, but that is still under military control and considered by the military to be a potential range area, and that has not been put to a new use that is incompatible with range activities.

3.11 Intentional Detonation. An intentional detonation is a planned, controlled detonation.

3.12 Intrusive Activity. An activity that involves or results in the penetration of the ground surface at an area known or suspected to contain OE. Intrusive activities can be of an investigative or removal action nature.

3.13 Maximum Credible Event. The worst single event that could occur at any time, with maximum release of a chemical agent from a munition, container, or process as a result of unintended, unplanned, or accidental occurrence.

3.14 Most Probable Event (MPE). The most likely event, as a result of an accidental, unplanned, or unintended detonation of an item of ordnance, that could occur during OE activities. The event must be realistic with reasonable probability of occurrence.

3.15 Most Probable Munition (MPM). The OE item that has the greatest hazard distance based on calculations of the explosion effects of the OE items anticipated to be found at a site. Typically, the MPM is the OE item with the greatest fragmentation or overpressure distance based on the type of OE items that were historically used at the site.

3.16 Military Munitions. All ammunition products and components produced or used by or for the U.S. DOD or the U.S. Armed Services for national defense and security, including military munitions under the control of the DOD, the U.S. Coast Guard, the U.S. Department of Energy (DOE), and the National Guard personnel. The term military munitions includes: confined gases, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries used by DOD components, including bulk explosives and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components thereof.

3.17 Military Range. Designated land and water areas set aside, managed, and used to conduct research on, develop, test, and evaluate military munitions and explosives, other ordnance or weapons systems, or to train military personnel in their use and handling. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, and buffer zones with restricted access and exclusionary areas.

3.18 Non-Stockpile Chemical Warfare Materials. CWM (defined above) that is not included in the chemical stockpile. Nonstockpile CWM is divided into five categories:

(1) Buried CWM.

(2) Recovered chemical weapons (items recovered during range clearing operations, from chemical burial sites, and from research and development testing).

(3) Former chemical weapon production facilities.

(4) Binary chemical weapons.

(5) Miscellaneous CWM (unfilled munitions and devices and equipment specially designed for use directly in connection with employment of chemical weapons).

3.19 Ordnance and Explosives (OE) consists of:

(1) Ammunition, ammunition components, chemical or biological warfare materials that have been abandoned, expelled from demolition pits or burning pads, lost, discarded, buried or fired. Such ammunition, ammunition components, and explosives are no longer under accountable record control of any DOD organization or activity.

(2) Explosive Soil. See definition under "explosive soils."

(3) OE market includes: Unexploded Ordnance (UXO), Chemical Weapons Materials (CWM), OE Contaminated Soils and Groundwater, Range Maintenance, Ordnance Demilitarization (Demil), and Demining (DM).

3.20 Quantity-Distance (QD). The quantity of explosives material and distance separations that provide defined types of protection. These relationships are based on levels of risk considered acceptable for the stipulated exposures and are tabulated in the appropriate Q-D tables provided in DOD 6055.9-STD. Separation distances are not absolute safe distances but are relative protective safe distances. Greater distances than those shown in the Q-D tables shall be used whenever possible.

3.21 Removal Action. The cleanup of OE from the environment to include the disposal of removed material. The term includes, in addition, without being limited to, security fencing or other measures to prevent, minimize, or mitigate damage to the public health or welfare or the environment.

3.22 Response Action. Action taken instead of or in addition to a removal action to prevent or minimize the release of OE so that it does not cause substantial danger to present or future public health or welfare or the environment.

3.23 Senior UXO Supervisor (SUXOS). Supervises all contractor onsite UXO activities. This individual must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen proving Ground, MD, or the U.S. Naval EOD School, Indian Head, MD. This individual must have at least 15 years of combined active duty military EOD and contractor UXO experience, to include at least 10 years in supervisory positions.

3.24 Unintentional Detonation. A detonation not planned in advance.

3.25 Unexploded Ordnance (UXO). Military munitions that have been primed, fuzed, armed, or otherwise prepared for action, and have been fired dropped, launched, projected or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

3.26 UXO Personnel. Contractor personnel who have completed specialized military training in EOD methods and have satisfactorily performed the EOD function while serving in the military. Various grades and contract positions are established based on skills and experience.

3.27 UXO Safety Officer (UXOSO). Contractor personnel with the responsibility of enforcing the contractor's SSHP. This individual must, therefore, be in the field whenever possible to observe operations. This individual must have the same minimum qualifications as the UXO Technician III. In addition, this individual must have the specific training,

knowledge, and experience necessary to implement the SSHP and verify compliance with applicable safety and health requirements.

3.28 UXO Technician III. Supervises a UXO team. This individual must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD, the U.S. Naval EOD School, Indian Head, MD, or U.S. Naval EOD School, Elgin Air Force Base, FL, or a DOD-equivalent certified course. This individual must have a minimum of 10 years of military EOD or contractor UXO experience.

3.29 UXO Technician II. This individual must be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD, the U.S. Naval EOD School, Indian Head, MD, or U.S. Naval EOD School, Elgin Air Force Base, FL, or a DOD-equivalent certified course. This individual must have a minimum of 5 years of military EOD or contractor UXO experience.

4.0 Project Execution

4.1 Safe Work Practices

The requirements of this section are to be followed by CH2M HILL employees who enter OE exclusion zones, regardless of the company performing OE operations. These requirements also pertain to OE subcontractor personnel when CH2M HILL is providing oversight.

4.2 Regulations/Industry Standards

As described in the "Subcontractor, Contractor, and Owner" SOP HSE-55, CH2M HILL's project EE&SBG UXOSO may be required to provide oversight of an OE subcontractor. OE subcontractors retain control over their practices, and CH2M HILL's oversight does not relieve them of their own responsibility for effective implementation and enforcement of HS&E requirements. The following subsections provide the minimum regulatory and industry standard requirements pertaining to OE operations.

4.2.1 General Safety Concerns and Procedures

(a) OE operations will not be conducted until a complete plan for the site is prepared and approved by the CH2M HILL EE&SBG UXOSO. These plans will be based upon limiting exposure to the minimum number of personnel, for the minimum amount of time, to the least amount of OE consistent with safe and efficient operations.

(b) Only UXO qualified personnel will perform OE procedures. Non-UXO personnel may be used to perform OE-related procedures when supervised by a UXO Technician III. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III.

(c) Personnel who will be handling OE items will not wear outer or inner garments having static electricity-generating characteristics. Materials made of 100 percent polyester, nylon, silk, and wool are highly static producing.

(d) UXO Technicians are required to wear hard hats except when investigating suspect UXO. Hard hats may create an unsafe condition by falling off of the head of a UXO technician at a critical moment. In the event of the accidental detonation of a UXO (the worst case accident scenario), the hard hat will not protect the UXO technician from fragments and may worsen the injury by reflecting fragments into the head of the technician. This is consistent with safety guidance from the U.S. Army Corps of Engineers OE Center of Excellence. Also, protective shoes worn by personnel performing UXO operations should be constructed of nonferrous materials (e.g., fiberglass) to prevent interference with sensitive geophysical instruments.

(e) Prior to any action being performed on an ordnance item, all fuzing will be positively identified. This identification will consist of fuze type by function, condition (armed or unarmed), and the physical state/condition of the fuze, i.e., burned, broken, parts exposed/sheared, etc.

4.2.2 OE Safety Precautions

(a) Every effort will be made to identify a suspect OE item. Under no circumstances will any OE be moved in an attempt to make a positive identification. The OE item will be visually examined for markings and other external features such as shape, size, and external fittings. If an unknown OE item is encountered, the CH2M HILL EE&SBG UXOSO will be notified immediately. The following are additional considerations for the safe handling of OE items:

(1) Projectiles containing base detonating (BD) fuzes are to be considered armed if the round is fired.

(2) Arming wires and pop-out pins on unarmed fuzes should be secured prior to any movement.

(3) Do not depress plungers, turn vanes, rotate spindles, levers, setting rings, or other external fittings on OE items. Such actions may arm or activate the OE.

(4) Do not attempt to remove any fuzes from the OE. Do not dismantle or strip components from any OE items unless the item is included in the scope of work (SOW).

(5) UXO personnel are not authorized to inert any OE items found onsite unless it is a part of the SOW.

(6) OE/UXO items will not be taken from the site as souvenirs/training aids.

(7) Civil War ordnance will be treated as any other OE.

(b) Prior to entering U.S. Army-controlled areas/ranges contaminated with Improved Conventional Munitions (ICM), an approved Department of the Army (DA) wavier must be obtained.

(c) Any time suspect chemical warfare material (CWM) is encountered during conventional OE site activities, all work will immediately cease. Project personnel will withdraw along cleared paths upwind from the discovery. A team consisting of two personnel will secure the area to prevent unauthorized access. Personnel should

position themselves as far upwind as possible while still maintaining security of the area. The local point of contact designated in the Work Plan will be immediately notified.

(d) Avoid inhalation and skin contact with smoke, fumes, and vapors of explosives and other related materials.

(e) Consider OE items that have been exposed to fire and detonation as extremely hazardous. Chemical and physical changes may have occurred to the contents, which might render them more sensitive than their original state.

(f) Do not rely on the color coding of OE for positive identification. Munitions having incomplete or improper color codes have been encountered.

(g) Avoid approaching the forward area of an OE item until it can be determined whether or not the item contains a shaped charge. The explosive jet, which is formed during detonation, can be lethal at great distances. Assume that all shaped charge munitions contain piezoelectric (PZ) fuzing system until identified. PZ is extremely sensitive. It can function at the slightest physical change and can remain hazardous for an indefinite period of time.

(h) Approach an unfired rocket motor from the side at a 45-degree angle. Accidental ignition can cause a missile hazard and hot exhaust.

(i) Do not expose unfired rocket motors to any electromagnetic radiation (EMR) sources.

(j) Consider an emplaced landmine armed until proven otherwise. It may be intentionally booby-trapped to deceive.

(k) Assume that practice OE contains a live charge until it can be determined otherwise. Expended pyrotechnic and practice devices can contain red or white phosphorous residue. Due to incomplete combustion, the phosphorous may reignite if the crust is broken and exposed to air.

(l) Do not approach a smoking white phosphorous (WP) munition. Burning WP may detonate the explosive burster charge at anytime.

(m) Foreign ordnance was returned to the United States for exploitation and subsequent disposal. Every effort must be made to research the applicable documentation and publications prior to commencement of a project.

4.2.3 OE Storage

(a) During OE projects, explosive storage falls into two categories, on-DOD installations and off-DOD installations.

(b) For On-DOD installations the provisions of DOD 6055.9-STD will be followed.

(c) In the event the installation does not have an existing storage facility, the provisions of DOD 6055.9-STD will apply.

(d) For Off-DOD installations, establish a temporary explosive storage area that will meet all local, state, and 27 CFR, Bureau of Alcohol Tobacco, and Firearms (BATF) requirements and as much of DOD 6055.9-STD as is practical to implement. The establishment of a temporary explosive storage area must meet the following requirements:

(1) The area will, if possible, meet the inhabited building and public traffic route distances specified in DOD 6055.9-STD. If the distances are less than required by the DOD guidance, a proposed barricading plan to protect the public from accidental detonation must be developed and reviewed by the CH2M HILL Corporate UXOSO.

(2) Magazines must meet the requirements of the BATF regulations, and each magazine must have a Net Explosive Weight (NEW) established for the explosives to be stored.

(3) Each magazine must be grounded as specified in NFPA 780 and must meet the intermagazine distances as defined in the DOD guidance.

(4) A physical security survey will be conducted to determine if fencing or guards are required. This survey will be coordinated through the CH2M HILL EE&SBG UXOSO and local law enforcement agencies.

(5) A fire plan for either on- or off-installation explosive storage areas will be prepared and coordinated through the CH2M HILL EE&SBG UXOSO and the local fire department. All magazines will have placards.

(e) OE Waste (OEW) may be stored: 1) in RCRA regulated units (i.e., tanks, containers, containment buildings, etc.) as described in HSE-80; 2) in military magazines conforming to DDESB standards (as described above); or 3) under the MMR conditional exemption (40 CFR 266.205). The MMR conditional exemption applies to military non-chemical munitions, and the following procedures must be met:

(1) Follow DDESB requirements for storage.

(2) Notify EPA of the location of the unit within 90 days of when storage unit first is used for waste munitions storage.

(3) Notify EPA within 24 hours of any loss or theft of munitions from the storage area.

(4) Inventory wastes annually, conduct inspections quarterly and keep records for at least three years.

(5) Limit access to the area to appropriately trained and authorized personnel.

4.2.4 OE Transportation

In the event that OE items must be transported offsite, the provisions of 49 CFR, DA Pam 385-64 state and local laws must be followed. These additional considerations are provided for the safe transport of OE items:

(a) Do not transport WP munitions unless they are immersed in water, mud, or wet sand.

(b) If loose pyrotechnic, tracer, flare, or similar mixtures are to be transported, they will be placed in #10 mineral oil or equivalent to minimize the fire and explosion hazards.

(c) Incendiary loaded munitions should be placed on a bed of sand and covered with sand to help control the burn if a fire should start.

(d) If a base-ejection projectile must be transported to a disposal area, the base will be oriented in the vehicle so that it is parallel to the rear axle. This will afford maximum protection for the personnel operating the vehicle.

(e) OE with exposed hazardous fillers such as high explosives (HE), will be placed in appropriate containers with packing materials to prevent migration of the hazardous fillers. Padding should be added to protect the exposed filler from heat, shock, and friction.

4.2.5 OE Exclusion Zone Operations

On OE project sites, it is the responsibility of the UXOSO to establish the exclusion zone for each UXO team. This exclusion zone should not be confused with the safe separation distance that is maintained between teams.

(a) The purpose of the exclusion zone is for the protection of nonessential project personnel and the public from blast overpressure and fragmentation hazards. There are two criteria for calculating exclusion zones:

(1) Intentional Detonations. When destroying ordnance, both the hazards from fragmentation and overpressure must be considered. The minimum separation distances in DOD 6055.9-STD will also be used unless otherwise stated.

(2) Unintentional Detonations. If the identification of OE on an OE site is unknown, the minimum separation specified in DOD 6055.9-STD, Chapter 5, Paragraph C5.5.4, will be used to establish the exclusion zones.

(b) When multiple teams are working onsite, a safe separation distance will be established. The minimum distance maintained between teams will never be less than 200 feet or the K50 overpressure distance. The one that is greater will be used.

(c) While OE operations are being conducted, only personnel essential for the operation will be allowed in the exclusion zone. When nonessential personnel enter the exclusion zone, all OE operations will cease. In addition to this work stoppage, the following actions will be accomplished:

(1) The individuals must receive a safety briefing and sign the visitors' log prior to entering the zone.

(2) The individuals will be escorted by a UXO qualified individual.

(3) All OE operations will cease within the radius of the exclusion zone for the areas to be visited.

(d) All personnel working within the exclusion zone must comply with the following:

(1) There will be no smoking within the exclusion zone, except in areas designated by the UXOSO.

(2) There will be no open fires for heating or cooking within the exclusion zone, except where authorized by the UXOSO.

(3) During magnetometer operations, workers will have no metal parts in or on their shoes that would cause the magnetometer to present false indications.

4.2.6 OE Excavation Operations

(a) Hand excavation is the most reliable method for uncovering OE, provided the item is near the surface. Hand excavation exposes personnel to the hazard of detonation for longer periods of time than any other method. Taking this into consideration, only UXO qualified personnel will be used to accomplish this task.

(b) Earth-Moving Machinery (EMM) may be used to excavate overburden from suspected OE. EMM will not be used to excavate within 12 inches of a suspected OE. Once the EMM is within 12 inches of the OE, the excavation will be completed by hand excavation methods. Personnel who are not UXO qualified may operate EMM only when supervised by a UXO Technician III.

(1) If more than one EMM is to be used onsite, the same minimum separation distances required for multiple work teams applies.

(2) EMM operations will be conducted within the guidelines of HSE-32 "Excavations."

(c) Excavation operations, whether by hand or EMM, will employ a step-down or offset access method. Under no circumstances will any excavation be made directly over the suspected OE.

4.2.7 OE Disposal Operations

To avoid MMR regulation, all demolition operations will be conducted on-range in accordance with TM/EODB 60A 1-1-31. Any deviation from this policy must be approved by the UXOSO and ECC. The following are on-range disposal procedures.

(a) As a general rule, all demolition operations will be accomplished by use of shock tubing or electrical means to assure maximum safety. There are exceptions to this requirement in situations where static electricity of EMR hazards are present.

(b) The only acceptable disposal method is the one stated in the appropriate TM/EODB 60-series manual for specific ordnance types. Any commercial explosives being used will be equivalent to the military explosive required for the disposal operation.

(c) If a situation dictates, protective measures to reduce shock, blast overpressure, and fragmentation will be taken. The CH2M HILL EE&SBG UXOSO will assist in any design work and must review and approve all proposed protective works. As a minimum requirement, all demolition shots will be tamped with clean earth or sand. In accordance with DOD 6055.9-STD the following separation distances will be observed unless otherwise directed:

(1) Minimum separation distance for nonfragmenting explosive materials will be no less than 1,250 feet.

(2) Minimum separation distance for fragmenting explosive ordnance will be no less than 2,500 feet. For bombs and projectiles with a diameter of 5 inches or greater, use a minimum distance of 4,000 feet.

(3) Ordnance items with lifting lugs, strong backs, base plates, etc., will be oriented away from personnel, as fragments from these items tends to travel farther than normal.

(d) Once demolition operations are completed, a thorough search of the demolition area will be conducted with a magnetometer to ensure a complete disposal was accomplished.

(e) Inert ordnance will not be disposed of for scrap until the internal fillers/voids have been exposed and unconfined. Heat generated during the reclamation process can cause the inert fillers, moisture, or air to expand and burst the sealed casings. In this situation, Oil Well Perforators can be used for venting these ordnance items that require demilitarization.

(f) Inert ordnance to be disposed of as scrap may require certification by the UXOSO and a government representative. This may require further treatment by operation of a portable incinerator, depending on local requirements and acceptance criteria. The UXOSO and ECC will determine if certification and incineration is necessary, along with any permitting requirements during project planning.

4.2.8 OEW Disposal

When the used or fired munition is managed off-range (i.e., transported off-range and stored, reclaimed, treated or disposed) or disposed of on-range (i.e., buried without treatment), it is subject to regulation as a solid waste under RCRA. This means it may also be subject to regulation as a hazardous waste. Also, munitions that land off-range, and that are not promptly retrieved, are solid wastes. Table 4-1 describes how solid wastes may be characterized as hazardous in these situations. All characterization must be based on field observations by the EE&SBG UXOSO, who is trained in the proper identification of waste ordnance items and meet the requirements for an "emergency response expert" under RCRA. In the event the OEW is regulated as hazardous waste, refer to the Hazardous Waste SOP, HSE-80 for RCRA hazardous waste management requirements.

Table 4-1 Waste Characterization

Item	Characterization	Waste Code
Uncontaminated Metal Debris	If visual inspection determines if item does not contain waste residue, waste is non-hazardous scrap metal, excluded from RCRA regulation under 40 CFR 261.6(a)(3). Waste may be subject to further incineration and certification requirements.	None
Contaminated Metal Debris	If visual inspection determines item contains hazardous waste residue, manage as potential hazardous waste.	Potential D003 and/or D008
Ordnance Items Less than 0.5 Caliber	Small-arms ammunition is not considered reactive hazardous waste in accordance with EPA policy (November 30, 1984 Memorandum, John Skinner, OSWER Director).	None
Ordnance Items Greater than 0.5 Caliber	Untreated UXO presumed to be reactive hazardous waste using generator knowledge under 40 CFR 261.23.	D003
Ordnance Items Greater than 0.5 Caliber w/ Lead Projectiles	Ordnance containing lead projectiles will be presumed to be toxic hazardous waste under 40 CFR 261.24.	D008

4.3 Forms/Permits

(a) **Type-33 User of High Explosives License/Permit** issued by the BATF? is required for the purchase, storage, and use of high explosives (HE) in support of OE operations, construction projects, and demolition and disposal (D&D) projects. Written authorization designating the individuals who can purchase, store, or use explosives must be included in the site-specific work plans.

(b) **State and Local Explosive Permits** may be required for the purchase, storage, and use of HE in support of OE operations, construction projects, and D&D projects.

4.4 Self-Assessment Checklists

The "HS&E Self-Assessment Checklist—OE Operations" found in Attachment 2 is provided as a method of verifying compliance with established safe work practices, regulations, and industry standards pertaining to OE operations. CH2M HILL's project UXOSO/EE&SBG UXOSO shall use this checklist when: 1) CH2M HILL employees are potentially exposed to hazards associated with OE operations, and/or 2) CH2M HILL oversight of an OE subcontractor is required. The EE&SBG UXOSO shall specify the frequency in which this checklist shall be completed and provide this information in the project's written safety plan. Completed checklists shall be sent to the EE&SBG UXOSO for review. The EE&SBG UXOSO shall assist the Site UXOSO in resolving any deficiencies identified during the self-assessment.

5.0 Attachments

Attachment 1: Subcontractor Safety Procedure Criteria for OE Operations

Attachment 2: H&S Self-Assessment Checklist for OE Operations

Ordnance Explosives (OE)

Standard of Practice HSE-91

Attachment 1: Subcontractor Safety Procedure Criteria for OE Operations

Pending. Contact the CH2M HILL EE&SBG UXO Safety Officer for assistance.

Ordnance Explosives (OE)
Standard of Practice HSE-91
Attachment 2: HS&E Self-Assessment Checklist - OE Operations

Pending. Contact the CH2M HILL EE&SBG UXO Safety Officer for assistance.

Attachment C
MEC/UXO Notification Procedures

Procedures for Communicating Potential Live UXO to Navy

The following are procedures designed to effectively communicate the finding of potential live unexploded ordnance (UXO) which could be encountered during investigative and remedial work at St. Juliens Creek Annex (SJCA). Communicating in a **fast, accurate**, and **calm** manner is critical in keeping the situation under control.

During all intrusive investigations, a UXO contractor will be on-site and have expertise and knowledge in dealing with UXO. Only the UXO contractor has the ability to determine whether an item is considered live or inert. If the UXO support contractor can not make a determination regarding the found item or if the item is determined to be live, the following steps should be taken:

1. **Stop all work**. Under no circumstances should work continue near the item (Norfolk Naval Shipyard [NNSY] security typically does not permit any work to occur at a site even if it is some distance away from the item).
2. NNSY Security dispatcher should be contacted (757) 396-5111. The field team lead should discuss the situation with the UXO contractor prior to making the call. It is imperative to communicate that the situation is not an emergency, that activities have stopped, and that people will not have access to the area.
3. Immediately following notification to NNSY Security, a phone call should be placed to the CH2M HILL activity manager/project manager (AM/PM). The CH2M HILL AM/PM will be responsible for contacting the LANTDIV project manager (Mr. Bob Schirmer @ 322-4751 before September 17th, 2004 and Mr. Stephen Garth @ 322-4145 after September 17th, 2004).
4. If the project is a construction project which includes the NNSY Resident Office In Charge Of Construction (ROICC), contact the ROICC office at (757) 396-5121.
5. NNSY security will arrive on-site and make a determination as to call the local explosive ordnance detachment (EOD), this will likely be stationed out of NAB Little Creek (EODMU2). EOD will not be contacted directly from site operation people. However, the phone number is (757) 444-2734 and the contact name is LT. Marc Carmichael. EOD may request to speak with the UXO subcontractor and direct them in identifying or handling the item.
6. Understand that from the moment that NNSY security arrives, they are in charge and there are no exceptions. Although our UXO contractor is trained in handling these matters, we should not have them interfering or directing NNSY security in the handling of the situation.

It is important to discuss this procedure with our UXO contractor prior to initiating the project. Most times, the UXO subcontractors are former military personnel who understand the importance of following a procedure. Whether the item is considered live or inert will determine how LANTDIV reports this incident to CNRMA and Naval Ordnance Safety & Security Activity (NOSSA).

Attachment D
Explosives Safety Submission Waiver Request

EXPLOSIVES SAFETY SUBMISSION

WAIVER REQUEST

Date: 27 July 2004

Site Name: St. Juliens Creek Annex (multiple locations). See attached Figure 1 for the location of St. Juliens Creek Annex and Figure 2 for the locations of sites discussed in this waiver.

Supporting EOD unit or UXO contractor: EOD Mobile Unit 2 DET Norfolk has provided technical assistance and emergency support.

CH2M HILL has subcontracted UXO support for St. Juliens Creek Annex with Explosive Ordnance Technologies Inc. and USA Environmental. CH2M HILL will continue to have a qualified UXO subcontractor on-scene during intrusive operations.

POC Name/phone/fax: -Mr. Robert Schirmer (NAVFACENGCOM)/ ph. (757) 322-4751/ fax (757) 322-4805

Site History

St. Juliens Creek Annex began operations as a naval ammunition facility in 1849. In the past, operations at SJCA have included general ordnance operations involving wartime transfer of ammunitions to various other U.S. Naval facilities throughout the United States and abroad. In addition, the Annex has been involved in specific ordnance operations and processes including those involving black powder operations, smokeless powder operations, projectile-loading operations, mine loading, tracer mixing, testing operations, and decontamination operations. Decontamination was performed in, around, and under ordnance-handling facilities at SJCA in 1977, after ordnance operations had ceased.

Site 2—Waste Disposal Area B

Site 2 is a former waste disposal area located at the corner of St. Juliens Drive and Cradock Street, in the southwestern portion of the facility (Figure 2) . The waste disposal area began operating in 1921. Initially, refuse was burned onsite and was used to fill an adjacent swampy area. **Mixed municipal wastes, organics, inorganics, solvents, and waste ordnance may have been disposed at Site 2.** The total volume of waste prior to burning is reported to have been approximately 35,185 cubic yards, and it is estimated that half of this waste was disposed of prior to 1942. In 1942, an incinerator was installed and replaced the open-burning practices. The waste disposal area was closed sometime after 1947 (A.T. Kearney, 1989).

During the 1989 RCRA Facility Assessment (RFA), stained soil associated with leaking heavy equipment stored onsite, ash, and ABM were observed on the ground surface at Site 2. An RFI was recommended at Site 2 owing to the high potential for release to soil, which is attributable to the waste disposal area being unlined and the moderate to high potential for release to surface water via runoff and groundwater discharge because of proximity to St. Juliens Creek. Additionally, soil sampling for inorganics was recommended in the areas of ABM to determine if hazardous constituents were associated with the material.

During the Relative Risk Ranking (RRR) data collection study in 1996, two surface soil and two groundwater samples were collected at Site 2 and analyzed for VOCs, SVOCs, pesticides/PCBs, inorganics, and nitramines. The soil samples were found to contain pesticides/PCBs and inorganics. The groundwater samples contained 2,4,6-trinitrotoluene, 1,3,5-trinitrobenzene, acetone, and several inorganics (CH2M HILL, 1996).

The RI field investigation activities conducted in 2001 included geophysical investigations, monitoring well installations, water-level monitoring, waste delineation, and the collection and analysis of surface and subsurface soil samples, groundwater samples, sediment samples, and surface water samples. Based on the results of the waste delineation trenching, historical aerial photograph reviews, and SJCA IR Partnering Team discussions, it was determined that Site 2 had not been operated as a cut-and-fill landfill. Therefore, Site 2 was reclassified as a waste disposal area. In addition, the Site 2 boundary was adjusted to reflect the extent of waste. No UXO was encountered by the on-site UXO team.

Based on the results of the Site 2 RI and data gaps identified, an Expanded RI was conducted from December 2003 through January 2004 and included shallow monitoring well installation and sampling to further define the nature and extent of groundwater contamination, stormwater and surface water sampling to assess the source of VOC contamination in inlet surface water, and sediment sampling. A qualified UXO subcontractor was on site during all intrusive activities and no UXO was encountered.

Intrusive activities to be conducted in the summer of 2004 include the advancement of up to 20 direct push technology (DPT) points, installation of up to five monitoring wells, and collection of three sediment samples. The DPT uses a 2-inch diameter rod which will be advanced to a maximum depth of 20 feet below ground surface (bgs). Groundwater is no more than five feet bgs. The five monitoring wells will require the use of 10-inch outside diameter augers which will be advanced to a maximum depth of 20 feet bgs. Three sediment samples will be collected in the wetland portion of the site with each sample be collected at a depth of no more than 6 inches.

Site 4—Landfill D

The Site 4 landfill covers an estimated 10 acres. The site is located on dredge fill material which reportedly originated from Blows Creek and the Southern Branch of the Elizabeth River. In earlier documents, Site 4 was referred to as Dump D or SWMU 6 and included SWMU 7 and AOC L.

The first indication of activity at Site 4 is a trench identified on a historical aerial photograph from 1961. The trench was approximately 1,000 ft long and paralleled Blows Creek about 500 ft north of it. The original trench and others were filled with trash, wet garbage, and soil from subsequent trenches. It is not known how many trenches were eventually dug, but based on a review of historical aerial photographs, there appears to have been only two trenches.

An Initial Assessment Study (IAS) indicated that around 1970, sanitary landfill operations began at Site 4 in the marshes of Blows Creek. **Primarily trash and wet garbage were disposed of. Sanitary landfill operations continued until 1976, at which time trash and garbage were hauled to an off-site facility, and inert material was then disposed of at the landfill**. The RFA indicates that refuse was disposed of at Site 4 between 1970 and 1981. The

wastes managed were primarily trash, wet garbage, construction material, and outdated civil defense stores. Wastes disposed of at Site 4 were estimated at 1.5 million ft^3.

The results of sampling conducted to date at Site 4 have not indicated the presence of hazardous materials. Although trenching and landfilling may have continued after 1976 (implementation of RCRA), **it is believed that only municipal wastes and inert material were disposed of.** In addition, no sampling to date has indicated the presence of hazardous waste. Based on a comparative analysis conducted as part of a Feasibility Study (CH2M HILL, 2004), a soil cover and removal of contaminated sediment in the upland drainage ditch has been selected as the recommended remedial alternative for Site 4. A Proposed Remedial Action Plan (PRAP), Record Of Decision (ROD), and Remedial Design (RD) will be submitted in FY 2004. The RD will be implemented in FY 2005.

Intrusive activities, scheduled for spring of 2005, associated with the placement of the soil cover will include the consolidation of surface waste from wetlands at the site and the installation of a horizontal gas vent system. The gas vent system will require the excavation of two shallow trenches, the dimensions of which will be 650' long, by 3' deep by 8" wide. Additional landfill material may also be moved along the landfill edges to allow appropriate construction of the landfill cover.

Site 19—Wharf Area Building 190

Building 190 was located near Building M-5, south of the mouth of Blows Creek. The 1981 IAS **identified Building 190 to have handled loose ordnance materials and used for loading explosives into ammunition. From the 1940s to the 1970s, Explosive D and Composition A-3 were used at Building 190.**

The RFA reported that various ordnance items had been disposed of in the area between Building M-5 and Building 190 during past ordnance management activities (A. T. Kearney, 1989). Site 19 was referred to as AOC H during the RFA, and the area was noted to contain a variety of construction rubble and facility personnel reported no knowledge of residual contamination from ordnance management operations. The RFA recommended that a determination be made as to whether residual ordnance exists and the collection of soil samples to determine possible residual contamination.

During a Relative Risk Ranking (RRR) data collection study, surface soil and groundwater samples were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, inorganics, and nitramines. No nitramines were detected in the surface soil samples and no ordnance encountered during the investigation. (CH2M HILL, 1996).

A Site Investigation (SI) was conducted at Site 19 in August 2003 and included the collection of subsurface soil samples. No ordnance was encountered during this investigation and no explosive chemicals were detected in the soil samples. A qualified UXO subcontractor was on site during the entire intrusive investigation.

Intrusive activities to be conducted in the summer of 2004 include the advancement of up to five direct push technology (DPT) points and the collection of five shallow soil samples. The DPT uses a 2-inch diameter rod which will be advanced to a maximum depth of 3 feet bgs. The five shallow soil samples will be collected at a depth of 6 inches up to 2 feet bgs. These shallow soil samples will be collected with a hand auger or trowel.

Site 21— at Building 187

Building 187 was a locomotive shed used for locomotive maintenance. The IAS stated that the area around the locomotive shed was saturated with oil (NEESA, 1981). Currently, the building and surrounding areas are covered with concrete and asphalt. A review of historical documents and historic aerial photographs dating back to 1937 do not indicate any disposal of base generated waste or ordnance.

During a Relative Risk Ranking (RRR) data collection study performed in 1996, surface soil and groundwater samples were collected and analyzed for VOCs, SVOCs, pesticides/PCBs, and inorganics. Soil and groundwater were not sampled for explosives, but no ordnance encountered during the investigation. (CH2M HILL, 1996).

A Site Investigation (SI) was conducted at Site 21 in August 2003 and included the installation of seven groundwater monitoring wells collection of subsurface soil samples. No ordnance was encountered during this investigation and no explosive chemicals were detected in the soil samples. A qualified UXO subcontractor was on site during the entire intrusive investigation.

Intrusive activities to be conducted in the summer of 2004 includes the installation of up to five monitoring wells. The five monitoring wells will require the use of 10-inch outside diameter augers which will be advanced to a maximum depth of 20 feet bgs.

Munitions Encountered				
Type	**Quantity**	**Condition**	**Date**	**Site**
Protective Cap for projectile fuze	1	Ordnance-related scrap	2 July 2001	2
5-inch Projectile Cartridge Casing	2	Expended - 2 casings filled with sand and crimped together	2 July 2001	2
MK II 40mm cartridge casing	1	Expended	3 July 2001	2

Justification for not Submitting an ESS:

So far, munitions and related items have been found only at Site 2 and have been non-hazardous. The items recovered may be residue from documented munitions-related activities or carelessly discarded scrap. No munitions and related items have been found in previous investigations at Sites 4, 19, or 21.

The Explosive Hazard Evaluation (EHE) tables of the DoD Munitions Response Site Prioritization Protocol was used for risk hazard assessment. A summary of the EHE score for St. Juliens Creek Annex is presented below.

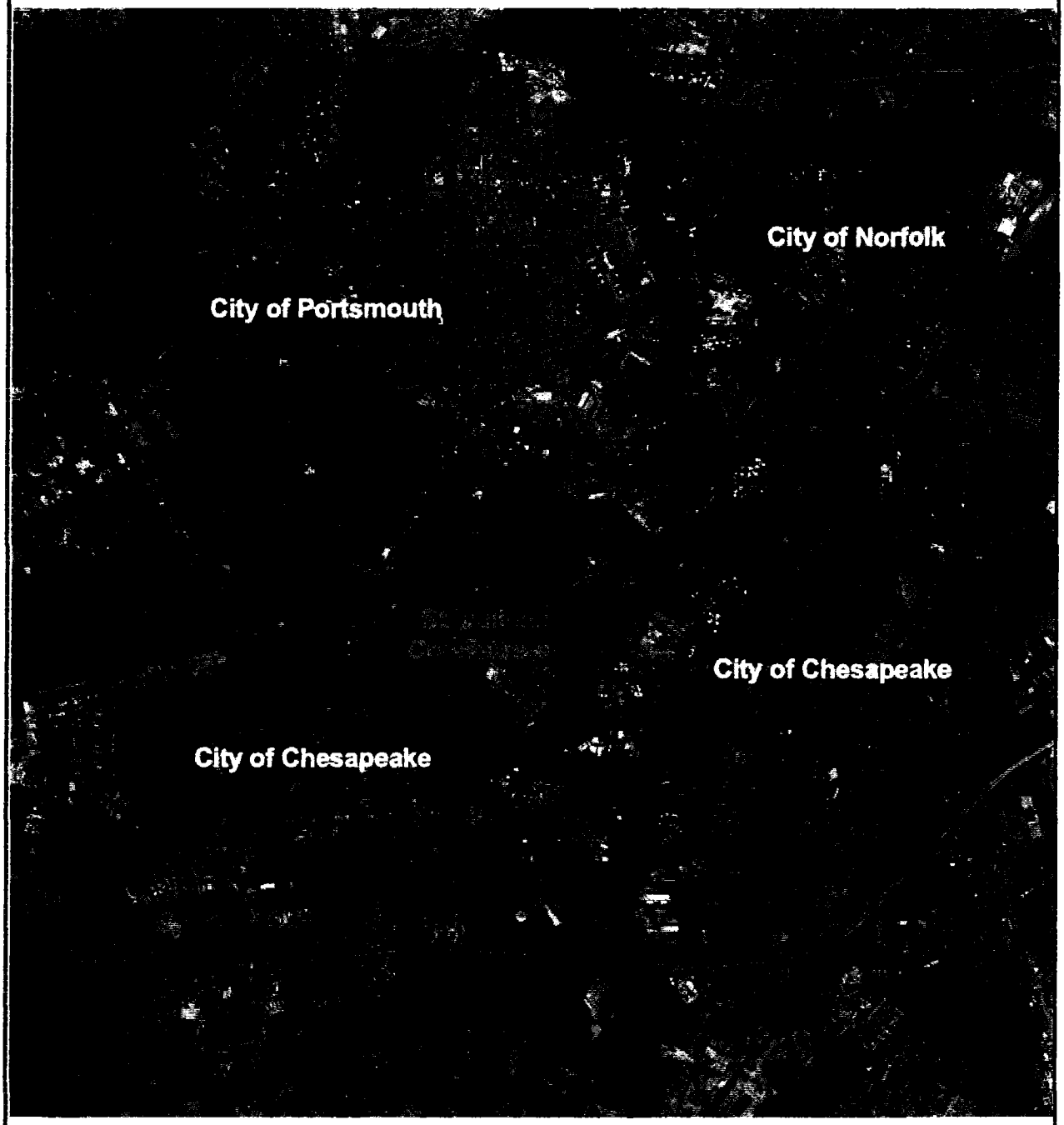
EHE Module Summary		
Classifications	**Description**	**Score**
High Explosive Munitions (unused)	All DMM containing HE filler not damaged by burning or detonation	15
Former storage or transfer point	Munitions were stored or handled for transfer between modes	2
Subsurface, stable (confirmed)	Physical evidence of subsurface DMM; not likely to be exposed by erosion	15
Complete barrier; monitored site	Complete barrier and active, continual surveillance	0
DoD Control	Site is on property owned by the DoD	0
Population density	More than 500 persons per square mile in the county in which site is located	5
Nearby structures	More than 26 inhabited structures within 2 miles of the site boundary	5
Types of structures	Residential, educational, commercial, and subsistence	5
Ecological/cultural resources	No ecological or cultural resources on site	0
Overall EHE Score		**47**

According to the EHE Module, the overall score of 47 is an EHE Rating "**G**" and puts the sites on St. Juliens Creek Annex in the **second lowest hazard category**.

Based on the past uses of St. Juliens Creek Annex, the amount and type of munitions and ordnance related items found so far, and a very low EHE score we request these sites be considered for a waiver to the ESS process.

We will continue to have qualified UXO personnel onsite during intrusive operations. All munitions and ordnance related items will be reported to NOSSA. If any "live" items are recovered we will immediately readdress the ESS requirement.

File Path: c:\18gis\cd projects\ess waiver sites.apr



LEGEND

St. Juliens Creek Annex

N

0 2 4 6 Miles

Figure 1
Waiver For ESS Submittal
St. Juliens Creek Annex
Base Location Map
Chesapeake, Virginia

CH2MHILL

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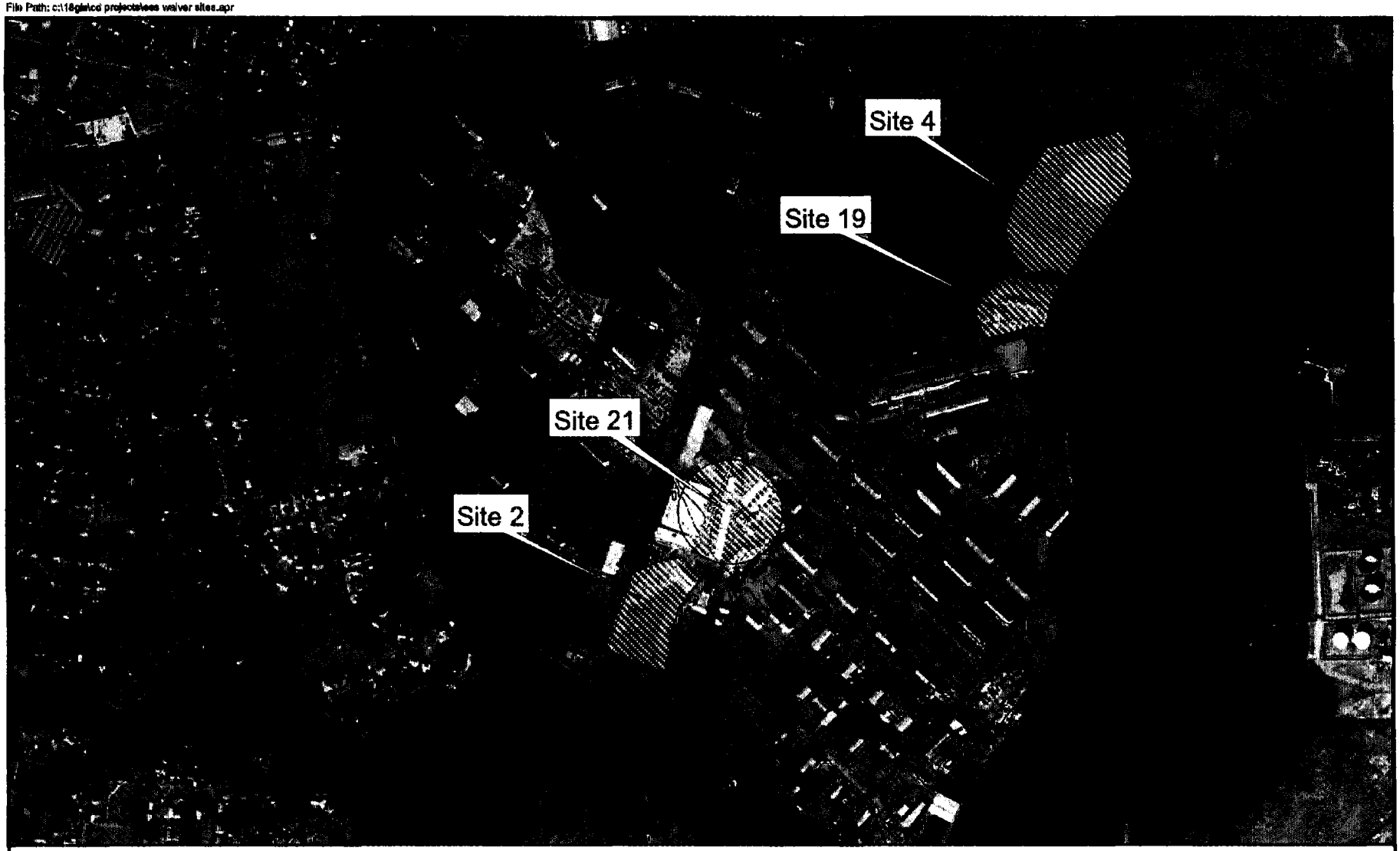

LEGEND

ESS Waiver Sites

N

2000 0 2000 4000 Feet

Figure 2
Waiver For ESS Submittal
St. Juliens Creek Annex
Sites 2, 4, 19, & 21
Chesapeake, Virginia

CH2MHILL

Attachment E
Toxicity-Testing Protocol & Quality Control Procedures

TITLE: Ammonia by Lachat

Approved By:

QA Officer:_____Date:_____

President:_____Date:_____

Revision History:

Revision Number	Changes	Authorization	Date
1	Review and Update	Sue Dionne	5/00

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TITLE: Ammonia by Lachat

1.0 Purpose and Applicability

This Standard Operation Procedure describes the determination of ammonia in wastewater and groundwater samples using the Lachat analysis system. It is based on the Berthelot Reaction.

2.0 Definitions - NA

3.0 Applicable Documents/References

Standard Methods for the Examination of Water and Wastewater. 1995. 19th Edition. Nitrogen (Ammonia) 4500 NH3 G, Automated Phenolate Method.

ESI SOP 1328. Ammonia Distillation.

Quik Chem Automated Ion Analyzer, Methods Manual. Lachat Instruments 6645 West Mill Road, Milwaukee, WI 53218.

Quik Chem Automated Ion Analyzer, Training Manual. Lachat Instruments 6645 West Mill Road, Milwaukee, WI 53218.

Quik Chem Automated Ion Analyzer, Hardware Installation and System Operation Manual. Lachat Instruments 6645 West Mill Road, Milwaukee, WI 53218.

4.0 Materials and Apparatus

4.1 Lachat Instruments

RAS Autosampler
Reagent Pump
Qick Chem 8000 System Unit
Computer
Printer
Heating Unit
630nm Filter
Ammonia Manifold

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4.2 Reagents

Milli-Q® water
DI rinse water
Concentrated Sulfuric Acid
Sodium Phenolate
Sodium Hypochlorite
Sodium EDTA Buffer
Sodium Nitroprusside
Stock Standard
Seven Working Standards
Check Standard

4.3 Parts Equipment List

Pump tubing - Green - Green
Orange - Orange
Grey - Grey
Black - Black
Red - Red
Culture Tubes -15 mL and 12.75 mm
Lachat Repair and Extra Parts Kit
Micro Loop
Waste Container
Ruler (measuring in cm)
Cutting Utensil
Stir Bar
Drying oven set at 110EC " 1EC

5.0 Methods/Procedures

5.1 Reagents

Use Milli-Q® water for the preparation of all solutions. To prevent gas bubbles, Milli-Q® water may be autoclaved for 20 minutes at slow vent speed.

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Store all reagents in the dark at 4°C; expiration of one month after mixing.

5.1.1. **Sodium Phenolate**

Caution: Read MSDS. Phenols can cause severe burns and are rapidly absorbed into the body through the skin. Will melt many types of plastic.

In a pre-weighed 1L volumetric flask, add approximately 800mL of Milli-Q® water. Add **83g crystalline phenol (C_6H_5OH)**. While stirring, slowly add **32g sodium hydroxide (NaOH)**. Cool, dilute to volume, invert to mix thoroughly. Do not degas.

5.1.2. **Sodium Hypochlorite**

In a 500ml volumetric flask, place **250mL Regular Clorox Bleach** [5.25% sodium hypochlorite (NaOCl), The Clorox Company, Oakland, CA] and dilute to volume with Milli-Q® water. Invert to mix.

5.1.3. **Buffer**

In a pre-weighed 2L volumetric flask, place approximately 900mL of Milli-Q® water. Add **100g disodium ethylenediamine tetraacetate (Na_2EDTA)** and **11.0g sodium hydroxide (NaOH)**. Add a stir bar, mix well until all solids are dissolved, cool and dilute to volume with Milli-Q® water. Invert to mix.

5.1.4. **Sodium Nitroprusside**

In a pre-weighed 1L volumetric flask, dissolve **3.50g sodium nitroprusside (Sodium Nitroferricyanide ($[Na_2Fe(CN)_5NOC2H_2O]$)** and dilute to volume with Milli-Q® water.

5.1.5. Standard 1- **Stock Standard 10000.0mg N/L as NH_3**

In a 1L volumetric flask dissolve **38.19g ammonium chloride (NH4CL)**,(previously dried for two hours in a drying oven set to

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110°C ± 1°C) in approximately 800 mL Milli-Q® water. Add 1mL **sulfuric acid**. Dilute to volume with Milli-Q®and invert to mix. Store in the dark at 4°C. If no sulfuric acid is used, the standard expires in 48 hours.

5.1.6. Standard 2 - **Intermediate Stock Standard 200.0mg N/L as NH_3**

In a 1L volumetric Flask, add **20.0mL Stock Standard** (Standard 1). Add 1mL **sulfuric acid**, and dilute to volume with Milli-Q® water and invert to mix. Store in the dark at 4°C. If no sulfuric acid is used, the standard expires in 48 hours.

5.1.7 Seven Working Standards:

To seven 250mL volumetric flasks add, respectively, exactly the amounts shown under the final concentration of the **Intermediate Stock Standard** (Standard 2) in approximately 200 mL Milli-Q® water. Add 0.5 mL of concentrated **sulfuric acid**, dilute to volume and invert to mix. Store in the dark at 4°C. If no sulfuric acid is used, the standard expires in 48 hours.

Final Concentration (MgN/L)	20.0	8.00	2.00	1.00	0.400	0.200	0.100
Standard 2 to add (mL)	25.0	10.0	2.50	1.250	0.500	0.250	0.125

5.1.8. Check Standard

Use the extra sample from ERA WP test standards with known quantities and limits.

5.2 Apparatus Set Up

5.2.1 Timing

System IV GAIN: 175* 1. AE instrument, top scale response = 1.0

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abs.

Sample throughput:	90 samples/h; 40 s/sample
Pump Speed:	35
Cycle Period:	40s
Inject to Start of peak period:	25s
Inject to End of peak period:	63s
Warm up time:	15 - 30 min.

5.2.2 The Ammonia Manifold - Please see the Hardware Installation and System Operation Manual for complete details regarding operations of the various apparatus. Replace any lines that have become flattened or worn from the pump.

5.2.2.1. The **Sample Line** is pumped from the **autosampler needle** to **port 6** on the injection valve using a **Green - Green** line with its ends cut to exactly 2cm.

5.2.2.2. The **Micro Loop** connects **ports 1** and **4** on the injection valve.

5.2.2.3. The **Carrier** Line is pumped from the **rinse water** container to **port 2** on the injection valve using a **Grey - Grey** line.

5.2.2.4. The **Manifold** Line connects from **port 3** on the injection valve to the tee fitting labeled **°from valve** on the left side.

5.2.2.5. The **Waste** Line is connected to **port 5** on the injection valve and to the **waste container** under the counter using a **Green - Green** line.

5.2.2.6. The **Sodium EDTA Buffer** Line is connected from the **Buffer** container to the tee fitting labeled **Buffer⇐** on the right side using a **Red - Red** line.

5.2.2.7. The **Sodium Phenolate** line is connected from the **Phenolate** container to the tee fitting labeled **⇒Phenolate**

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on the left side using an **Orange - Orange** line.

5.2.2.8. The **Sodium Hypochlorite** line is connected from the **Hypochlorite** container to the tee fitting labeled ⇒**Hypochlorite** on the left side using a **Black - Black** line.

5.2.2.9. The **Sodium Nitroprusside** line is connected from the **Nitroprusside** container to the tee fitting labeled ⇒**Nitroprusside** on the left side using an **Orange - Orange** line.

5.2.2.10. The **Heater In** line comes from the left of the heater and up through the **hole** in the manifold board connecting to the top of the tee fitting labeled ⇒**Nitroprusside**.

5.2.2.11. The **Heater Out** line comes from the right of the heater (after use it becomes slightly brown in color) and up through the **hole** in the manifold board connecting to the left of the fitting labeled **to flow cell ⇒ 630nm**.

5.2.2.12. The fitting labeled **to flow cell ⇒ 630nm** connects to the **flow cell** line to the right of it.

5.2.2.13. Turn the power on, the sampling needle should rise to its top position and the temperature reading will turn on with an indicator light for the flow cell. Turn on the pump and check that all is working properly. The pump speed is set to 35 for this procedure.

5.2.2.14. Place all of the reagent lines into the rinse water container and allow water to flow through the entire system.

5.2.2.15. To set the Temperature, locate the heater control on the right side of the Quick Chem 8000. Press the **Arrow in an Oval** key until "**SP for Set Point**" shows. Press the **Big Arrow** keys to raise or lower the set point to 60°C. Once the temperature has been set, press the **Enter** key to save the set point. Press the **Arrow in an Oval** key to display the

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current temperature.

Caution! The pump must remain on and have water flowing through it, as the reagent line will melt if empty or allowed to sit in standing water.

5.2.2.16. Place the 630 nm Filter right-side up into the flow cell. It is stored in a desiccator and can be put into place just before starting the run. It should be placed back into the desiccator immediately after use.

5.3 System Start Up - See the manual for complete details.

5.3.1. Turn the computer and the Quick Chem unit on. Log into the Omnion FIA program. Enter the program using analyst's name and password.

5.3.2. Click on "Flow Injection Analysis" and select the Ammonia Method.

5.3.3. Click on "Tray" and select the tray to be used or modified. Enter all sample data required into the tray spreadsheet.

5.3.4. Click on "DQM" and select "Ammonia." The DQM will require updating each time a change is made in the check standard. See the Hardware Installation and System Operation Manual if the "DQM" requires updating.

5.3.5. Go to "File" and "Save Tray."

5.4 Sampling

Samples are preserved with sulfuric acid and tested within 28 days. Unpreserved samples must be run within 24 hours.

The Federal Register entry which defines standard EPA NPDES and NIPDWR methods states that "Manual distillation is NOT required if comparability data on representative effluent samples are on company file

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to show that this preliminary distillation step in not necessary; however, manual distillation will be required to resolve any controversies." Certain samples may be required to be distilled, speak to the lab manager if there are any questions as to which samples will be distilled. See ESI SOP 1328 for the distillation procedure.

5.4.1. Standards -The Ammonia procedure uses S1 - S9 with15 mL culture tubes. Pour each standard into its appropriate culture tube and place it into the autosampler rack as labeled in the tray. S9, containing check standard, is listed in the DQM.

5.4.2. Samples - Mix each sample and pour it into a 12×75 mm culture tube, placing it into the autosampler rack as it is listed in the tray on the computer.

5.4.3 To start a run, click on "Run Tray."

5.4.3.1. Prompt "Method." Enter "Ammonia".

5.4.3.2. Prompt "Tray." Enter the tray to be run.

5.4.3.3. Prompt "Data File" .

5.4.3.4. Enter any comments that may be useful.

5.4.3.5. Click on the "Run" box. If the data file already exists it will state twice "This data file and/or its associated runtime report already exist. Choose 'OK' to overwrite or 'Cancel' to enter another data file name."

The autosampler will move the rack to the appropriate location and run the samples.

5.4.4. Dilute any samples with results that are above 20 mgN/L. Add them to the tray with the dilution adjusted in the column labeled "Manual Dilution", and save the tray. **Note:** If the tray is not re-saved before the added sample is reached, the computer will not run the new sample. The computer will beep when the run is

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finished.

5.5 Shut-Down Procedure

5.5.1. When the tray is finished and the Quality Control elements are verified as within limits, the lines may be removed from the reagents and placed in rinse water.

5.5.2. Remove the filter and place it into the desiccator.

5.5.3. Re-set the Temperature to room. Press the **Arrow in an Oval** key until "**SP for Set Point**" shows. Press the **Big Arrow** keys to lower the set point to approximately 20°C. Once the temperature has been set, press the **Enter** key to save the set point. Press the **Arrow in an Oval** key to display the current temperature.

5.5.4. When the temperature has reached below 30°C the lines may be removed from the rinse water and dried by allowing the pump to run until there is no water left in the reagent lines.

5.5.5. Exit the program and log off.

6.0 Quality Control Requirements

6.1 Standards Curve - The standards required for the ammonia curve are: 20 mg N/L, 8.0 mg N/L, 2.0 mg N/L, 1.0 mg N/L, 0.4 mg N/L, 0.2 mg N/L, 0.1 mg N/L, and 0.0 mg N/L.

6.2 Other required Standards - Blanks and duplicates shall be run at 10% of total samples. Check standards will be run every ten (10) injections.

6.3 If standards are found to be out of limits in the initial run, the "Peak Base Width" and the "Threshold" may need adjusting.

6.3.1 Go to "Method" in the top bar and to "Graphical Events Programming."

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6.3.2. To change the "Peak Base Width," click on it and the screen will show the graph. Choose the best fit on the largest peak available. Click once at the beginning of the peak and once at the end of the peak.

6.3.3. To change the "Threshold," click on it and the screen will show the graph. Choose the best fit on the flattest blank standard available. Click once at the beginning of the peak and once at the end of the peak.

6.3.4 If repeated peak corrections do not bring the standards in line, see section 8.1 and run the curve again.

6.4 Continuing calibration check standards will be evaluated to determine acceptability of the data. To achieve this, a known standard will be analyzed with each batch of 20 samples. Results of the calibration data will be maintained with the raw data set.

6.5 Precision will be assessed through duplicate analysis. One sample in 20 will be evaluated in duplicate to determine the relative percent difference between the two analyses. Relative percent difference values will be compared to historic data sets to determine acceptability.

7.0 Calculations/Reporting

7.1 Custom Report - Please see the Hardware Installation and System Operation Manual for complete information.

7.1.1. If a run has just finished, the data file it is stored in is already open. If not, go to the "Data" button at the top of the screen and open the file to be reported.

7.1.2. Go to the button labeled "Custom" at the top of the screen.

7.1.3. Check that the report has been updated to reflect current standards data by double clicking in each box on each page. Make any necessary changes. Each time the standards are renewed the

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"Header" box must have the new "Date Made" information entered.

7.1.4. Preview each page to adjust the data location.

7.1.4.1 If there are overflow messages on page one in the "Multi-Channel Table" box, close the preview. Change the Range box which lists the number of cups that will be printed on that page. Enter the number of the last cup readable from the preview. Change the "Multi-Channel Table" box on page two to start with the next cup and end with the last cup run.

7.1.4.2 On page four the "Graph Chanel 1" box shows the portion of the graph which has the curve for the run included in the preview. If the standardization curve is not shown, exit the preview and double click on the "Graph Chanel 1" box. Change the "X Range (sec):" and "Y Range (Fv-s):" to the required ranges for the correct portion of the curve to show.

7.1.5. Print the report by clicking on the printer icon.

7.2. Export Data

7.2.1. Go to "File" and "Export Data."

7.2.2. Turn on all required columns for the final report.

7.2.3. Chose the "Ammonia" data folder and name the file.

7.2.4. Open "Corel Quattro Pro 8."

7.2.5. Go to "File" and "Open." In the "File Type" find the "ASCII Text ["x.txt"]" type file and open the file to be modified. It will be found in C:\omnion\data\ammonia\"File name."

7.2.6. Go to "Tools", "Data Tools", "Quick Columns" and "Parse." The source must be "File" and the file name.

7.2.7. Sort the data and record any required notes about the run. If

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any dilutions have been run, report the dilution and calculate the final result. Include the file name, date and initials at the top of the report.

8.0 Corrective Actions

8.1 Precision errors - If baseline drifts, peaks are too wide, or other problems with precision arise, clean the manifold by the following procedure:

8.1.1. Place all reagent lines in deionized water and pump to clear reagents (2 - 5 minutes).

8.1.2. Place reagent lines and carrier in 1 M hydrochloric acid (one part concentrated HCL added to 11 parts of deionized water) and pump for several minutes.

8.1.3. Rinse all lines in deionized water until thoroughly cleaned.

8.1.4. Resume pumping reagents.

8.2. If samples are colored or are suspected to show a background absorbance, subtract the absorbance from the result by:

8.2.1. Calibrate the system in the normal manner.

8.2.2. Disable the check standard or DQM features and analyze the samples.

8.2.3. Place reagent and carrier lines in DI water and allow the baseline to stabilize.

8.2.4. Inject samples again without recalibrating.

8.2.5. Subtract the "background" concentration from the original concentration to give the corrected concentration. Corrected Concentration=Original Concentration - Background Concentration

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8.3. Calcium and magnesium ions may precipitate if present in sufficient concentrations. Tartrate or EDTA is added to the sample in-line in order to prevent this problem.

8.4.1 If the base line is sloping, curved or shows interference, see the troubleshooting portion of the Hardware Installation and System Operation Manual.

9.0 Health and Safety

Samples that have been preserved with sulfuric acid should be handled with gloves, safety glasses and proper shoes. A well-ventilated work area is recommended. As with all samples, gloves and safety glasses should be worn when handling undiluted effluents. Read all appropriate MSDS reports. Waste containing Phenols must be treated as hazardous.

10.0 Responsibilities

It is the lab manager's responsibility to insure technicians performing this procedure are properly trained and the training is documented in the technician's training file. Specialized Lachat training is required for this procedure. The technician is responsible for following the procedures outlined in this SOP.

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ENVIROSYSTEMS, INCORPORATED
STANDARD OPERATION PROCEDURE

SOP Number: QA-1339
Date Issued: 06/01
Revision Number: 0

TITLE: Collection of Sediment Pore Water Samples

Approved By:

QA Officer: _____ Date: _____

President: _____ Date: _____

Revision History:

Revision Number	Changes	Revised By	Date

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TITLE: Collection of Sediment Pore Water Samples

1.0 Purpose and Applicability

Conduct of various sediment assays may require collection of pore water samples to document water chemistry. Pore water samples may be collected using two (2) basic techniques, a destructive sampling protocol which generates the required sample but renders the sediment unusable for subsequent testing and a non-destructive protocol in which the sample is collected using techniques that result in minimal disturbance to the sediment. The latter technique may be used during the conduct of an assay.

2.0 Definitions

Pore Water- water located in the spaces between grains of sediment/soil.

3.0 Applicable Documents/References

NA

4.0 Materials and Apparatus

Centrifuge
Centrifuge bottles
Aquarium air stones or fritted glass
Plastic air line
Syringes, various volumes, or appropriate device for creating vacuum

5.0 Methods/Procedures

5.1 Destructive Sampling Technique

The destructive sampling technique involves collection of pore water from a sediment sample using centrifugication. A representative sample is placed in a

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centrifuge bottle and centrifuged to separate the pore water from the sediment. Use of this technique to collect pore water samples during an assay requires inclusion of a sufficient number of surrogate test vessels in the study design to accommodate the anticipated number of pore water collections.

5.1.1 Sample Collection - Whole Sample

Samples received at the laboratory will be inspected to determine that the sample has not been artificially compacted. If the observations of the sample in the sample container indicate significant water above the sample surface, the client will be notified and the condition of the sample reviewed to determine if the overlying water is pore water forced out of the sample during transport or if it was surface water. If there is no evidence of excessive surface water, a representative sample will be collected. The sample will be transferred to a centrifuge bottle and placed in a centrifuge. NOTE - review centrifuge protocol regarding sample volumes, speeds and balancing. The sample will be centrifuged until the supernatant is clear. The supernatant is decanted into a clean bottle, preserved as required, for subsequent analysis.

5.1.2 Sample Collection - During Assay

Pore water samples collected during an assay using the destructive methodology are obtained from surrogate test vessels. Overlying water in the test vessel is carefully decanted, minimizing resuspension of the sediment. After removal of the overlying water, the remaining sediment is transferred to a centrifuge bottle and then placed in a centrifuge. The sample is centrifuged and the supernatant, expelled pore water, is transferred to an appropriate bottle, preserved as required, for subsequent analysis.

Note, the volume of pore water that will be extracted from a sample is dependant upon the amount of pore water in the sample, sample grain size distribution, length of time for centrifuging and centrifuge speed.

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5.2 Non-Destructive Sample Collection

A non-destructive sample collection technique may be used to collected pore water samples in cases where sample volume is limited, in field applications where a centrifuge is not available or during an assay.

5.2.1 Sample Collection - During Assay

At the start of the assay, during sample addition, an air stone or other fritted glass element is placed in the test chamber. An extraction line, plastic or Teflon®, is attached to the air stone or fritted element. The length of the line should be sufficient so that the end is above the top of the test chamber. Test sediment is added to the test chamber. Insure that the sediment completely covers the air stone. When required, a syringe is attached to the end of the sampling line and an appropriate volume of pore water is extracted from the test sediments by applying a vacuum sampling line. The syringe may be replaced with a small vacuum pump. The sample is then transferred to a clean bottle for subsequent analysis. If there is evidence of sediment in the sample, transfer the sample to a centrifuge bottle and centrifuge to remove solid material, or if appropriate for the analytes, the particulate material may be removed from the sample by filtration.

5.2.2 Sample Collection - Field Event

Pore water samples may be collected during field activities using air stones and a syringe or vacuum pump. An air stone is attached to a sample collection line and inserted into the sediment being sampled. After insertion to the appropriate depth, a sample may be collected by drawing a vacuum using either the syringe or vacuum pump. The sample is then transferred to a clean bottle for subsequent analysis. If there is evidence of sediment in the sample, transfer the sample to a centrifuge bottle and centrifuge to remove solid material, or if appropriate for the analytes, the particulate material may be removed from the sample by filtration.

Note - the size the air stone or fritted element used in the sample collection process will, in part, determine sample collection rates.

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6.0 Quality Control Requirements

NA

7.0 Calculations/Reporting

Provide specifics related to methodologies used for sample collection plus information on centrifuge time and speeds. If filtration was used, provide specifics related to filter type and pore size.

8.0 Corrective Actions

NA

9.0 Health and Safety

9.1 As with all samples, gloves and safety glasses should be worn when handling sediment samples and chemicals.

9.2 At the end of the process excess sample material and material used in the collection process will be disposed of appropriately.

9.3 Sample disposal will be conducted using procedures to minimize potential pollution of surface and ground waters plus soil and sediments.

10.0 Responsibilities

It is the lab managers responsibility to insure technicians performing this procedure are properly trained and the training is documented in the technician's training file. The technician is responsible for following the procedures outlined in this SOP.

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TITLE: Sulfide Analysis by Titration

Approved By:

QA Officer:_____Date:_____

President:_____Date:_____

Revision History:

Revision Number	Changes	Revised By	Date
0	Preparation of SOP	S. Dionne	03/02

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TITLE: Sulfide Analysis by Titration

1.0 Purpose and Applicability

Sulfide often is present in groundwater, especially in hot springs. Its common presence in wastewaters comes partly from the decomposition of organic matter, sometimes from industrial wastes, but mostly from the bacterial reduction of sulfate. Hydrogen sulfide escaping into the air from sulfide-containing wastewater causes odor nuisances. Dissolved H_2S is toxic to fish and other aquatic organisms.

This SOP uses a back-titration method to determine sulfide levels in aqueous samples.

2.0 Definitions - NA

3.0 Applicable Documents/References

APHA. *Standard Methods for the Examination of Water and Wastewater.* 20th . Edition. 1998. 4500-S^{2-} F.

4.0 Materials and Apparatus

Hydrochloric Acid, HCl, 6*N*
Standard Iodine solution, 0.025*N* (KI, iodine)
Standard sodium thiosulfate solution, 0.025*N* ($Na_2S_2O_3$ - $5H_2O$, NaOH -6*N* or solid)
Standard Bi-iodate solution ($KH(IO_3)_2$)
Starch solution (soluble starch, salicylic acid)
Sulfide standard (1.00 mg S^{2-} /1.00 mL) - buy prepared
- Intermediate Standard : Dilute 10 mL stock to 1 L water. Prepare fresh daily. Standardize 1mL $\approx$ 0.01 mg S^{2-}
- Working standards: Dilute 50 mL intermediate to 500 mL with 0.01N NaOH. Prepare fresh daily. 1.00 mL $\approx$ 0.001 mg S^{2-}

1000 mL volumetric flasks

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Erlenmeyer flasks
Stir plate / stir bars
Buret / stand

5.0 Methods/Procedures

5.1 Reagents:

5.1.1 Standard Iodine solution, 0.025*N*: Dissolve 20 - 25 g KI in 10 -20 mL water and add 3.2 g iodine. After iodine has dissolved, dilute to 1000 mL and standardize against 0.025*N* $Na_2S_2O_3$, using starch solution as indicator.

5.1.2 Standard thiosulfate solution, 0.025*N*:Dissolve 6.205 g $Na_2S_2O_3$ - $5H_2O$ in distilled water. Add 1.5 mL 6*N* NaOH or 0.4 g solid NaOH and dilute to 1000 mL. Standardize with bi-iodate solution.

5.1.3 Standard Potassium bi-iodate solution, 0.0021 *M*: Dissolve 812.4 mg $KH(IO_3)_2$ in distilled water and dilute to 1000 mL.

5.1.4 Standardization: Dissolve approximately 2 g KI, free from iodate, in an Erlenmeyer flask with 100 to 150 mL distilled water. Add 1 mL 6*N* H_2SO_4 or a few drops of conc. H_2SO_4 and 20.00 mL standard bi-iodate solution. Dilute to 200 mL and titrate liberated iodine with thiosulfate titrant, adding starch toward end of titration, when a pale straw-yellow color is reached. When the solutions are of equal strength, 20.00 mL 0.025*M* $Na_2S_2O_3$ should be required. If not, adjust the $Na_2S_2O_3$ solution to 0.025*M*.

5.1.5 Starch solution: Dissolve 2 g laboratory grade soluble starch and 0.2 g salicylic acid, as a preservative, in 100 mL hot distilled water.

5.2 Procedure: (Iodometric Method)

5.2.1 Measure from a buret into a 500 mL Erlenmeyer flask an amount of iodine solution estimated to be an excess over the amount of sulfide present. Add distilled water, if necessary, to bring volume to about 20

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mL.

5.2.2 Add 2 mL 6*N* HCl.

5.2.3 Pipet 200 mL sample into flask, discharging sample under solution surface. If iodine color disappears, add more iodine until color remains.

5.2.4 Back-titrate with $Na_2S_2O_3$ solution, adding a few drops of starch solution as end point is approached, and continuing until blue color disappears.

5.3 The iodometric method suffers interference from reducing substances that react with iodine, including thiosulfate, sulfite, and various organic compounds, both solid and dissolved. Eliminate interference by first precipitating ZnS, removing the supernatant, and replacing it with distilled water. Use the same procedure, even when not needed for removal of interferences, to concentrate sulfide.

5.3.1 Zinc acetate solution: Dissolve 220 g $Zn(C_2H_3O_2)_2$ - $2H_2O$ in 870 mL water; this makes 1 L solution.

5.3.2 Sodium hydroxide solution, NaOH, 6*N*.

5.3.3 Put 0.20 mL (4 drops) zinc acetate solution and 0.10 mL (2 drops) 6*N* NaOH into a 100-mL glass bottle, fill with sample, and add 0.1. mL (2 drops) 6*N* NaOH solution. Stopper with no air bubbles under stopper and mix by rotating back and forth vigorously. Add enough NaOH to raise the pH above 9. Let precipitate settle for 30 min. The treated sample is relatively stable and can be held for several hours. However, if much iron is present, oxidation may be fairly rapid.

5.3.4 Collect precipitate (ppt) on a glass fiber filter. Return filter with ppt to original bottle and add about 100 mL water. Add iodine solution and HCl and titrate as in step 5.2.4.

6.0 Quality Control Requirements

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6.1 Precision: The precision of the end point varies with the sample. In clean waters it should be determinable within 1 drop, which is equivalent to 0.1 mg/L in a 200 mL sample.

6.2 Sulfide standard must be within 10% of known concentration.

6.3 Duplicates shall be run in 5% of samples, or one per batch of less than 20. Results shall be within 0.1 mg/L in a 200 mL sample.

7.0 Calculations/Reporting

1 mL 0.025*N* iodine solution reacts with 0.4 mg S^{2-}:

$$\text{mg } S^{2-} / \text{L} = \frac{[(A \times B) - (C \times D)] \times 16{,}000}{\text{mL sample}}$$

where: A = mL iodine solution
B = normality of iodine solution
C = mL $Na_2S_2O_3$ solution
D = normality of $Na_2S_2O_3$ solution.

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TITLE: Chronic Toxicity of Sediments to the Amphipod, *Leptocheirus plumulosus*

Approved By:

QA Officer:_____Date:_____

President:_____Date:_____

Revision History:

Revision Number	Changes	Authorization	Date
1	Update and Review	K. A. Simon	3/99
2	Review and Update	Sue Dionne	5/00
3	Review and Update (NELAP)	K. A. Simon	7/01
4	Update based to include EPA protocol	K. A. Simon	10/01
5	Review and Update, Addition of NELAP Requirements	S. Dionne	03/02
6	Modifications as per CH2M Hill project requirements	K. A. Simon	01/03
7	Modification to Section 11 as per request of CH2M Hill	K. A. Simon	02/03

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TITLE: Chronic Toxicity of Sediments to the Amphipod, *Leptocheirus plumulosus*

1.0 Purpose and Applicability

This Standard Operating Procedure describes methods for assessing the chronic toxicity of marine sediments to the amphipod *Leptocheirus plumulosus* using a 28-day exposure period based on methods developed by the U.S. EPA (2001) and U. S. Army Corps of Engineers (1996).

The study involves exposing neonate amphipods to marine and estuarine sediments for a period of 28 days. At the end of the exposure period the amphipods are recovered, sexed, and their growth determined based on dry weight. The number of juveniles produced are also recorded.

This protocol is suitable for evaluation of samples to assess impacts of contaminated sediments under Comprehensive Environmental Response, Compensation and Liability Act (Superfund), Clean Water Act, Marine Protection, Resources and Sanctuary Act (Dredging), National Environmental Policy Act, Resource Conservation and Recovery Act, plus additional federal programs.

This protocol has been modified to meet project specific requirements. Specifically, the frequency of the measurement for ammonia and sulfide in overlying and pore waters has been increased.

2.0 Definitions

Overlying Water: the water placed over sediment in a test chamber during a test.

Reference Sediment: a whole sediment near an area of concern used to assess sediment conditions exclusive of material(s) of interest. The reference sediment may be used as an indicator of localized sediment conditions exclusive of the specific pollutant input of concern. Such sediment would be collected near the site of concern and would represent the ambient conditions resulting from any non site related localized pollutant inputs as well as global pollutant input. This is the manner in which reference sediment is used in dredge material evaluations.

Reference-Toxicity Test: a test conducted with reagent-grade reference chemical to assess the sensitivity of the test organisms. Deviations outside an established normal range may indicate a change in the sensitivity of the test organism population. Reference-toxicity tests are most often performed in the absence of sediment.

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Pore water: Water located in spaces between grains of sediment.

Sediment: particulate material that usually lies below water. Formulated particulate material that is intended to lie below water in a test.

Whole Sediment: sediment and associated pore water which have had minimal manipulation. The term bulk sediment has been used synonymously with whole sediment.

3.0 Applicable Documents/References

ASTM. 2001. *Guide for Conducting 10 Day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods*. Method E 1367-99. ASTM Annual Book of Standards, Volume 11.04.

U.S. EPA. 2001. *Methods for Assessing the Chronic Toxicity of Marine and Estuarine Sediment-associated Contaminants with the Amphipod, Leptocheirus plumulosus*. March 2001. EPA 600/R-01/120.

U.S. Army Corps of Engineers. 1996. *Preliminary Protocol for Conducting 28-day Chronic Sublethal Bioassays Using the Estuarine Amphipod Leptocheirus plumulosus*. Technical Note EEDP-01-36, March 1996.

4.0 Materials and Apparatus

Test Organisms, Amphipod, *Leptocheirus plumulosus*
Test Chambers, 1 L beakers drilled with screened overflow
Incubator or water bath capable of maintaining 25±3°C
Thermometer, Temperature Data Logger
pH Meter
Salinometer
D.O. Meter
Tetra-Min®
Dried Alfalfa
Wheat Grass Powder
Neo-Novum Shrimp Maturation Feed (Argent Chemical Laboratories)

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1 mm, 0.6 mm, 0.5 mm and 0.25 mm stainless steel sieves
Blender or mortar & pestle to grind food stocks
Oven, 70°C, and desiccator
Balance, 0.01 mg sensitivity
Lachat Autoanalyzer – Ammonia Analysis
SOP 1325 - Ammonia Analysis using Lachat Autoanalyzer
SOP 1339 - Collection of Pore Water Samples
SOP 1341 - Sulfide Analysis by Titration

5.0 Methods/Procedures

5.1 Test Material

5.1.1 The Test material will be clearly identified by the client. Data related to sample collection time, date and location must be provided on a chain of custody for each sample. Each sample container must be clearly identified with the identification corresponding to the chain of custody. If discrepancies exist between the chain of custody and sample container or, the chain of custody is not complete, the client will be notified as soon a possible.

5.1.2 Upon receipt, the sample will receive a sample number and be logged into the sample inventory as described in SOP QA-1103. Test material will be stored at 2-4°C, or as specified by the client. The sample shall never be stored at temperatures below 0°C.

5.1.3 Maximum holding time shall be 8 weeks. Holding times for samples known to be containing volatile compounds that are of regulatory concern should be <2 weeks.

5.2 Test Species

5.2.1 Amphipods will be neonates ≤24 hours old or selected from those that pass through a 600 µm sieve and be retained by a 250 µm screen.

5.2.2 Identification of the test animals shall be verified by the supplier or by using appropriate taxonomic keys.

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5.3 Pretest Observations and Procedures

5.3.1 Pretest observation data concerning the source, handling procedures, receipt date, disease treatment (if any), health, feeding, and mortality of animals used in the test will be recorded and reported.

5.3.2 The mean dry weight of the amphipods will be determined prior to the start of the assay. Weights will be determined for a minimum of 25 organisms.

5.4 Exposure Conditions

5.4.1 Amphipods will be maintained in 1 liter beakers containing approximately 175 mL sediment and approximately 725 mL of overlying water.

5.4.2 Dilution water will be natural seawater, collected from the Hampton / Seabrook Estuary, adjusted, using deionized water, to a salinity of either 5 or 20‰ with daily limits set at ≤3‰. The 28-day average salinity will fall within ≤2‰ of the specified level. The appropriate range will be based on a measure of initial pore water salinity. Samples with an initial pore water salinity of 1 to 10‰ will be tested at 5‰ while samples having >10 to 35‰ will be tested at 20‰. Water will be passed through a ≤5 micron filter. Water temperature will be 25 ± 2°C.

5.4.3 Prior to use, test sediments will be sieved, 1.0 mm, to remove larger particles and other living organisms. Sieving will be accomplished using as little water as possible. The salinity of the water used shall equal that used for overlying water. After sieving is complete the sample is allowed to settle. After settling, the overlying water is decanted and the sample slurry is added to the test chambers.

5.4.4 Control sediment will be a natural marine sediment that has been sieved, 1.0 mm, to remove larger particles and other living organisms. Laboratory control sediment will be collected from a site in the Hampton/Seabrook Estuary. The estuary, located on the

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New Hampshire seacoast, is rural in nature and receives no direct industrial inputs. The general area is characterized by over 10,000 areas of salt marsh with tidal creeks. Two small rivers provide freshwater influx to the system. The area is utilized for recreational purposes and mooring local fishing vessels. Sediments from the laboratory control sediment site were evaluated to determine acceptability prior to initial use.

5.4.5 Amphipods will be tested using a static renewal procedure which provides for two volume additions three times per week on a Monday, Wednesday, Friday schedule.

5.4.6 Dissolved oxygen concentration shall be maintained ≥60% saturation, relative to temperature and salinity, during the test. Dilution water may be aerated to assure that dissolved oxygen concentrations are above 60% saturation prior to use. If aeration is required for test chambers, it will be supplied to all test chambers at a rate of approximately 100 bubbles per minute. The tip of the air line shall be approximately 2 cm above the sediment's surface to minimize sediment resuspension. Placement and type of air lines will be the same for controls and treatments.

5.4.7 Photoperiod will be automatically controlled and adjusted to 16 hours light, 8 hours dark. Light intensity will be 500 to 1000 Lux. Light source will be wide spectrum fluorescent bulbs.

5.5 Study Conduct

5.5.1 Amphipods will be exposed to the test sediments for a total of 28 days. Amphipods will be added to the test vessels after sediments have settled for 24 hours.

5.5.2 Each treatment group, sample, and control will initially consist of 100 organisms equally divided between 5 replicates. The animals will be randomly assigned to the test vessels. The control will also utilize 100 organisms distributed between 5 replicates.

5.5.3 The number of surviving adults and juveniles will be determined and recorded at the end of the exposure period.

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5.5.4. Dissolved oxygen, temperature, pH, specific conductivity, and salinity will be measured in the overlying water in one replicate from each treatment at the start and end of the assay and prior to water renewals during the assay. Instruments will be checked and calibrated as specified in Section 9 of ESI's Quality Assurance Manual.

Ammonia and sulfide will be measured in the overlying water on days 0 (start), 7, 14, 21 and 28 (end) of the assay in each treatment. Ammonia analysis will be conducted following guidance specified in ESI SOP 1325. Sulfide will be measured using the titration, ASTM Method 4500-S^{2-}F, ESI SOP 1341 (comparable to EPA 376.2).

Ammonia, sulfide, pH, temperature and salinity will be measured in the pore water from one replicate of each treatment on days 0, 7, 14, 21 and 28 of the assay. Pore water samples will be collected utilizing procedures outlined in ESI SOP number 1339, "Collection of Sediment Pore Water Samples."

If the unionized ammonia in the pore water at the start of the assay exceeds 0.8 mg/L the client will be notified and the data reviewed. If the unionized ammonia is deemed to be sufficient high to result in acute toxicity the sediments may be "washed" according to Army Corps of Engineers protocol to reduce ammonia levels.

Temperature will be measured in one surrogate test chamber or water bath on an hourly basis.

5.5.5 To insure an adequate level of food, test amphipods will be fed a prepared feed on a Monday/Wednesday/Friday basis. Feeding rates during the first two weeks will be 1 mg per initial amphipod (total of 20 mg/replicate). During the second two weeks of the assay the rate is increased to 2 mg/amphipod (total of 40 mg/replicate).

5.5.6 Food for the amphipods will be based on guidance provided in U.S. Army Corps of Engineers (1996) guide for conducting the

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28-day exposure assay. Food will be prepared as follows:

Mix in a blender and pass through a 0.5 mm screen.
48.5 grams Tetra-Min®
24.0 grams dried Alfalfa
24.0 grams Wheat Grass Powder
4.5 grams Neo-Novum Shrimp Maturation Feed

5.6 Study Termination

5.6.1 At the end of the exposure period the sediments will be removed from the chamber and sieved through 600 and 250 µm mesh screens stacked together. Amphipods retained by the 600 µm screen will be classified as adults while those retained by the 250 µm screen are classified as juveniles.

5.6.2 Amphipods will be collected and counted. Adult male and female amphipods will be enumerated separately. Juveniles will be enumerated separately from the adult amphipods.

5.6.3 Male and female adult amphipods will be transferred to separate tarred weigh boats and dried at 70°C for 24 hours. Amphipods will be allowed to cool in a desiccator and weighed to the nearest 0.01 mg.

6.0 Quality Control Requirements

6.1 A 'water only' reference toxicant assay will be conducted for each batch of test organisms.

6.2 After the organisms have been recovered from the sediments a representative number of the recovered organisms, 10% of the test chambers, will be recounted to determine the accuracy of the initial count.

6.3 Interferences

6.3.1 Salinity less than 5‰ may result in reduced ability for the amphipods to reproduce.

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6.3.2 Water quality (dissolved oxygen, salinity, temperature) parameters outside established limits may impact the outcome of the assay. In cases where these values exceed protocol limits overall water quality data will be evaluated to determine if there was a likelihood of a significant negative impact. In cases where decreases in dissolved oxygen are noted the monitoring frequency will be increased. The increased monitoring will provide additional data to make a determination regarding use of aeration.

6.3.3 Variation in total organic carbon (TOC) content of the sediments may impact the outcome of the assay. Published data suggest that TOC values <1% and >7% may impact survival. In cases where TOC values are outside these ranges a reference sediment with similar TOC levels should be included in the design.

6.3.4 Pore water salinity, ammonia and sulfides may impact the outcome of an assay. Data from available literature indicates that pore water salinity <1‰ may impact the outcome of an assay. Salinity values between 1 and 35‰ have had no impact on the outcome of an assay. There is no available data related to pore water salinity values of >35‰. Pore water ammonia levels of >16 mg/L may have lethal and sublethal impacts on *L. plumulosus*. The presence of hydrogen sulfide in test sediments may have an impact on the outcome of an assay. Currently, no data is available to determine levels of hydrogen sulfide that may result in acute or sublethal impacts. *L. plumulosus*'s burrowing activity and circulation of water into the burrows will reduce or eliminate exposure to pore water hydrogen sulfide. Monitoring pore water ammonia and sulfides at the start and end of the assay will document existing conditions. Additional monitoring during an assay would provide data for analysis of trends in these two parameters.

6.4 Detection Limits – Not Applicable for Assay

6.5 Precision and accuracy of meters used in the assays to measure water quality will be documented as described in Section 9 of ESI's Quality Assurance Manual. Precision and accuracy of ammonia and sulfide analyses will be documented by analysis of duplicate and known,

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ammonia, and prepared, sulfide, samples.

7.0 Calculations/Reporting

7.1 Statistical Analysis of Data

7.1.1 Survival data generated will be evaluated using analysis of variance techniques. Data will be evaluated using the TOXSTAT, or similar, program. Prior to conducting the ANOVA, the data set will be evaluated to determine it's normality and homogeneity of variances. Data sets that are normally distributed and homogeneous will be evaluated using parametric statistics.

7.1.2 The number of juvenile amphipods produced per original amphipod and per surviving female will determined. A separate determination of numbers of juveniles per female is essential to allow for compensation in cases where there are no or few females in a sample. These values will analyzed using analysis of variance techniques.

7.1.3 Dry weights of the surviving adults and females will be determined along with the mean growth per day per surviving male and surviving female. These values will analyzed using analysis of variance techniques.

7.2 Reporting

All survival and tissue body burden data will be summarized and presented in tabular format. The final report will provide the following: Introduction, methods and materials, results of reference toxicant assay, and summary of results. Copies of all bench sheets, raw data and statistical output will be provided in an appendix included with the report.

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8.0 Corrective Actions

8.1 Acceptability Criteria

8.1.1 The amphipod assay will be considered acceptable if environmental parameters (temperature, dissolved oxygen, salinity, and pH) fall within the ranges specified. Mean survival in the control sediments after 28 days exposure will be ≥80% with no single replicate have <60% survival. In addition, there will be evidence of juvenile reproduction and growth in the control treatment.

8.1.2 Criteria specified in Section 11 will be met.

8.2 If survival fails to meet the minimum value specified by the protocol the client will be notified and the test restarted.

8.3 If water quality values fall outside study limits the laboratory manager, using sound scientific practice, will determine if the study requires repeating or the data is allowed to be accepted. The client will be notified, the results reviewed and a final determination made as to the acceptability of the data.

8.4 Corrective Actions

8.4.1 In the event that an element of the assay falls outside acceptable limits or there is a change in the protocol a Corrective Action Report must be initiated and completed.

9.0 Health and Safety

9.1 As with all samples, gloves and safety glasses should be worn when handling sediment samples, effluents and chemicals.

9.2 At the end of an assay excess sample material and material used in the assay will be disposed of properly. Material may be returned to the client, air dried and placed in an appropriate container for disposal at an approved disposal facility or, in the case where the material is non-hazardous, the material may be disposed in an appropriate waste container.

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9.3 Assays and sample disposal will be conducted using procedures to minimize potential pollution of surface and ground waters plus soil and sediments.

10.0 Responsibilities

10.1 It is the Lab Manager's responsibility to ensure analysts performing this procedure are properly trained and the training is documented in their training file. The analyst is responsible for following the procedures outlined in this SOP.

10.2 Prior to any staff member working unsupervised on a testing procedure, they must be certified by the Laboratory Manager. Certification will include reading this and associated SOP's, review of the primary literature and participation in similar procedures under the direct supervision of a trained staff member. Certification will be based upon a review of the persons' demonstrated abilities.

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11.0 Summary of Test Conditions

1. Test Mode:	Static Renewal
2. Test Duration:	28 Days
3. Renewal Schedule:	Two volume additions three time per week
4. Temperature:	25 ±3°C; 28-day average 25 ±2°C
5. Photoperiod:	16 hr light/ 8 hr dark
6. Light Source:	Wide - spectrum fluorescent
7. Light Intensity:	500 to 1000 Lux
8. Salinity:	5 or 20‰ ±3‰; use 5‰ if pore water salinity is 1 to 10‰ and 20‰ if pore water salinity is >10 to 35‰.
9. Test Chamber:	1000 mL beakers
10. Solution Volume:	725 mL overlying water (approximately)
11. Sediment Depth:	175 mL
12. Organisms/Chamber:	20
13. Replicates/Treatment:	5, minimum; 5 for control
14. Treatments:	Site Sediment, and Control Sediment
15. Age of Organisms:	Neonate amphipods, ≤24 hours or retained between 250 µm and 600 µm screens
16. Feeding Regime:	1 mg prepared feed per amphipod for first two weeks, 2 mg per amphipod for last two weeks
17. Dilution Water:	Natural Seawater - salinity adjusted
18. Aeration:	As required to maintain D.O. ≥60% saturation. Rate set so a not to resuspend sediments
19. Endpoint:	Survival, growth (weight), reproduction
20. Acceptability:	Control survival of ≥80% with reproduction and growth in control treatment. No single replicate with less than 60% survival
21. Support Chemistry:	Measurement of D.O., salinity, ammonia, sulfide and pH in pore water from one replicate of each treatment on days 0 and 28. Measurement of ammonia and sulfide in pore water on days 7, 14, and 21. Measurement of D.O., salinity, pH in overlying water prior to water change in 1 replicate. Hourly

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		temperature in surrogate vessel. Measurement of ammonia and sulfide in overlying water, prior to renewal in one replicate of each treatment on days 0, 7, 14, 21 and 28 of the assay.
22.	Pore Water Ammonia	<60 mg/L total ammonia, <0.8 mg/L unionized ammonia.
23.	Pore Water pH	Normal range of 7.0 to 9.0. If values fall outside of range notify client before preceding.

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