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Draft Remedial Action Work Plan for Phase I Interim Air Sparging Remediation System at Operable Unit No. 10, Site 35 Camp Geiger Area Fuel Farm MCB Camp Lejeune, North Carolina

DRAFT

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Atlantic Division
Naval Facilities Engineering Command
6500 Hampton Boulevard
Building A (South East Wing) 3rd Floor
Norfolk, VA 23508

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October 1997

Delivery Order 083

OHM Project No. 17536

OHM Remediation Services Corp.
A Subsidiary of OHM Corporation

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DRAFT REMEDIAL ACTION WORK PLAN FOR PHASE I, INTERIM AIR SPARGING REMEDIATION SYSTEM AT OPERABLE UNIT NO. 10, SITE 35 CAMP GEIGER AREA FUEL FARM MCB CAMP LEJEUNE, NORTH CAROLINA

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1.0 INTRODUCTION

Under Delivery Order No. 0083 Modification 1 of Navy Atlantic Division (LANTDIV) Contract N62470-93-D-3032, OHM Remediation Services Corp. (OHM) will provide labor, equipment and materials necessary to construct and operate an interim air sparging remediation system at Camp Lejeune, North Carolina. This Remedial Action Work Plan (RAWP) describes OHM's approach to implementing the Interim Remedial Action (IRA) at Site 35, Camp Geiger Area Fuel Farm. The elements of this RAWP are based on the information in the Revised Proposal for Construction of Air Sparging System dated July 26, 1996; Phase I, Interim Remedial Action Specifications dated August 14, 1997; and Final Basis of Design for Phase I, Interim Remedial Action dated August 14, 1997.

This RAWP identifies and describes how OHM will implement the major tasks associated with supplying, installing, operating, and monitoring operation of the Phase 1 air sparging system. This system will be used to remediate shallow groundwater contaminated with petroleum products and solvents at Site 35 as it migrates toward the site boundary in an area along the southern side of the proposed right-of-way for the U.S. Route 17 Bypass. It includes the following sections:

- Section 2.0 Pre-construction Activities
- Section 3.0 Design Basis and Criteria
- Section 4.0 System Construction Tasks and Methods
- Section 5.0 Electrical Power Installation
- Section 6.0 System Start-up
- Section 7.0 System Monitoring
- Section 8.0 Transportation and Disposal
- Section 9.0 Reporting
- Section 10.0 Project Schedule

1.1 REMEDIAL ACTION OBJECTIVES

The objectives of the Phase I IRA are to: 1) assess the applicability of air sparging technology to address shallow groundwater contamination at Site 35; 2) provide pilot data to evaluate effectiveness, implementability, and costs of a full scale system; 3) obtain design parameters for a full scale system design; and 4) assess the potential impact of fugitive emissions in the vicinity of the proposed highway project for the Route 17 Bypass. This plan details OHM's plan for construction, operation, and data collection of an in-situ air sparging (IAS) system with a 100-foot long air sparging trench at Site 35. The system shall function as an IAS "curtain" and is intended to remove contaminants as the plume travels through the curtain. Data obtained from this full-scale IAS system will allow evaluation of the IAS technology and assessment of its effectiveness in remediation of shallow groundwater contamination.

Sufficient data will be collected to assess the impact of air emissions on human health and the environment, and verify that air emissions will not impact the proposed highway project.

Following construction of the Phase I interim remedial action IAS system, adjustments or improvements will be recommended for the full scale remedial action. The ultimate objective for the full scale system is to treat groundwater passing through the air sparging curtain to levels presented in Section 3.0, Table 3.1.

1.2 SITE BACKGROUND

Site 35 at Camp Geiger refers to a former fuel storage and dispensing facility. Camp Geiger was constructed in 1945. Originally, the Fuel Farm ASTs were used for storage of No. 6 fuel oil. The facility consisted primarily of five 15,000-gallon aboveground storage tanks (ASTs), a pump house, a fuel loading/unloading pad, an oil/water separator, and a distribution island. At some unrecorded date the Fuel Farm was converted for storage of other petroleum products including unleaded gasoline, diesel fuel, and kerosene. These petroleum products were used to fuel government vehicles and to supply underground storage tanks (USTs) in use at Camp Geiger and the nearby New River Marine Corps Air Station. The tank farm was demolished in the Spring of 1995. Soil remediation activities were conducted by OHM between the Spring of 1995 and the Spring of 1996. Numerous monitoring wells have been installed at the Site 35 to define the extent of dissolved-phase groundwater contamination.

1.3 SITE DESCRIPTION

Camp Lejeune is located in Onslow County, North Carolina, and covers approximately 234 square miles. Camp Lejeune is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The west and northwest borders of Camp Lejeune are defined by U.S. Route 17 and State Route 24, respectively. The eastern border is defined by the Atlantic Ocean shoreline while the City of Jacksonville, North Carolina, borders Camp Lejeune to the north. Figure 1 provides a vicinity map.

Camp Geiger is located at the extreme northwest corner of Camp Lejeune and is comprised of a mixture of troop housing, personnel support and training facilities. The main entrance is located along U.S. route 17 approximately 3.5 miles southeast of the City of Jacksonville, North Carolina. Camp Geiger is roughly bounded by Brinson Creek to the north and northeast, an abandoned Seaboard Railroad right-of-way to the east, Curtis Road to the south, and U.S. Route 17 to the west. Site 35, Camp Geiger Area Fuel Farm refers to a former fuel storage and dispensing facility that was located just north of the intersection of Fourth and "G" Streets as illustrated on Figure 2 Site Layout.

The full scale horizontal air injection trench will be installed in a relatively flat field just north of Fourth Street along the south side of the future U.S. Highway 17 Bypass right-of-way as illustrated in Figure 2. Groundwater is approximately 6 to 8 feet below land surface (bls) and flow in the surficial aquifer was determined to be to the northeast towards Brinson Creek. The surficial aquifer extends from ground surface to a semi-confining layer located at approximately 40 to 44 feet bls. The surficial aquifer typically consists of sequences of fine-grained, coarse sands, silt, and clay. The Castle Hayne semi-confining unit consists of dark green silt with some shell fragments and sand. Scattered clay and peat lenses have been observed between 22 feet bls and the land surface.

Extensive groundwater contamination was observed in the surficial aquifer along both the upper and lower monitored intervals. Fuel-related contaminants are more prevalent in the upper portion of the surficial aquifer and solvent-related contaminants are more prevalent in the lower portion of the surficial aquifer.

1.4 SUMMARY OF PREVIOUS INVESTIGATIONS

The following is a list of previously conducted site assessment studies conducted for the subject site:

- WAR, Initial Assessment Study of Marine Corps Base, Camp Lejeune, North Carolina, 1983
- ESE, Final Site Summary Report, MCB Camp Lejeune, September 1990
- NUS, Draft Field Investigation/Focused Feasibility Study, Camp Geiger Fuel Spill Site, MCB, Camp Lejeune, NC, 1990
- Law Environmental, Final Report of Underground Fuel Investigation and Comprehensive Site Assessment, Camp Geiger Fuel Farm, MCB Camp Lejeune, NC, 1992
- Law Environmental, Addendum to Report of Underground Fuel Investigation and Comprehensive Site Assessment, Camp Geiger Fuel Farm, MCB Camp Lejeune, NC, 1993
- Baker Environmental, Inc., Interim Remedial Action Remedial Investigation/Feasibility Study for Soil, O.U. 10, Site 35, Camp Geiger Fuel Farm, MCB, Camp Lejeune, NC, 1994
- Baker Environmental, Inc., Final remedial Investigation Report, Operable Unit No. 10, Site 35, Camp Geiger Area Fuel Farm, May 1995
- Baker Environmental, Inc., Record of Decision (ROD) for Surficial Groundwater for a Portion of Operable Unit No. 10 Camp Geiger Area Fuel Farm, May 1995
- Baker Environmental, Inc., Final Interim Feasibility Study, Operable Unit No. 10, Site 35, Camp Geiger Area Fuel Farm, July 1995
- Baker Environmental, Inc., Draft IAS Treatability Study Report, Operable Unit No. 10, Site 35, Camp Geiger Area Fuel Farm, November 1996

- Baker Environmental, Inc., Draft Supplemental Groundwater Investigation Report, Operable Unit No. 10, Site 35, Camp Geiger Area Fuel Farm, November 1996
- Baker Environmental, Inc., Draft Feasibility Study, Operable Unit No. 10, Site 35, Camp Geiger Area Fuel Farm, January 1997
- Baker Environmental, Inc., Site 35, Pre Interim Remedial Action Field Investigation Letter Report, June 1997

1.5 REFERENCES

The following reference documents were utilized as the basis for preparing the elements of this RAWP:

- OHM Remediation Services Corp., Contract N62470-93-D-3032, Delivery Order 083, Modification 1, Proposal for Construction of air Sparging System, O.U. 10, Site 35, Camp Geiger, MCB Camp Lejeune, N.C., July 26, 1996
- Baker Environmental, Inc., Site 35, Final Basis of Design for Phase I Interim Remedial Action, Operable Unit No. 10, Site 35 - Camp Geiger Area Fuel Farm, MCB Camp Lejeune, North Carolina, August 14, 1997
- Baker Environmental, Inc., Specifications, Phase I Interim Remedial Action at Operable Unit No. 10, Site 35, MCB Camp Lejeune, North Carolina, August 14, 1997
- Baker Environmental, Inc., Site 35, Pre Interim Remedial Action Field Investigation Letter Report, June 1997
- Steven R. Day, Hazardous Materials Control Research Institute Superfund '90, Deep Groundwater Collection Trenches by Bio-Polymer Drain Method
- OHM Remediation Services Corp. Comments on Draft Basis of Design for Phase I Interim Remedial Action Operable Unit No. 10, Site 35, May 15, 1997
- Department of the Navy, Letter Response to Comment Draft Basis of Design Phase I, O.U. 10, Site 35, September 3, 1997

2.0 PRECONSTRUCTION ACTIVITIES

2.1 PRECONSTRUCTION SUBMITTALS

The following plans have been developed for this delivery order and are to be considered as complementary components to this work plan:

- Site-Specific Health and Safety Plan (SHSP) (included herein as Appendix A)
- Construction Quality Control Plan (CQCP) (included herein as Appendix B)
- Sampling and Analysis Plan (SAP) (included herein as Appendix C)
- Environmental Protection Plan (included herein as Appendix D)

Additional reports, certifications, etc., will be submitted in accordance with the submittal register. The submittal register is included in the Construction Quality Control Plan.

2.2 PERMITS

OHM will prepare all permit applications for submission by the Base as required for construction of this remediation system. Permits/registration required for this project include the following:

- Utility clearances
- Base construction/digging permits
- Electrical permits
- Well construction permits as required

2.3 PROCUREMENT

Upon approval of this Work Plan, OHM will start procurement of new equipment, materials, and subcontractors necessary for the execution of this project. The major equipment and materials to be procured include:

- Air sparging compressor package
- Air sparging distribution piping
- Porous air sparging piping
- Fittings and valves
- Instrumentation

Specialty subcontractors may be utilized to execute certain portions of work at O.U. 10, Site 35. The following is a list of potential subcontracted services:

- Direct push or geoprobe services for piezometer installation
- Electrical distribution
- Laboratory services for groundwater monitoring analyses
- Transportation and disposal services for residuals

2.4 PRECONSTRUCTION MEETING

OHM will participate in a pre-construction meeting at MCB Camp Lejeune with Base, LANTDIV and other parties prior to mobilization to the site. OHM representatives will include at a minimum the Project Manager and Site Supervisor. The purpose of this meeting will be to:

- Confirm roles and responsibilities of key personnel and flow of communication for project execution.
- Review the project schedule, work hours, sequence of tasks and key milestones.
- Identify and discuss Base-specific issues relative to the upcoming mobilization and construction activities.
- Obtain the necessary security clearances for operations personnel.

3.0 DESIGN BASIS AND CRITERIA

This section of the RAWP provides a detailed description of the design objectives; remedial technology; variances from the existing Phase I Interim Remedial Action Specifications and Final BOD prepared by Baker Environmental (Baker) dated August 14, 1997; and rationale for equipment selection and sizing including design calculations.

3.1 DESIGN OBJECTIVES

The design objectives of this Phase I interim remediation work plan are as follows:

- Provide a plan for installation of 100-feet long field pilot-scale air sparing well, air compressor system, and air sparging system monitoring wells.
- Assess the applicability of in-situ air sparging (IAS) technology in treating BTEX and chlorinated solvent contaminated shallow groundwater at Site 35 by evaluating the effectiveness, implementability, and cost of a full-scale treatment system.
- Obtain sufficient data to develop a full-scale system remedial design.
- Assess the impact of air emissions on human health and the environment, and verify that air emissions will not impact the proposed highway project.

The air sparge trench for Phase I will span approximately 100 feet perpendicular to flow over a small portion of the contaminated plume at the site and is therefore, referred to as a Phase I interim remedial action (IRA).

After the Phase I IRA performance is evaluated, adjustments or improvements will be recommended for the continuation of the IRA (i.e., Phase II) and possible extension of the IAS system. Ultimately, the goal of the interim remedial action is to prevent the migration of fuel and solvent-related groundwater contamination. The overall site groundwater cleanup goals for the contaminants of concern are presented in Table 3.1.

Table 3.1 - Groundwater Remediation Goals

Contaminant of Concern	*Remediation Level (ug/L)*	*Basis*
Trichloroethene (TCE)	2.8	NCWQS
cis-1,2-Dichloroethene (cis DCE)	70	NCWQS
trans-1,2-Dichloroethene (trans DCE)	70	NCWQS

Table 3.1 - Groundwater Remediation Goals		
Contaminant of Concern	*Remediation Level (ug/L)*	*Basis*
Ethylbenzene	29	NCWQS
Xylenes (total)	530	NCWQS
Methyl Tertiary Butyl ether (MTBE)	200	NCWQS
Benzene	1	NCWQS
Ethylbenzene	29	NCWQS
1,2-Dichloethene	70	MCL
Tetrachloroethene	0.7	NCWQS
1,1,2,2-Tetrachloroethane	0.41	Risk-based RGO (1)
Vinyl Chloride	0.015	NCWQS

Note:

(1) Based on a carcinogenic target risk level of $1x10^{-6}$. The equation used to calculate this RGO is based on guidance in USEPA Region IV Bulletin, November 1995.

(2) This table was taken from Table 2-1 in the Baker Environmental, Inc., Site 35, Final Basis of Design for Phase I Interim Remedial Action, Operable Unit No. 10, Site 35 - Camp Geiger Area Fuel Farm, MCB Camp Lejeune, North Carolina, August 14, 1997.

3.2 REMEDIAL TECHNOLOGY

Air sparging was determined in the "Interim Record of Decision (ROD) for Surficial Groundwater for a Portion of Operable Unit No. 10 - Camp Geiger Fuel Farm," signed on September 5, 1995 to be the best available technology for remediating the contaminated groundwater. Equipment selected by Baker Environmental, Inc. included a rotary screw air compressor system for injecting air to the air sparging well.

3.3 MODIFICATIONS TO THE SPECIFICATIONS

With exception of the horizontal air sparging well, OHM views other components of the Phase I system to be temporary. Therefore, OHM presents several modifications to the remediation system as specified. The following is a summary of these changes:

- The air compressor will be placed on a gravel base to reduce the cost of this temporary installation.

- A weather proof enclosure will not be provided for the air compressor. The compressor will be rated for outdoor use.

- A 6-feet (not 10-feet) high chain link fence with 3-strand barbed wire around the perimeter of the air compressor compound will be provided.

- The air sparging header piping will be routed above ground.

- Well vaults are not provided within the trench for the three air sparging trench risers.

3.4 EQUIPMENT AND MATERIAL SELECTION

This section provides detailed information on individual components of the treatment system and the rationale for equipment selection. Table 3.2 summarizes the key design parameters for the air sparging systems.

Table 3.2 - Key Design Parameters for Air Sparging System

Air Sparging System	*Design Parameter/Basis*
Depth to water	5.5-8 ft bls (Basis of Design by Baker, Pg. 2-10)
Confining layer	40-44 ft bls (Basis of Design by Baker)
Number of horizontal wells	1 each
Number of well vaults	None
Well diameter	1-1/2- to 2-inch
Distribution piping material	HDPE
Sparging screen material	Porous Pipe or pipe with drilled holes
Well depth	40-44 feet (directly on top of aquitard)
Well screen packing	Gravel
Horizontal sparging interval (length)	100 feet
Pressure needed at well head	17 psi (OHM calc)
Header piping pressure	20 psi (controlled by regulator)
Air sparge pipe and equipment loss	3 psi (OHM calc)
Pressure capacity at compress	100 psig
Total flow requirements	150 scfm, (OHM estimate)

3.4.1 Horizontal Air Sparging Well

The 100-feet long horizontal air sparing well will be constructed using a porous pipe or a pipe with drilled holes for delivering the injected air into the contaminated groundwater with three HDPE risers. OHM is proposing a relatively new design in air sparging piping for this application which appears to offer some significant advantages over conventional slotted pipe relative to air distribution and enhanced flow rates. The air sparge well will be installed just above the semi-combining clay layer to a depth of approximately 40 feet bls using deep trench excavation methods.

It is estimated that the 100-feet long horizontal air sparging well could have a flow rate well in excess of 1 standard cubic feet per minute (scfm) per foot. However, these high flow rates may not be necessary to attain remedial goals. This will be determined in the pilot test. For design purposes a flow rate for the horizontal well is conservatively assumed to be 100 scfm. The air sparge well and header are designed to handle 100 scfm of air.

3.4.2 Vertical Monitoring Piezometers

The monitoring points will be installed by direct push methods rather than conventional drilling. Ten new shallow and deep groundwater piezometers, each 1-inch diameter PVC, will be utilized to monitor groundwater conditions hydraulically upgradient and downgradient of the sparging curtain. Figure 3 shows piezometer locations and Figure 4 shows details of the piezometers.

3.4.3 Air Sparge Well Distribution Piping

Materials of construction evaluated for use in air sparging well distribution piping include thermoplastic, iron, Chem-Aire, ABS, and Air-Pro HDPE. Compressed air rated HDPE was selected for the air sparge well distribution piping based on its safety, durability, rapid joint curing time, flexibility, pressure rating, weight, speed of installation, and overall cost. The selected material is also resistant to oils, corrosion, and to some extent UV light. Air-Pro HDPE piping is pressure and temperature rated for all air sparge distribution piping from the equipment compound to the air sparge well. The pipe is joined with socket fittings using an electric heating element to fuse the pipe. Fused joints are rated for full pressures within seconds after the joint is constructed.

The three riser pipes will distribute compressed air to the air injection well as shown in Figures 4 and 6. The piping is sized to accommodate pressure drop both along the horizontal well and to the equipment compound to meet performance requirements. The piping sizes are shown on Figure 6. Sizing and pressure loss calculations are provided in Appendix E.

3.4.4 Air Sparging Compressor-System

A 40 horse power (hp) rotary screw compressor with 3-phase, 480 volt electric drive motor will be utilized to supply compressed air for the air sparging system. This unit will be capable of attaining a rate of approximately 150 scfm at 100 psi. Primary components of the skid mounted system include: a continuous-duty cycle compressor, a 200 psi rated steel receiver tank, motor starter, coalescing filters to remove oil, automated condensate removal system, after cooler, an oil/water separator, solenoid valves, regulator, instrumentation, interconnecting piping, and a control panel. Compressed air will be delivered continuously through a manifold system to the individual wells. Figure 6 shows the piping and instrumentation diagram (P&ID) for the air sparging system. Coalesced oil is collected in a designated container, while oil-free condensate is discharged to the ground. All air sparging components including the air compressor and panels will be designed for exterior outdoor applications and be weather-proof.

3.4.5 Well Heads, Vaults, and Instrumentation

Each of the three air sparging well risers will be equipped with a 0-100 psi pressure gauge, air flow meter, and ball valve for flow control. Figure 4 shows details for the air sparging well heads.

3.4.6 Equipment Compound

The temporary air sparging unit will be delivered to the equipment compound mounted on a steel skid. A 4-inch layer of gravel will be provided as a foundation for remediation equipment. A secure 6-feet high chain link fence with two access gates will surround the entire equipment compound. Figure 5 provides a preliminary equipment compound layout.

3.5 SYSTEM CONTROL LOGIC

Instrumentation and controls for the air sparging system are based on control relays and contacts for monitoring and system control. The process and instrumentation diagram (P&ID), shown as Figure 6, delineate the instrumentation and controls for the system. The air compressor pump will be controlled by a hand-off-auto switch, located at the control panel. A preset low air pressure switch will be located in the air sparge well header prior to the branch lines. If air pressure drops below the preset level, solenoid valves shall close and initiate an alarm conditions.

4.0 SYSTEM CONSTRUCTION TASKS AND METHODS

4.1 MOBILIZATION

OHM will mobilize personnel and equipment as necessary from its Southern Region offices, including Covington, Georgia; Norcross, Georgia; Clermont, Florida; and Gallatin, Tennessee. Prior to beginning work on site, a training meeting will be conducted to brief all site personnel on the Site-Specific Health and Safety Plan, construction drawings, and other relevant site-specific plans. Site hazards and conditions will be discussed and all personnel will acknowledge their understanding and compliance with the plan by signing an approved acceptance form.

4.2 SITE PREPARATION

Project site setup and preparation will consist of the following main activities:

- Temporary Facilities Installation - OHM will utilize its office trailer already located at the Lot 203 at Holcomb Boulevard, Camp Lejeune as an administrative area and command center. In addition, a canopy/decontamination trailer will be set-up on-site. The decontamination trailer/canopy will serve as the control check point for contractor/subcontractor personnel entering the site.

- Site Survey - OHM will layout the horizontal air sparing well location, piezometer locations, trenches, electrical lines, equipment lay down areas, and equipment compound prior to installation. The locations will be visibly marked using reinforcing bars and/or wood stakes.

- Erosion and Sedimentation Control - OHM will establish controls to prevent erosion and sedimentation through the use of sediment fencing and diversion berms. In this manner, OHM will mitigate the spread of contamination to other areas and minimize run-on into the active work area. Silt fencing may be placed along the down gradient sides of trenched areas. Clean soil may be used to construct a berm on the up-gradient side of the excavated areas to prevent the intrusion of surface water into the open trenches prior to backfill. The Environmental Protection Plan included in Appendix D of this RAWP provides details on environmental controls.

- Install Construction Fences - OHM personnel will erect safety fencing around the designated work areas. Fencing will be 3 feet high, bright orange, polyethylene, mesh fence to prevent personnel from accidentally entering an open trench.

- Site Security - All persons entering the site will be required to sign in and out daily. OHM reserves the right to deny access to any individual not showing proper identification.

- Decontamination Areas - In areas of excavation through contaminated soil, personnel and equipment decontamination areas will be provided within the Contamination Reduction Zones (CRZ) upon exiting the contaminated working areas. The Site-Specific Health and Safety Plan addresses these areas in detail.

- Health and Safety Zones - The site will be segregated into work areas on the basis of degree of hazard and PPE requirements. Personnel working within the CRZ will be required to wear the appropriate PPE as outlined in the Site-Specific Health and Safety Plan. Excavation areas within the CRZ will be designated the exclusion zone and will be delineated by orange safety fencing. OHM health and safety personnel will provide site air monitoring when excavating in areas of contaminated soil and will adjust work zone boundaries as appropriate.

- Personnel Decontamination Facility - OHM will set up a personnel decontamination area at the site. The location will be near construction areas depending on the phase of remediation activities. It will be furnished with portable wash basins. All decontamination and cleaning water generated from the decontamination activities will be collected and stored prior to analysis and subsequent disposal.

4.3 UTILITY CLEARANCES

OHM will contract with No-Cuts to provide location services. No-Cuts will identify and mark all known utilities potentially within the work zones. OHM will exercise caution while performing intrusive work and will implement its Standard Operation Procedures for excavation or drilling near utilities. Techniques for minimizing damage to existing utilities include the use of location devices, utility location services, and hand digging. OHM's Site-Specific Health and Safety Plan also addresses these concerns.

4.4 BIO-POLYMER SLURRY TRENCHING METHOD

Based on the excavation depth of 44 feet into sandy soils, with a water table approximately 6 to 8 feet bls, the open trench will require support to remain open during the well installation. To accomplish this, the vertical walls of the trench will be supported by an engineered, biodegradable slurry. The air sparging well material will be placed in the trench and the trench backfilled with gravel.

4.4.1 Bio-polymer Slurry

The slurry for supporting the trench will consist of a stable suspension of biodegradable bio-polymer in water. The bio-polymer slurry consists of 99 percent water and about 1 percent ground guar beans and proprietary degradable additives. The properties of the slurry will be monitored during trench excavation to verify that the slurry meets the necessary requirements and to determine when breakdown of the slurry begins. The gel strength of the slurry will be maintained at an optimum so that hydrostatic pressure is transferred from the slurry to the trench walls. Admixtures of softening agents, preservatives, dispersants, or retarders will be added to the slurry in the mixing plant to permit efficient use of and proper workability of the slurry. The bio-polymer slurry may be modified as required for successful trench excavation.

The bio-polymer will be prepared in an on-site mixing plant and hydrated in a tank with circulation until the resulting slurry appears homogeneous and meets project requirements. The slurry mixing plant will contain a high speed/high shear colloidal mixer with a static agitator.

The slurry used in trenching will be tested each shift in accordance with API RP 13B to ensure the ability of the slurry to stabilize the trench. Samples of the slurry will be obtained from both the trench and mixing plant. The following tests will be performed at the indicated minimum frequencies:

- Viscosity 2 per shift
- Density 2 per shift
- pH 2 per shift
- Temperature 2 per shift

4.4.2 Excavation and Material Handling

This section describes excavation, handling potentially contaminated soils, stockpiling, and a sequence of operation to for installation of the bio-polymer slurry trench. The air sparging trench will be constructed to the lines, grades and cross sections as indicated on Figure 4. The trench will extend through the overburden to the semi-confining layer located approximately 40 to 44 feet bls. The actual depth of the semi-confining layer will be based on examination of spoils.

Prior to start of excavation, a working platform will be constructed in the air sparging trench area. This platform will be relatively level and will be constructed of a stable surface of compacted fill and/or excavated earth which will support the excavator during trench construction. The walls of the working platform will also provide an adequate bio-slurry head to maintain a trench wall stability safety

factor of a minimum of 1.1. The height of the working platform above the existing land surface will be calculated based on depth of water table at the time of excavation. The height of working platform is anticipated to be less than 6-feet above land surface. The working platform will be lined to prevent additional contamination during excavation. The trench will be excavated using a long reach backhoe capable of excavation of a 2-feet wide trench in a single pass to a depth of the confining layer from the working platform.

After the initial 3-feet of soil has been excavated and stockpiled, slurry will then be pumped from the mixing plant into the trench at the time excavation begins. The level of the slurry in the open trench will be maintained no more than 3 feet below the ground surface until the placement of air sparging pipe and gravel backfill is complete. The trench will be constructed without undue interruption until it is completed. The integrity of the slurry will be maintained at all time, including periods of work stoppage. Measurements of the trench depth will be taken at least every 20 linear feet for generation of an as-built profile of the trench depth. Depth measurements will be made from the working platform to the bottom of the trench.

Excavated material will be stockpiled on and covered with plastic sheeting a sufficient distance from the trench excavation to ensure that the stockpiles do not affect trench stability. Stockpiled soils will be sampled in accordance with the Sampling and Analysis Plan included as Appendix C of this RAWP.

4.4.3 Horizontal Air Sparing Piping Placement and Backfill

The 100-feet long, 2-inch diameter horizontal air sparging porous pipe will be pre-assembled at the site using fusion welding techniques with the three 1-inch HDPE risers and lowered through the bio-slurry to the bottom of the trench. The air sparging pipe will be placed into the trench from the surface with fabricated concrete weights and pre-measured cables at the spacing required to counteract the buoyancy of the pipe. The piping plan presented in Figure 3 shows the location of the horizontal air sparging well and details are present in Figure 4. Graded gravel backfill will be immediately tremied through the slurry. Backfill placement will continue from the porous pipe located above the aquitard at approximately 40 to 43 feet bls to approximately 3 feet bls. The gravel backfill gradation will be based on filter criteria to minimize plugging.

A geotextile shall be placed over the gravel backfill at approximately 3-feet bls. The trench will then be backfilled between 3 feet bls and the land surface with clean excavated soil and compacted to prevent surface water from migrating into the trench. Soils containing less than 100 parts per million

(ppm) of total organic halogens (TOX), less than 40 ppm of total petroleum hydrocarbons (TPH), and less than 10 ppm to the benzene, toluene, ethyl benzene, and xylene (BTEX), can be used as fill material.

4.4.4 Degrade Slurry and Develop Air Sparing Trench

Once construction is complete, the slurry will be broken and the air sparge well developed much like a water well is developed. First, the pH of the slurry is lowered to below 7 to initiate enzyme action, then a propriety enzyme breaker solution is added to ensure bio-degradation. The degraded slurry and water in the trench will be tested to demonstrate that the slurry has been broken. The viscosity temperature and pH of the slurry will be tested to verify degradation. To remove the remaining residues, water will be continuously pumped and recirculated through the gravel backfill while metering in additives to inhibit anaerobic digestion. Pumping and flushing will continue for a day or several days until the flush water is clear, free from slurry, pH is stabilized, viscosity of flush water is similar to that of tap water and the trench continuity obvious.

4.5 PIPING AND WELL HEAD INSTALLATION

OHM's field personnel will install the air sparging piping and complete well heads as indicated on the drawings. All distribution piping will be constructed above-grade. Air sparging lines will utilize Air-Pro HDPE with socket welded joints. The Air-Pro piping will be pressure tested for leaks in accordance with manufacturer's recommendations. A single header will provide air to each of the three air sparging well risers. Figures 3 and 4 show well head and piping details.

4.6 EQUIPMENT COMPOUND INSTALLATION

The sub-grade in the area of the equipment compound will be leveled, compacted, with all vegetation removed. Herbicide will be used as necessary on the sub-grade to inhibit vegetation growth and a plastic sheeting will be placed on this treated sub-grade. Gravel shall be added in the area of the proposed compound fence. The gravel areas will be sloped to match the existing grade and the skid-mounted air compressor will be placed on this gravel area as shown in Figure 5.

Upon completion of all equipment, piping, and electrical installation, a chain-link fence topped with barbed wire will be placed around the equipment. Signs will be placed on all sides of the fence stating " No Unauthorized Entry."

4.7 PIEZOMETER INSTALLATION

Following the air sparging well installation, a well installation subcontractor will mobilize a direct push rig to the site to commence installation of the vertical piezometers. A total of 15 piezometers will be utilized for monitoring the performance of the Phase I air sparging system as shown in Figure 3. Thirteen of the 15 piezometers will be installed using direct push technology. Two piezometers will installed manually by OHM within the air sparging trench during the backfilling operation. Nested well pairs will be installed at both shallow (<15 feet) and deep (30-40 feet) water bearing zones in the upper aquifer using direct push equipment as presented on Figure 4.

The nested piezometers spaced at various intervals will be used to adequately monitor petroleum and chlorinated solvent constituents predominating in the shallow and deep zones of the upper water bearing zone. Each piezometer will be driven to depth with using a steel sacrificial tip and outer casing. A 1-inch SCH 40 PVC riser with slotted 0.010 inch slotted screen will remain in place as the steel sleeve is retracted. A bentonite seal will be placed near the top of each piezometer. Surface completions will be below grade and will consist of a 8-inch diameter well vault with locking well cap and cover. Figure 4 shows the detail for the shallow and deep piezometers.

Prior to well installation, OHM will mark each of the proposed locations in the field as shown on Figure 3. A pilot hole will then be advanced in each boring using a hand auger or post hole diggers to a depth of 4 feet bls to check for unmarked subsurface obstructions. If subsurface obstructions are not encountered, the piezometer will be driven/pushed to completion depth using the direct push rig. If subsurface obstructions are encountered, then the well location will be off-set. In areas where utilities are present, hand digging will be employed to minimize the possibility of damage to the existing facilities and/or services.

This technique will produce minimal soil cuttings for subsequent recycling or disposal. The small amount of soil generated during the installation of the piezometers will be combined with the soils generated from the trenching operations. This material will be tested along with the trenched soils in accordance with the Sampling and Analysis Plan.

4.8 SITE RESTORATION AND DEMOBILIZATION

Upon completion of installation of the remediation system, OHM will begin site restoration activities. The site will be regarded to the original contours. Grass areas destroyed or disturbed during construction will be seeded. OHM will repair asphalt pavement areas and roadway surfaces damaged

or destroyed during construction to North Carolina standards. Upon completion of site restoration, all equipment, support trailers and personnel will be demobilized from the project site.

5.0 ELECTRICAL POWER DISTRIBUTION

OHM will provide primary electrical power to the temporary compound by tapping into the base's existing aerial 12.47kV power line. The new electrical transformer was sized to supply power for the future Phase II remedial action which may require air compressors for up to 1,100 linear feet of air sparging trench. OHM's electrical subcontractor will install a new power pole with three 100 kVA transformers and a 600 amp service entrance rated panel board. Overhead lines will run from an existing power pole to the new power pole, as shown in Figure 7. Three phase, 480 V power to the compound will be delivered from the new power pole to the compound via an underground concrete encased feeder. The electrical distribution details are shown in Figure 7.

The main distribution panel board will be enclosed in a NEMA 3R enclosure and it will be mounted on the new service pole. The control panel for the air sparging system will be mounted on the equipment. Hand/off/auto switches and alarm/run lights will be provided for the air sparging system. Prior to startup, all electrical equipment will be tested to ensure proper operation. All electrical work shall be in accordance with NFPA 70.

6.0 SYSTEM STARTUP

System start-up and monitoring activities will begin upon final completion of the equipment, piping, well head, and electrical installation. The air sparging system start-up and optimization will require approximately 5 days. This will include testing, calibration, adjustment, and initial maintenance of the compressor and ancillary process equipment and instrumentation. During this time, the system will be placed into operation. Specific start-up and optimization activities include:

- Equipment shakedown (mechanical and electrical)
- Further air sparging well development as necessary to prepare for air injection
- Test and calibrate process controls and equipment including testing of critical alarms and system shutdowns
- Develop and quantify air flow and pressures to the horizontal sparging well
- Determine air injection breakthrough pressure and develop pressure and flow relationships
- Determine and quantify air injection rates and responses to nearby groundwater monitoring piezometers
- Test three injection points along the horizontal well and observe air distribution patterns throughout the horizontal screen interval
- Test and calibrate process controls and equipment including testing of critical alarms and system shutdowns
- Document start-up monitoring parameters for system optimization
- Perform baseline piezometer sampling and analysis in accordance with the Sampling and Analysis Plan

7.0 SYSTEM MONITORING

Formal field pilot testing for up to 180 days, if necessary, will commence following the initial startup and shakedown period. A good monitoring program is essential in this phase for determining full scale design parameters, predicting performance, and determining full scale system costs for extending the air sparging wall to 1,100 linear feet. The network of piezometers will provide the basis for monitoring the performance of the air sparging system. Air flow rates will be varied during operation of the air sparging system and data collected to determine the lowest flow rate required to achieve the remedial goals. System monitoring components which are planned include the following:

- Baseline sampling and analysis from hydraulically upgradient and downgradient shallow and deep piezometers to assess initial concentrations of petroleum and chlorinated solvents in the groundwater prior to air sparging testing

- Sampling and analysis from select upgradient and downgradient piezometers to assess changes in contaminant concentrations across the air sparging wall

- Dissolved oxygen monitoring using the piezometer network to discern sparging influence, air injection rates, the uniformity of air distribution, and hydraulic properties of the sparging wall

- Routine piezometric surface measurements to assess potential mounding or other hydraulic properties relative to air injection rates which will be important design parameters for the full scale system

- Pressure monitoring to determine air sparging wall influence formational properties

- Soil vapor monitoring for VOCs using a field flame ionization detector (FID) from two piezometers in the air sparging trench to assess hydrocarbon emissions released from the sparging system

- Ambient vapor monitoring for VOCs (using an FID) near the proposed right-of-way for the new highway

Also during the operation and monitoring period, routine maintenance of the system will be conducted by OHM. OHM personnel will visit the site routinely to monitor system performance and maintain the systems in accordance with the plans. During each visit, equipment operating parameters and well flow rates and pressures will be logged. The results of the pilot test will be presented in the Field Test Report to be included with the Contractor's Closeout Report.

8.0 TRANSPORTATION AND DISPOSAL

8.1 INTRODUCTION

This Materials Handling, Transportation and Disposal Plan (MHTDP) was prepared for use during remedial action activities at the O.U. 10, Site 35, Camp Geiger Area Fuel Farm site which is located within the Marine Corps Base, Camp Lejeune, North Carolina.

The MHTDP objective is to specify the methods and procedures to be implemented by OHM to ensure that wastes generated during site remediation activities will be transported, stored, treated, and disposed of in full compliance with applicable federal, state, and local rules and regulations.

8.2 CHARACTERIZATION OF WASTE STREAMS

Based on the information provided to OHM in the Basis of Design and Specifications, OHM will generate various types of Remedial Derived Waste during installation, operation, and monitoring of the remediation system at this site which will require recycling, treatment, or disposal. These materials are outlined in Table 8.1.

OHM will complete characterization and disposal analysis of the waste materials generated from the remedial activities in accordance with Section 02222 of the specifications. For the purposes of this plan, OHM assumes that contaminants of concern are benzene, toluene, ethylbenzene, xylene , methyl tertiary butyl ether from aboveground storage tank (AST) releases of gasoline and diesel fuel; and trichloroethene, cis-1,2-dichloroethene, trans-1,2-dichlorethene, 1,2-dichloethene, tetrachloroethene, 1,1,2,2-tetrachloroethane, and vinyl chloride from solvent releases at a maintenance facility.

OHM will collect samples in accordance with the Sampling and Analysis Plan and perform appropriate characterization and disposal analysis of the wastes described in Table 8.1 during the course of this project. Final characterization and disposal alternatives are contingent upon these analyses. An addendum to this plan will be prepared with that information when it is available.

Table 8.1 - Remedial Activity Derived Waste From OU 10, Site 35

Waste	*Description*	*Estimated Quantity*	*Disposal Method*
PPE	Personal protective equipment generated during on-site remedial activity	8 drums	Off-site landfill
Decontamination water Bio-Polymer Slurry Liquids	Decontamination water from equipment cleanup, water from piezometer development Excess water left after the bio-polymer slurry breaking	40,000 gallons	TBD: on-site groundwater treatment plant located at Lot 203 or off-site disposal facility
Soil from trenching and well installation	Soil cuttings from well installation and contaminated soils from air sparge trench installation	500 tons	TBD: on-site biocell, or off-site landfill
Excess Bio-degradable Slurry	Solids from excess bio-polymer slurry and solids/sludge generated during breaking the polymer bond	11 tons	TBD; on-site biocell or off-site landfill

8.3 WASTE DISPOSAL APPROVAL

OHM will assign a T&D Coordinator for this project who will report to the Project Manager as a single point-of-contact for all waste management activities. The individual assigned to this project will be familiar with all the applicable portions of RCRA, CERCLA, and SARA regulations, especially 40 CFR 261 (Identification and Listing of Hazardous Wastes). In addition, this individual will be familiar with the State of North Carolina regulations related to hazardous and solid waste treatment, storage, disposal, and transportation. This individual will specify analyses needed to identify hazardous wastes. Based on this data and consultations with the Department of the Navy representatives, the project T&D Coordinator will assist the Department of Navy in identifying regulated wastes materials. The T&D Coordinator will also be responsible for preparing waste profiles to the selected disposal vendor and coordinating disposal approvals.

Based on the materials identified that will require off-site disposal, it is anticipated that the wastes generated will not be RCRA hazardous pursuant to 40 CFR 261. The T&D Coordinator, in consultation

with the project manager and procurement personnel, has reviewed potential vendors to pre-qualify transportation and disposal companies based on:

- NOV status
- Ability to handle the wastes identified
- Cost effectiveness of the available transportation and disposal options
- Past experience

At this time OHM has identified the following qualified vendors to provide transportation and disposal of non-hazardous petroleum contaminated wastes from this Delivery Order should this be necessary:

- BFI Waste Systems
- Cherokee Sanford Group
- East Coast Environmental

8.4 WASTE PACKAGING

All drummed waste of personal protective equipment (PPE) that is collected in 55-gallon (17H open-top) steel drums will be labeled and logged using OHM's standard drum inventory procedures (see Drum Inventory Log presented in the Sampling and Analysis Plan). OHM will maintain these drum logs and a database summary of the type and quantity of wastes generated each day. Appropriate measures will be taken to keep off-site back-up copies of this data as well.

All materials will be accumulated on-site until sufficient quantities are available for shipment of a full load of drums or (20 to 30 cubic yards) of bulk material. Pending quantities of waste, OHM will bulk or package waste in bulk roll-off containers for cost effective disposal. OHM will conduct weekly inspections of the temporary waste storage areas. All temporary storage will be in compliance with 40 CFR 262.34 and the applicable North Carolina regulations.

Decontamination water and well development water will be stored in drums or storage tanks pending quantity and location of each respective type. OHM plans to be transported to these liquids to the groundwater treatment plant adjacent to Lot 203 via tanker truck for treatment and discharge.

8.5 PREPARATION OF REQUIRED DOCUMENTATION

OHM will prepare or oversee the preparation of all paperwork associated with off-site disposal for review and signature by LANTDIV and Camp Lejeune representatives. This will include TSDF waste profiles, and bill of lading or non-hazardous manifest. The selected vendor(s) will be required to provide all manifests, and other shipping paperwork. A completed example of all manifests, and other shipping paperwork will be provided for OHM's review and approval at least one week in advance of the scheduled start of shipments. After these documents are reviewed by OHM they will be provided to the Navy's representative for review and signature. Final copies of all manifests, and other shipping paperwork will be received by OHM's on-site personnel at least 24 hours in advance of the scheduled start of shipments.

The disposal vendors will provide written verification that the proposed disposal site is permitted to accept the contaminated materials generated from the site. The disposal vendors shall provide written verification that wastes were actually delivered to the disposal site.

9.0 REPORTING

The following paragraphs discuss the reports OHM plans to prepare during the course of this project. Any other reports not mentioned in this section have been deemed non-applicable to this project.

Environmental Conditions Report

Prior to starting any field activities at the project site, ROICC and an OHM representative will tour the site, take photographs and note any existing environmental conditions on or adjacent to the site. This report will be submitted on a contractor's production report form included in the Appendix D Quality Control Plan with attachments as necessary.

Daily Reporting

OHM will prepare and submit daily Contractor's Production Reports and a Contractor's Quality Control Report each day that field activities are conducted or material is delivered for this project. It is anticipated that the site supervisor will perform the role of site QC manager during all periods when the designated site QC manager is not present at the job site.

As-Built Drawings

The two sets of contract drawings will be maintained at OHM's field offices at Camp Lejeune. These drawings will be updated as required for any deviation which has occurred. Upon completion of field activities, OHM will incorporate all changes into the record drawings for the project. Record drawings will accompany the submission of the Contractor's Closeout Report.

Monthly Status Reports

Monthly status reports in the form and content previously approved by LANTDIV will be submitted by the Program Office. Sections regarding progress, forecast, costs incurred, committed, delivery order modifications, waste tracking, and government materials tracking will be included. Schedules will be updated and variances explained. The monthly status report will summarize operating data, equipment maintenance problems, and downtime associated with the system.

Contractor's Closeout Report

OHM will supply a Contractor's Closeout Report which will summarize the construction of the remedial system. This report will include the following:

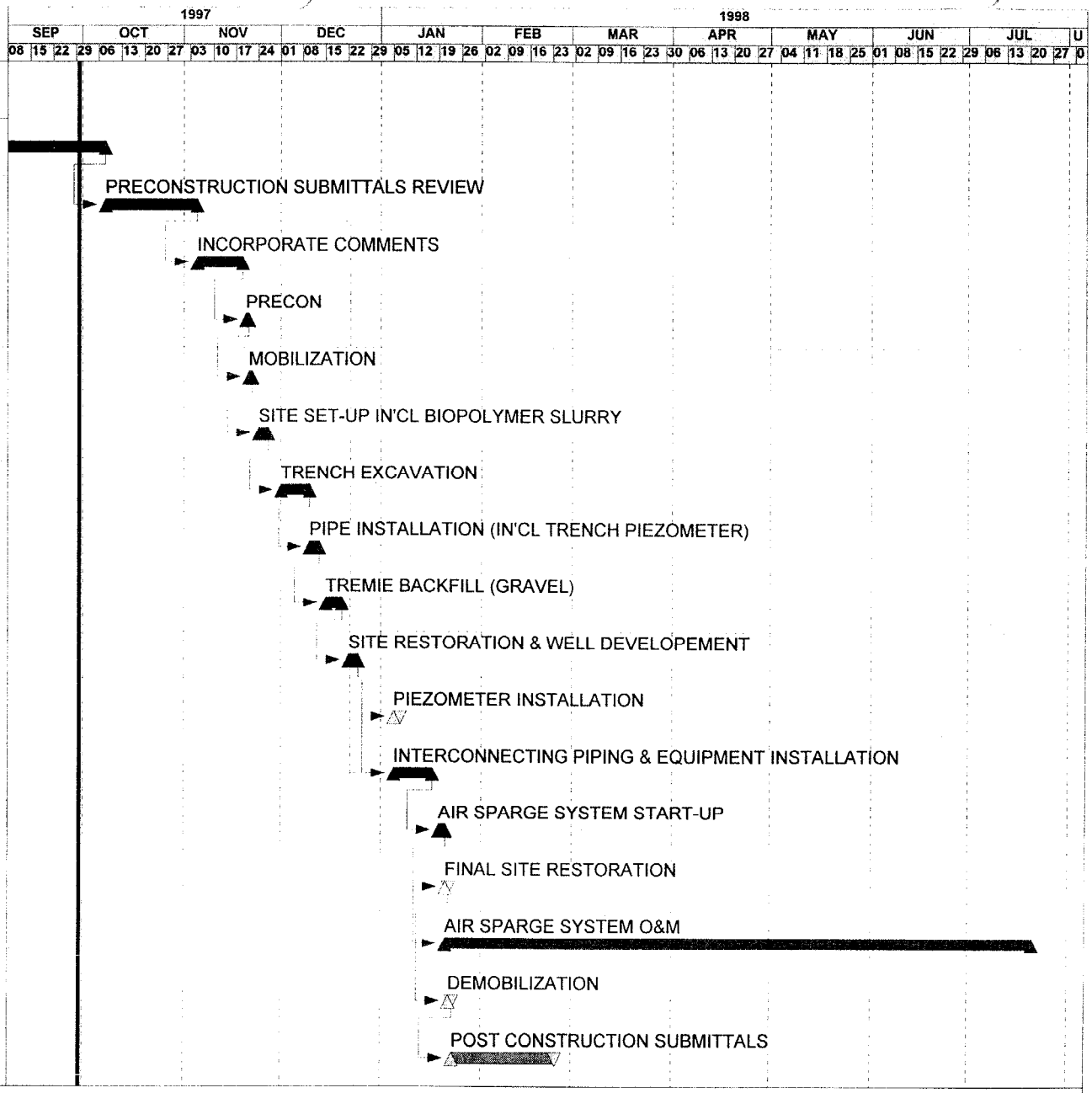
- Introduction
- Summary of Remedial Action
- Discussion of field changes and contract modifications
- Photographic documentation
- Rework items list and corrective actions taken (if required)
- Quality Control Daily Reports

- On-site sample test results
- Laboratory analyses results
- Field daily reports
- Final health and safety report
- Quality assurance sample results
- Contaminated soil disposal documentation including manifests
- As-built drawings
- Recommendations for operation and expansion of the treatment system

10.0 PROJECT SCHEDULE

The project schedule depicts the major tasks and duration to perform implementation of remedial action at the O.U. 10 Site 35. Refer to the project schedule attached.

Act ID	Description	Orig Dur	Early Start	Early Finish
1000	DELIVERY ORDER AWARD	0	31JUL96 A	
1010	PRECONSTRUCTION SUBMITTALS	322	31JUL96 A	07OCT97
1020	PRECONSTRUCTION SUBMITTALS	20	08OCT97	04NOV97
1025	INCORPORATE COMMENTS	10	05NOV97	18NOV97
1030	PRECON	1	20NOV97	20NOV97
1040	MOBILIZATION	1	21NOV97	21NOV97
1050	SITE SET-UP IN'CL BIOPOLYMER	3	24NOV97	26NOV97
1070	TRENCH EXCAVATION	7	01DEC97	09DEC97
1071	PIPE INSTALLATION (IN'CL TRENCH	3	10DEC97	12DEC97
1072	TREMIE BACKFILL (GRAVEL)	5	15DEC97	19DEC97
1073	SITE RESTORATION & WELL	3	22DEC97	24DEC97
1080	PIEZOMETER INSTALLATION	2	05JAN98	06JAN98
1090	INTERCONNECTING PIPING &	10	05JAN98	16JAN98
1110	AIR SPARGE SYSTEM START-UP	2	19JAN98	20JAN98
1120	FINAL SITE RESTORATION	1	21JAN98	21JAN98
1130	AIR SPARGE SYSTEM O&M	180	21JAN98	20JUL98
1140	DEMOBILIZATION	1	22JAN98	22JAN98
1150	POST CONSTRUCTION	22	23JAN98	23FEB98



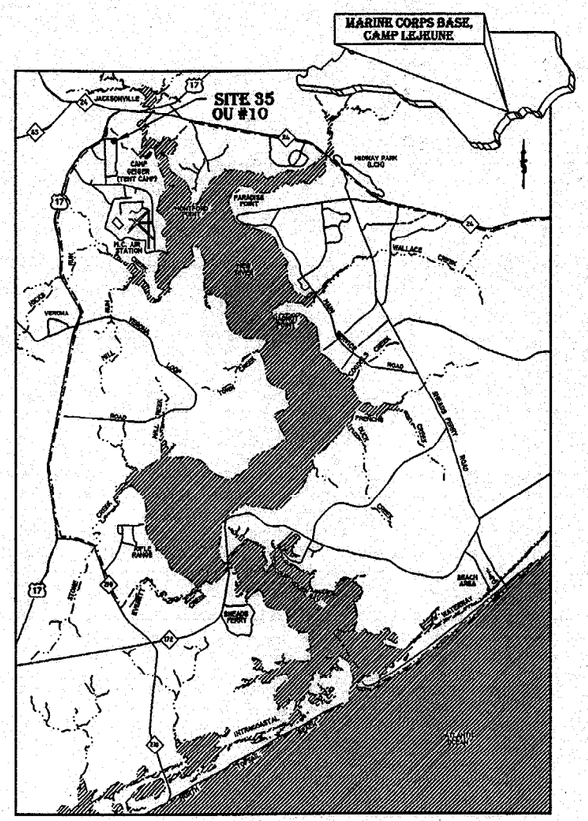
Start date	31JUL96
Finish date	20JUL98
Project name	17536MA
Data date	30SEP97

Proposal Schedule
Camp Geiger Air Sparging
LANTDIV D.O. #83, Mod #1

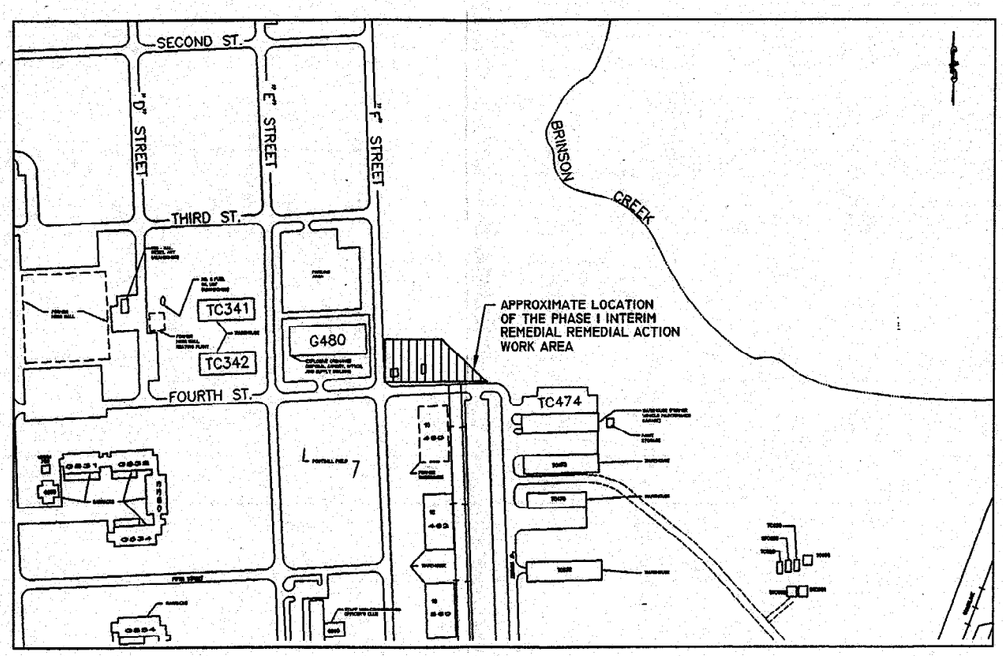
00098 E BIZ

PHASE 1 INTERIM REMEDIAL ACTION AT OPERABLE UNIT NO. 10, SITE 35

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA



VICINITY MAP
2 0 2
1 INCH = 2 MILES



LOCATION MAP - SITE 35
200 0 100 200
1 INCH = 200 FEET

LIST OF DRAWINGS

DRAWING NO.	SHEET TITLE
FIGURE 1	COVER SHEET AND VICINITY MAP
FIGURE 2	SITE LAYOUT
FIGURE 3	PIPING PLAN AND NEW PIEZOMETER LOCATION MAP
FIGURE 4	AIR SPARGING & PIEZOMETER DETAILS
FIGURE 5	EQUIPMENT COMPOUND AND DETAILS
FIGURE 6	PROCESS AND INSTRUMENTATION DIAGRAM-AIR SPARGING SYSTEM
FIGURE 7	ELECTRICAL DISTRIBUTION AND DETAILS

1. MAPPING FOR SHEET C-1 WAS PREPARED BY LANIER SURVEYING COMPANY OF JACKSONVILLE, NORTH CAROLINA AND IS DATED SEPTEMBER 18, 1996. MAPPING FOR SHEET C-2 WAS PREPARED BY COLBERT ENGINEERING, INC. OF BALTIMORE, MARYLAND AND IS DATED AUGUST 26, 1994.
2. ELEVATIONS SHOWN ARE IN FEET AND REFER TO NATIONAL GEODETIC VERTICAL DATUM NAD-83.
3. ELEVATIONS SHOWN ARE REFERENCED TO BENCHMARKS "STAFF", EL. 5.855 METERS (19.209 FEET NGVD), AND "WASHETTE", EL. 7.717 METERS (25.318 FEET NGVD), ONSLOW COUNTY, NORTH CAROLINA. "STAFF" (N 364,176.8512, E 2,462,865.630) IS LOCATED APPROXIMATELY 1.7 MILES WSW OF JACKSONVILLE, 1.0 MILES SOUTH ALONG U.S. ROUTE 17 FROM THE INTERSECTION OF U.S. ROUTE 17 AND U.S. ROUTE 258. "WASHETTE", (N 363,087.9623, E 2,460,723.0120) IS 1.5 MILES SOUTH ALONG U.S. ROUTE 17 FROM THE INTERSECTION OF U.S. ROUTE 17 AND U.S. ROUTE 258.
4. GRID IS BASED ON NORTH CAROLINA STATE PLANE COORDINATE SYSTEM (SOUTH ZONE) AND APPLIES TO SHEETS C-1 AND C-2.

OHM Remediation Services Corp.
Norcross, Georgia
A Subsidiary of OHM Corporation

SUBMITTED: _____ PROJECT MANAGER: _____ DATE: _____
APPROVED: _____ SR. PROJECT ENGINEER: _____ DATE: _____
APPROVED: _____ DEPT. MANAGER: _____ DATE: _____

AT FULL SCALE (IF NOT 3"-SCALE ACCORDINGLY)
CADD FILE: _____
DRAWN: J. LANGE/J.C.
DESIGNED: G. GILLES
CHECKED: J. DUNN
CHECKED: _____

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
CONTRACT N62470-93-D-3032 DELIVERY ORDER NO.0083
OHM PROJECT No. 17536 MARINE CORPS BASE CAMP LEJEUNE, N.C.

FIGURE 1
COVER SHEET AND VICINITY MAP
OU 10 SITE 35

DRAWING NUMBER: —
SHEET NUMBER: OF
DATE: 9/26/97

G:\OHM2\CAMP GEIGER\17536\COVER.DWG

LEGEND

DESCRIPTION		DESCRIPTION	
CONTOUR LINES	18	SPOT ELEVATION	11.33
GUY WIRE		CHAIN LINK FENCE	
SANITARY SEWER MANHOLE	SMH	SAFETY FENCE	
MANHOLE (UTILITY UNKNOWN)	MH	SILT FENCE	SF
POWER POLE		MARSH	
TELEPHONE BOX AND LINE		TOP OR BOTTOM OF BERM OR SLOPE	
FIRE HYDRANT		RIPRAP	
CATCH BASIN	OR	RAILROAD TRACKS	
TREE		HEADWALL	
FLOW DIRECTION		CULVERT PIPE	
TREELINE		MONITORING WELL	MW-1
BUILDING	TC 341		
EDGE OF WATER			
PROPOSED HIGHWAY			
RIGHT-OF-WAY			

HOLE
HOLE
METAL PIPE
MC ROAD
MW-13
MW-25
35GWD-4
EMW-4
MW-23
EMW-2
MW-20
EMW-3
MW-17
EMW-6
MW-18
35GWD-2
MW-16
MW-19
EMW-7
35GWD-5
MW-22
MW-26A
PW-28
MW-26B
MW-27
TC 474
TC 473
TC 470
GRASS
TC 572
TC 462
TC-560
TC-562
TC-569
CONC. FOUNDATION
PAVING
MAC PAD
MW-12
MW-11
MACADAM PAVING
MW-14
MW-15
EMW-1
MW-6
MW-5
MW-3
MW-4
MW-7
MW-10
MW-8
MW-1
MW-2
TC 341
MW-11
MW-16
GRAVEL
MW-9
TC 342
MW-12
MW-8
MW-17
G 480
CONC. PAD
35MW-31A
35MW-31B
EMW-5
APPROXIMATE BOUNDARY OF PHASE I INTERIM REMEDIAL ACTION WORK AREA
5TH STREET
E STREET
F STREET
G-554
G-553
G-552
G-560
MW40B
BRINSON CREEK
SWAMP
TW30AB
EL. 14.82
DIRT RD
MW60A
GS=7.60
TOP=10.08
MW60B
GS=7.10
TOP=9.59
GWD07
GS=7.30
TOP=9.41
TW31AB
EL. 9.50
SEE FIG.3 FOR ENLARGED SITE PLAN
APPROXIMATE RIGHT-OF-WAY FOR PROPOSED US ROUTE 17 AND JACKSONVILLE BYPASS
THIS AREA UNDER CONSTRUCTION
PUMP STATION (SEWAGE)
WOODED
BRINSON CREEK
ABANDONED RAILROAD
12" CMP
TRAIL
CONCRETE MONUMENT 1
X=2466818.2657
Y=362944.7053
Z=8.83
END WALL
DROP INLET
PINE TREE
PP
TC-564
TC 628
TC 630
MOBILE UNIT
100 0 50 100

OHM Remediation Services Corp.
Norcross, Georgia
A Subsidiary of OHM Corporation

SUBMITTED:	PROJECT MANAGER:	DATE:
APPROVED:	SR. PROJECT ENGINEER	DATE:
APPROVED:	DEPT. MANAGER	DATE:

AT FULL SCALE (IF NOT 2"-SCALE ACCORDINGLY)
CADD FILE:
DRAWN: J. LANGE/J.C.
DESIGNED: G. GILLES
CHECKED: J. DUNN
CHECKED:

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO.0083
OHM PROJECT No. 17536 — MARINE CORPS BASE CAMP LEJEUNE, N.C.

FIGURE 2
SITE LAYOUT
OU 10 SITE 35

DRAWING NUMBER: —
SHEET NUMBER: of
DATE: 9/26/97

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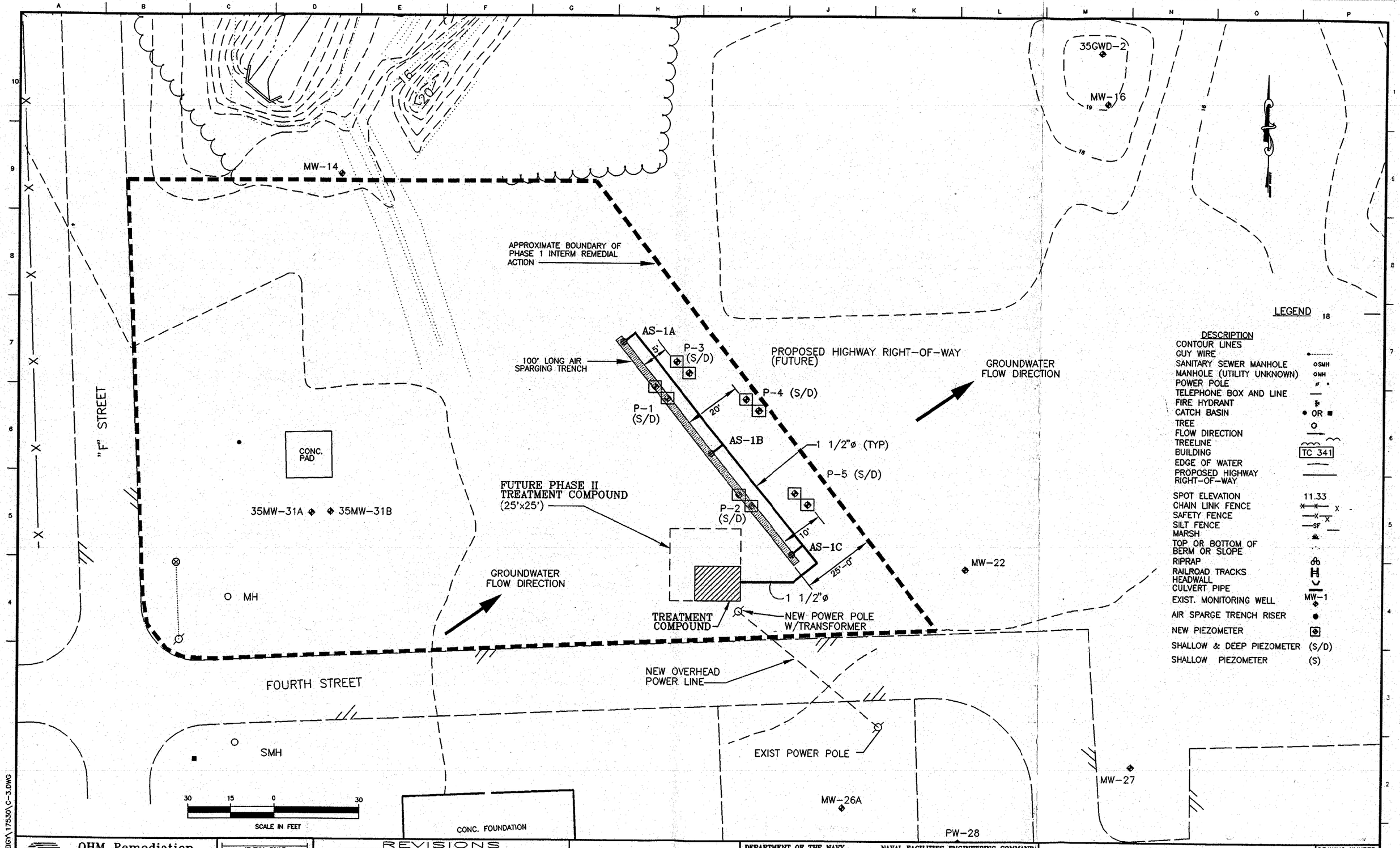

OHM Remediation Services Corp.
Norcross, Georgia
A Subsidiary of OHM Corporation

SUBMITTED: _____ PROJECT MANAGER: _____ DATE: _____
APPROVED: _____ SR. PROJECT ENGINEER _____ DATE: _____
APPROVED: _____ DEPT. MANAGER _____ DATE: _____

AT FULL SCALE (IF NOT 2"-SCALE ACCORDINGLY)
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DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO.0083
OHM PROJECT No. 17536 — MARINE CORPS BASE CAMP LEJEUNE, N.C.

FIGURE 3
PIPING PLAN AND NEW PIEZOMETER LOCATION MAP
OU 10 SITE 35

DRAWING NUMBER: —
SHEET NUMBER: of
DATE: 9/26/97

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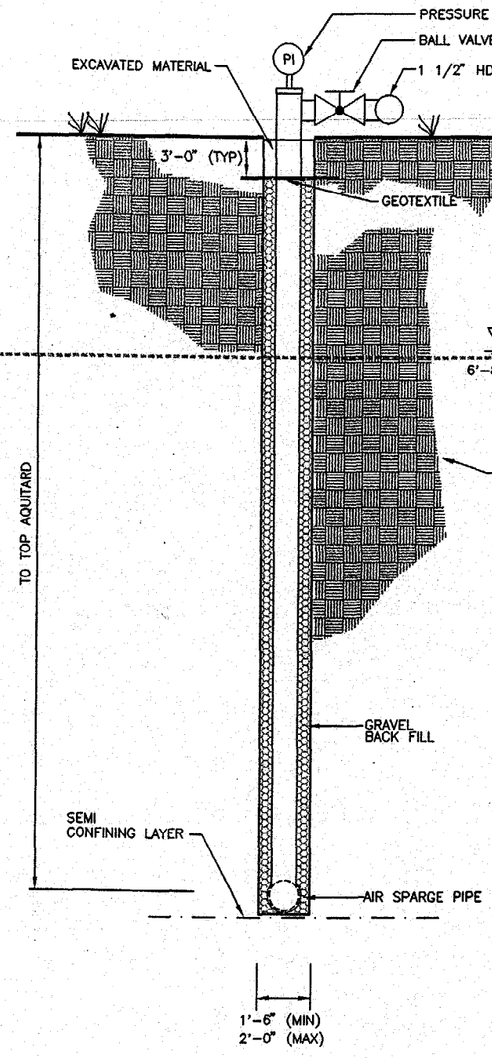
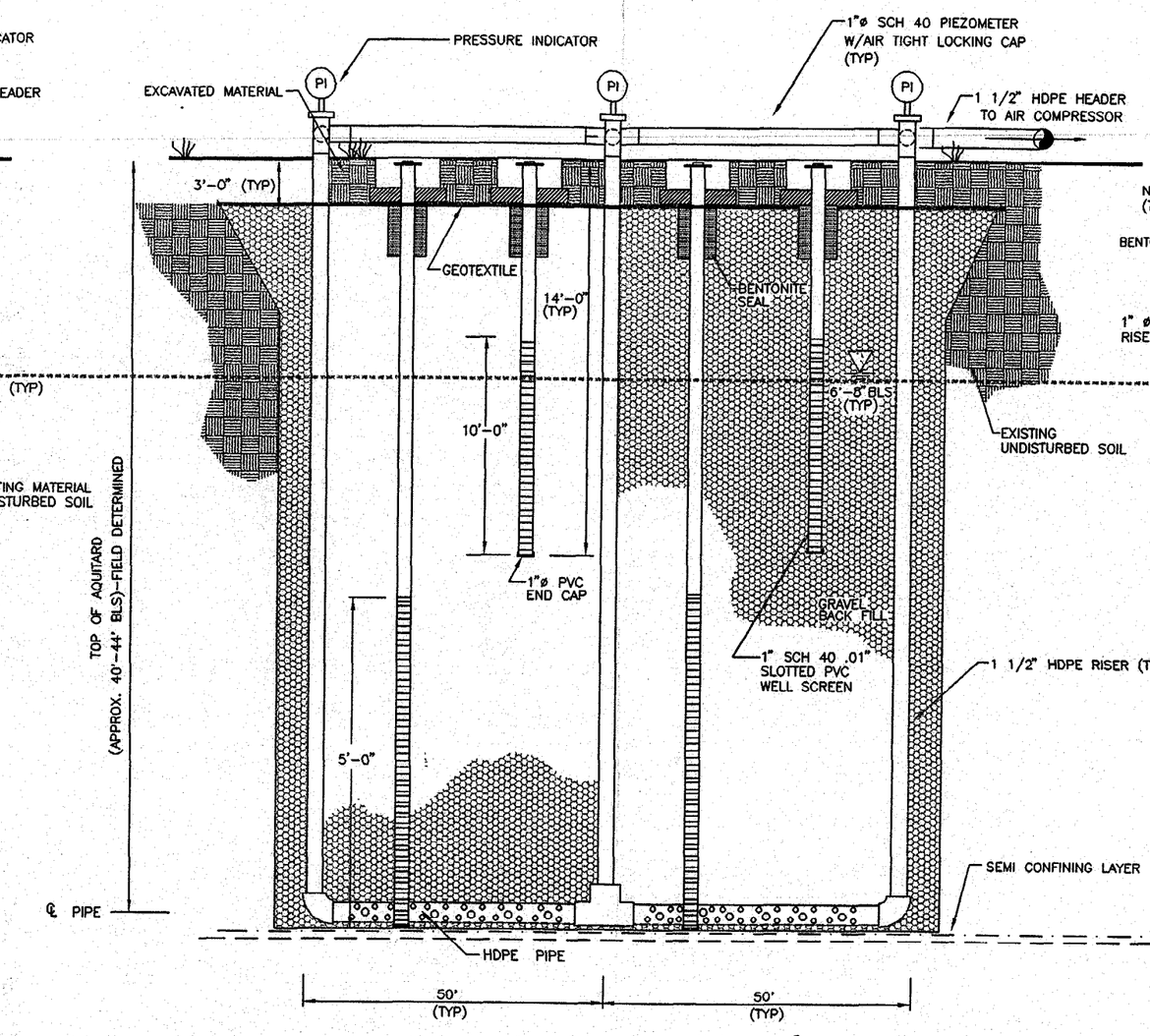


AIR SPARGING TRENCH ELEVATION

NOT TO SCALE

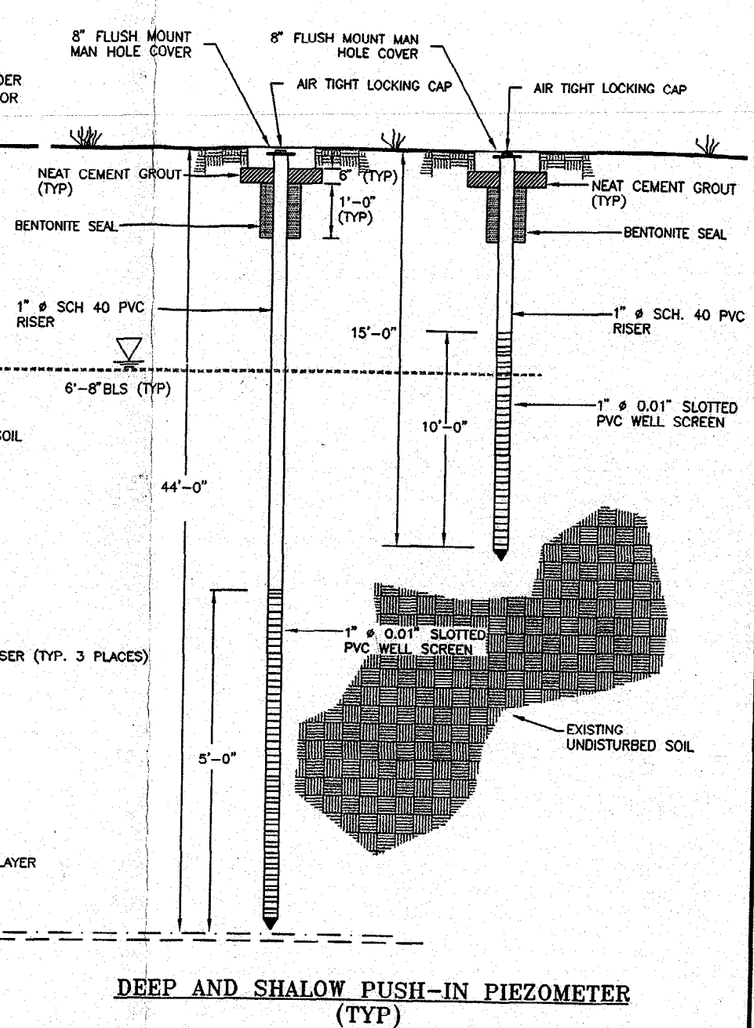
(LOOKING NORTH WEST)



AIR SPARGING WELL PROFILE

NOT TO SCALE

(LOOKING NORTH EAST)



DEEP AND SHALOW PUSH-IN PIEZOMETER (TYP)

NOT TO SCALE

NOTES:

1. AIR SPARGING DISTRIBUTION PIPING FROM WELLHEAD TO COMPOUND IS AIR PRO™ HDPE
2. GRAVEL BACKFILL TO BE GRADED TO FILTER OUT SAND AND SILT WHICH MAY SEEP INTO THE TRENCH.
3. THE 100'-0" LONG AIR SPARGE PIPE LOCATED AT BOTTOM OF THE TRENCH SHALL BE HORIZONTAL ± 1'.

OHM Remediation Services Corp.
Norcross, Georgia
A Subsidiary of OHM Corporation

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APPROVED: _____ SR. PROJECT ENGINEER: _____ DATE: _____
APPROVED: _____ DEPT. MANAGER: _____ DATE: _____

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CADD FILE: _____
DRAWN: J. COLLINS
DESIGNED: L. PETTIT
CHECKED: G. GILLES
CHECKED: _____

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DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ATLANTIC DIVISION

NAVAL STATION — NORFOLK, VIRGINIA

CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO. 0083

OHM PROJECT No. 17536 — MARINE CORPS BASE CAMP LEJEUNE

FIGURE 4

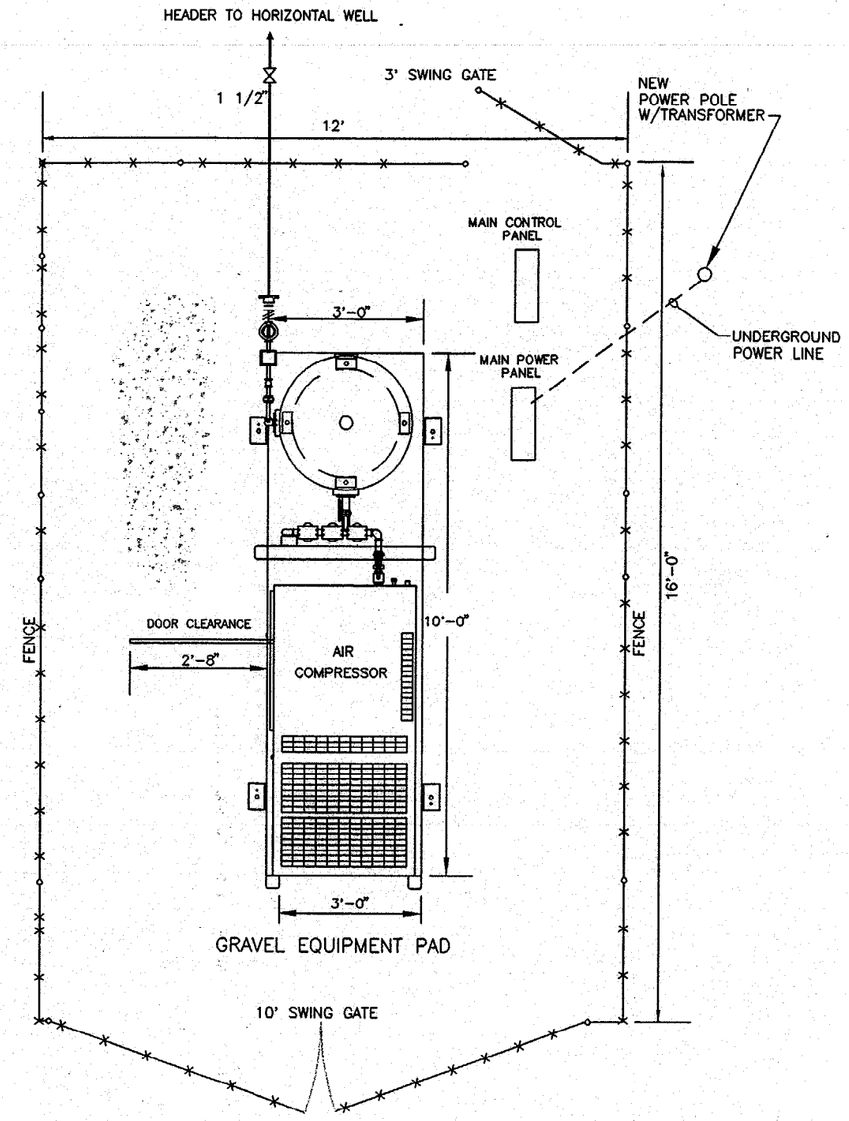
AIR SPARGING & PIEZOMETER WELL DETAILS OU10 SITE 35

DRAWING NUMBER: —

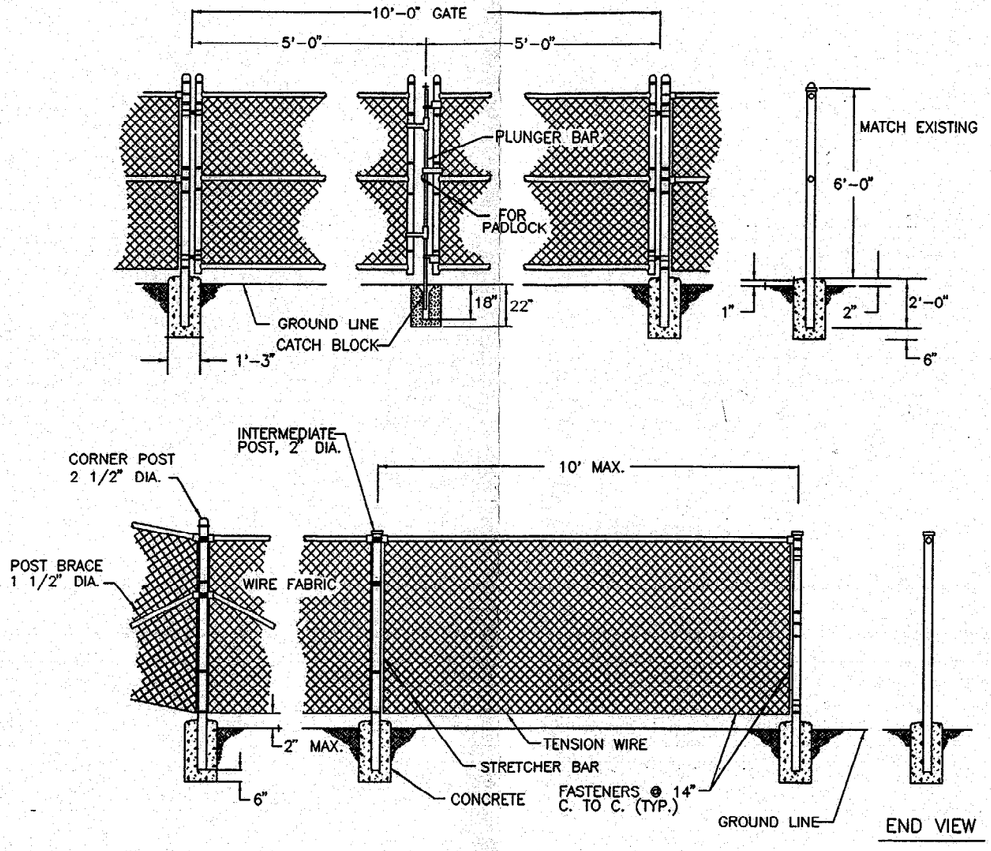
SHEET NUMBER: of

DATE: 9/26/97

G:\OHM2\GEIGER\FIG1.DWG



EQUIPMENT COMPOUND
NTS



CHAIN LINK GATE AND FENCE
DETAILS
NOT TO SCALE

NOTES:
1. PROPOSED LAYOUT IS PRELIMINARY; ACTUAL LAYOUT WILL BE FINALIZED UPON EQUIPMENT VENDER SELECTION.
2. NOT ALL PIPING OR ELECTRICAL SERVICE SHOWN.
3. A MINIMUM OF 4" GRAVEL WILL BE PLACED ON ALL GROUND SURFACE AREAS INSIDE THE EQUIPMENT COMPOUND THAT ARE NOT COVERED WITH CONCRETE OR ASPHALT.

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CADD FILE: FIG8.DWG
DRAWN: J. COLLINS
DESIGNED: G. GILLES
CHECKED: J. DUNN
CHECKED: _____

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DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO. 0083
OHM PROJECT No. 17536 — MARINE CORPS BASE, CAMP LEJEUNE, N.C.

FIGURE 5
EQUIPMENT COMPOUND AND DETAILS
OU 10 SITE 35

DRAWING NUMBER: —
SHEET NUMBER: of
DATE: 9/26/97

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LEGEND

VALVES

- BALL VALVE
- CLOSED BALL VALVE
- BUTTERFLY VALVE (OPEN)
- BUTTERFLY VALVE (CLOSED)
- CHECK VALVE
- GATE VALVE
- GATE VALVE (CLOSED)
- REGULATOR WITH EXTERNAL TAP
- AIR PRESSURE REGULATOR
- 2-WAY SOLENOID
- SAMPLE PORT

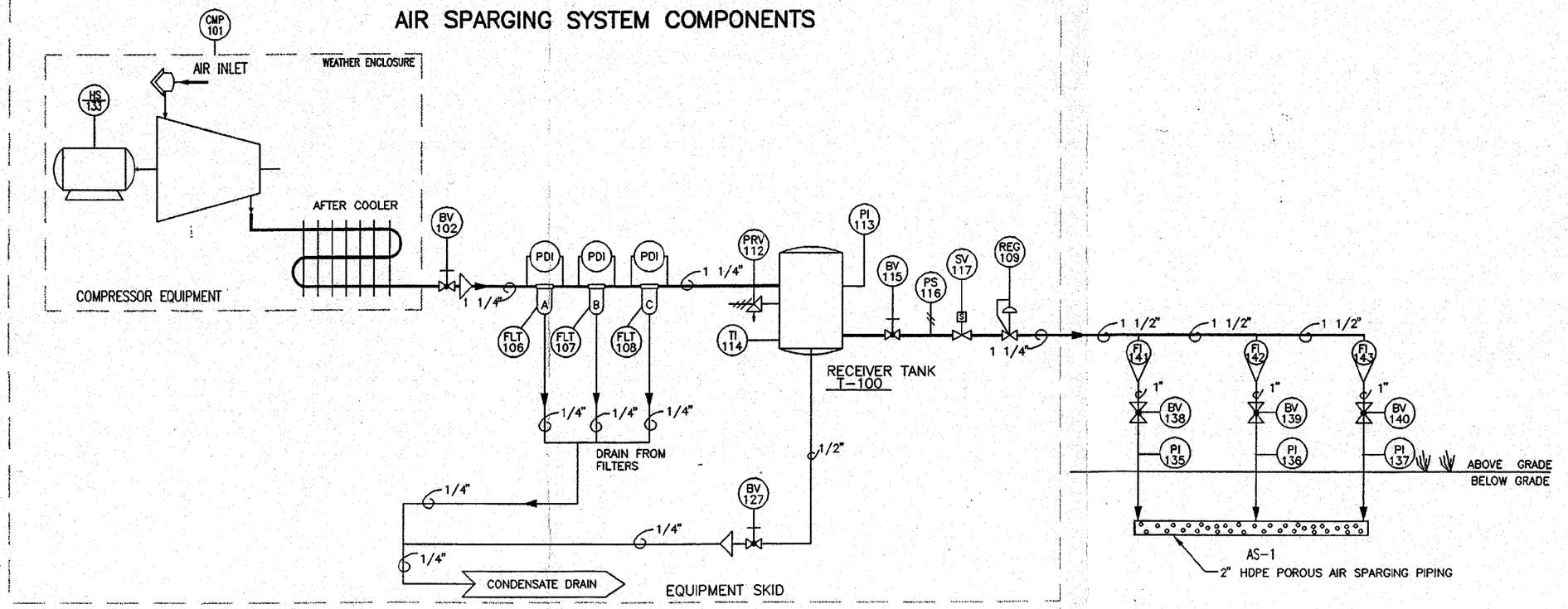
SAFETY RELIEFS

- AIR PRESSURE RELIEF VALVE
- VACUUM SAFETY VALVE (PSV)
- COMPRESSOR
- AIR FILTER
- FLOW TOTALIZER
- (A) OIL REMOVING FILTER
- (B) COALESCING FILTER
- (C) ADSORBING FILTER

INSTRUMENTS

- (PI) PRESSURE INDICATOR
- (PS) PRESSURE SWITCH
- (TI) TEMPERATURE INDICATOR
- (TS) TEMPERATURE SWITCH
- (PI 110) LOCAL MOUNTED INSTRUMENTS
- (HS #) PANEL MOUNTED HAND-OFF-AUTO INSTRUMENT
- (LSL) LEVEL SWITCH LOW
- (LSH) LEVEL SWITCH HIGH
- (LSA) LEVEL ALARM
- (FI) FLOW METER
- (FS) FLOW SWITCH

AIR SPARGING SYSTEM COMPONENTS



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DESIGNED: G. GILLES
CHECKED: J. DUNN
CHECKED: _____

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ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO.0063
OHM PROJECT No. 17530 — MARINE CORPS BASE CAMP LEJEUNE, N.C.

FIGURE 6
PROCESS AND INSTRUMENTATION DIAGRAM-AIR SPARGE SYSTEM
OU 10 SITE 35

DRAWING NUMBER: —
SHEET NUMBER: of
DATE: 9/26/97

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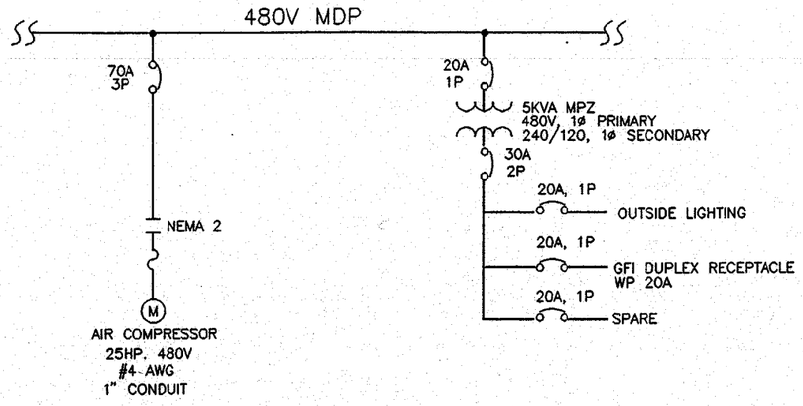
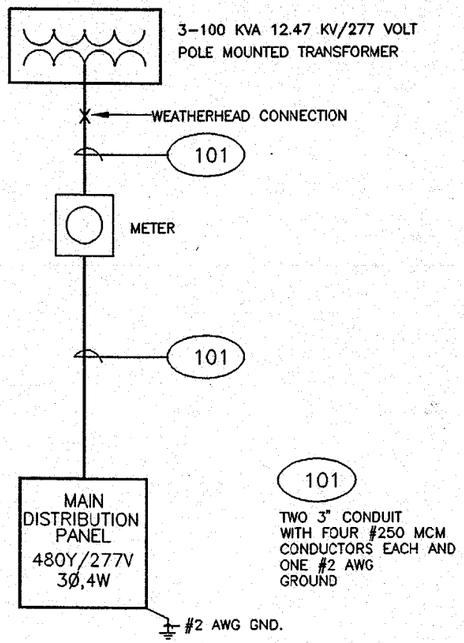
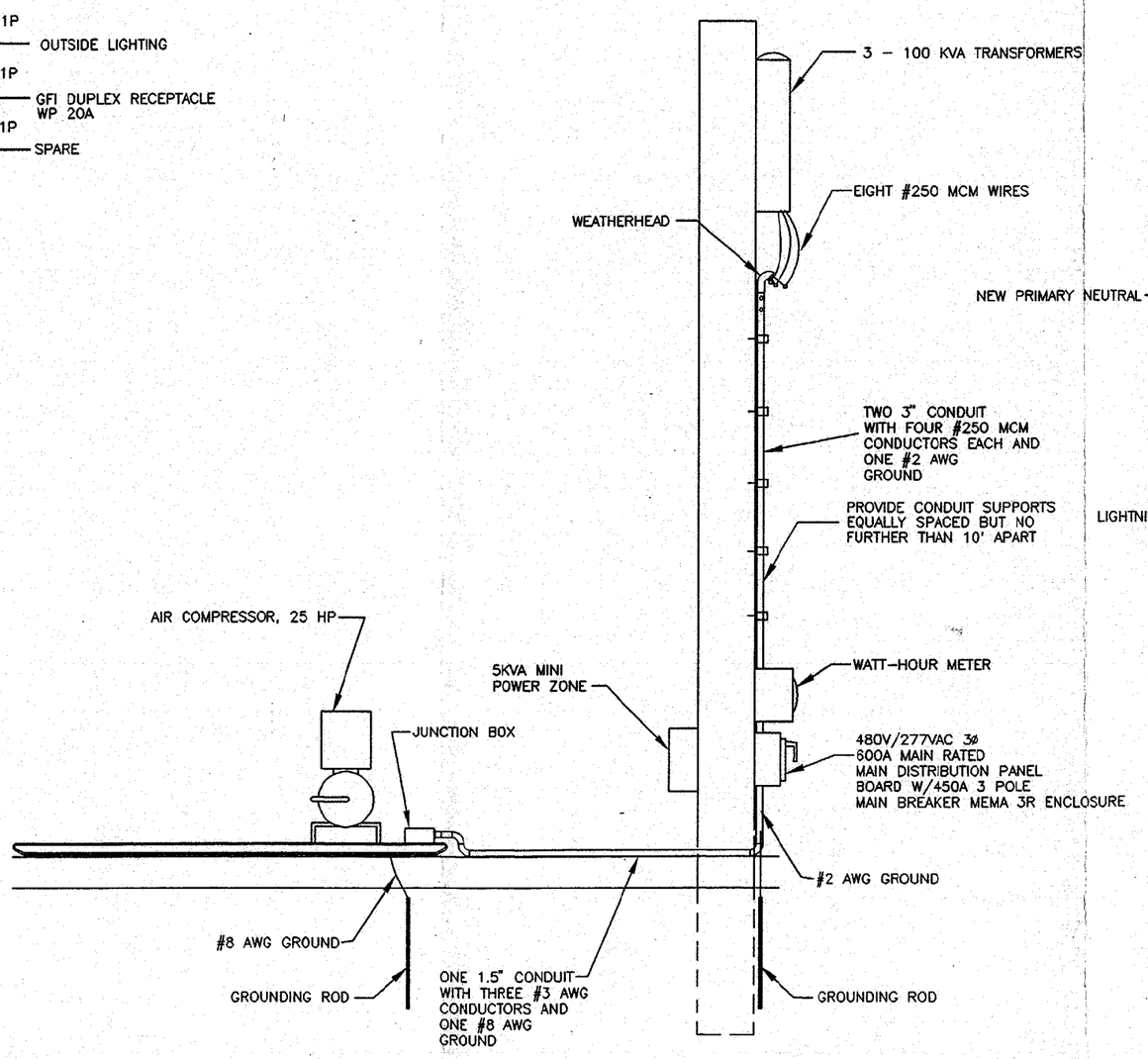


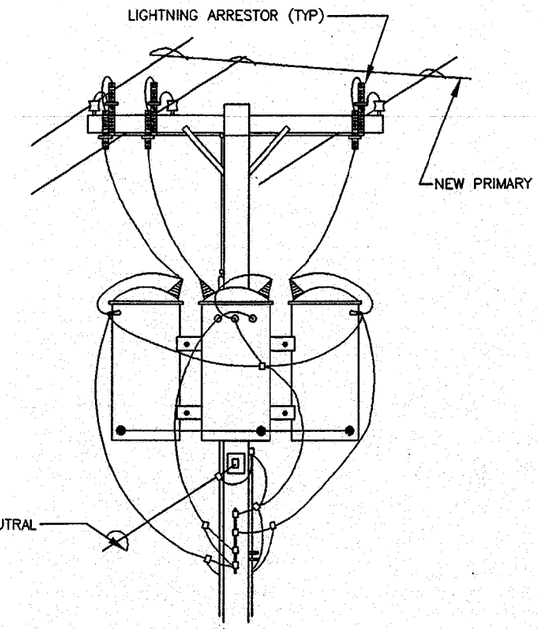
ONE LINE DIAGRAM
N.T.S.



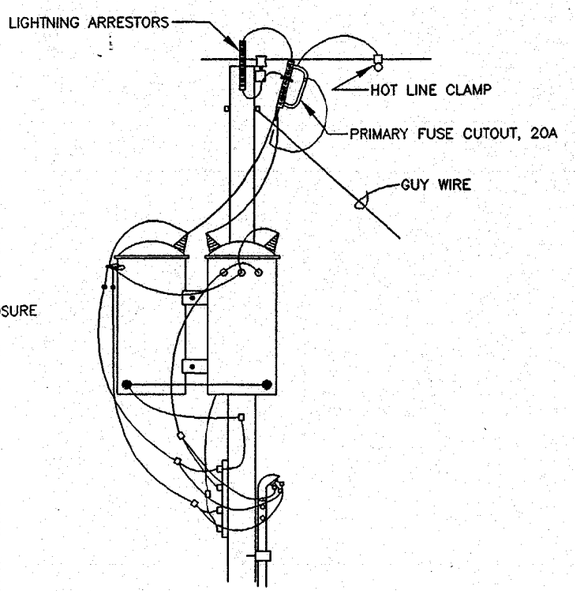
POWER DISTRIBUTION BLOCK DIAGRAM
N.T.S.



MAIN DISTRIBUTION PLAN
N.T.S.



ELEVATION
N.T.S.



SIDE ELEVATION
N.T.S.

OHM Remediation Services Corp. Norcross, Georgia A Subsidiary of OHM Corporation	NOT TO SCALE	DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND	FIGURE 7
SUBMITTED: PROJECT MANAGER DATE:	CADD FILE: FIG7.DWG	ATLANTIC DIVISION	MAIN ELECTRICAL DISTRIBUTION DETAILS OU10 SITE 35
APPROVED: SR. PROJECT ENGINEER DATE:	DRAWN: J. McCARTHY	NAVAL STATION NORFOLK, VIRGINIA	DRAWING NUMBER:
APPROVED: DEPT. MANAGER DATE:	DESIGNED: J. McCARTHY	LANTDIV RAC CONTRACT N62470-93-D-3032 DELIVERY ORDER NO. 083	SHEET NUMBER: _ of
	CHECKED: R. KESKONIS	OHM PROJECT NO. 17536 MARINE CORPS BASE, CAMP LEJEUNE, N.C.	DATE: 4/30/97
	CHECKED: J. DUNN		

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C:\OHM\CAMP GEIGER\17536\FIG7.DWG

SITE-SPECIFIC HEALTH AND SAFETY PLAN
FOR
SITE 35 OPERABLE UNIT 10
CAMP GEIGER AREA FUEL FARM
MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Delivery Order 0083

Prepared by

OHM Remediation Services Corp.
Norcross, Georgia

John Franz, P.E.
Program Manager

James A. Dunn, Jr., P.E.
Project Manager

Mark S. Wilson, CIH
Southern Region Health and Safety Manager

September 1997

OHM Project No. 17536

OHM Remediation Services Corp.

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed for United States Navy, LANTDIV, Delivery Order 0083 entitled, Operable Unit No. 10, Site 35, Camp Geiger Area Fuel Farm, Camp Lejeune, North Carolina. The Delivery Order will be executed per the requirements stated in the Final Statement of Work (SOW) for Service Delivery Order per Contract No. N62470-93-D-3032, Delivery Order 083, in cooperation with the Navy. This Delivery Order will also be executed in accordance with Naval Facilities Control Plan (NAVFAC) Specification No. 05-93-3124 dated September 27, 1994.

This HASP documents the policies and procedures which protect workers and the public from potential hazards posed by work at this site. OHM considers safety the highest priority during work at a site containing potentially hazardous materials and has established a goal of zero accidents for all projects. All projects will be conducted in a manner which minimizes the probability of injury, accident, or incident occurrence. This HASP is a key element in the proper planning of project work which is necessary to assure the goal of zero accidents. The HASP Certification (Appendix A) will be signed by all who actively participate at this project.

Although this plan focuses on the specific work activities planned for this site, it must remain flexible because of the nature of this work. Conditions may change and unforeseen situations may arise that require deviations from the original plan. This flexibility allows modification by the OHM supervisors and health and safety officials with approval from the project CIH.

This plan has been prepared in accordance with OSHA's "Hazardous Waste Operations and Emergency Response" standard contained in 29 CFR 1910.120 and the U. S. Army Corps of Engineers's (USACE's) Safety and Health Requirements Manual (COE EM-385-1-1, September 1996).

1.1 SITE HISTORY AND DESCRIPTION

Camp Lejeune is located in Onslow County, North Carolina. Camp Lejeune currently covers approximately 234 square miles and is bisected by the New River, which flows in a southeasterly direction and forms a large estuary before entering the Atlantic Ocean. The west and northwest borders of Camp Lejeune are defined by U. S. Route 17 and State Route 24, respectively. The eastern border is defined by the Atlantic Ocean shoreline while the City of Jacksonville, North Carolina, borders Camp Lejeune to the north.

Camp Geiger is located at the extreme northwest corner of Camp Lejeune and contains a mixture of troop housing, personnel support and training facilities. The main entrance is located along U.S. Route 17, approximately 3.5 miles southeast of the City of Jacksonville, North Carolina. Camp Geiger is roughly bounded by Brinson Creek to the north and northeast, an abandoned Seaboard Railroad right-of-way to the east, Curtis Road to the south, and U. S. Route 17 to the west.

Site 35, Camp Geiger Area Fuel Farm refers to a former fuel storage and dispensing facility that was located just north of the intersection of Fourth and "G" Streets, prior to its demolition in the spring of 1995. The facility consisted primarily of five, 15,000-gallon aboveground storage tanks (ASTs), a pump house, a fuel loading/unloading pad, an oil/water separator, and a distribution island.

The Phase I IRA will be implemented in an area located along the southern boundary of the proposed U. S. Highway 17 Bypass right-of-way, immediately south of the former fuel farm, and north of the intersection of Fourth and "G" Streets.

Construction of Camp Lejeune began in 1941 with the objective of developing the "Worlds Most Complete Amphibious Training Base." Construction started at Hadnot Point, where the major functions of Camp Lejeune are centered. Development at Camp Lejeune is primarily in five geographical locations under the jurisdiction of the Base Command. These areas include Camp Geiger, Montford Point, Courthouse Bay, Mainside and the Rifle Range Area.

Construction of Camp Geiger was completed in 1945, four years after construction of Camp Lejeune was initiated. Originally, the Fuel Farm ASTs were used for the storage of No. 6 fuel oil. An underground distribution line (now abandoned) extended from the ASTs to the former Mess Hall Heating Plant, located adjacent to "D" Street, between Third and Fourth Streets. The underground line dispensed No. 6 fuel oil to a UST which fueled the Mess Hall Boiler. The Mess Hall, located across "D" Street to the west, is believed to have been demolished along with its Heating Plant in the 1960s. At some unrecorded date, the fuel farm was converted for storage of other petroleum products, including unleaded gasoline, diesel fuel and kerosene.

From the date of this conversion until the facility was decommissioned in the spring of 1995, the ASTs at Site 35 were used to dispense gasoline, diesel and kerosene to government vehicles, and to supply underground storage tanks (USTs) in use at Camp Geiger and the nearby New River Marine Corps Air Station. The ASTs were supplied by commercial carrier trucks which delivered product to fill ports located on the fuel loading/unloading pad located south of the ASTs. Six, short-run (120 feet maximum), underground fuel lines were utilized to distribute the product from the unloading pad to the ASTs.

During the lifetime of the facility, several releases of product occurred. Reports of a release from an underground distribution line near one of the ASTs date back to 1957-58 (ESE. 1990). Apparently, the leak occurred as the result of damage to a dispensing pump. At that time, the Camp Lejeune Fire Department estimated that thousands of gallons of fuel were released although records of the incident have since been destroyed. The fuel reportedly migrated to the east and northwest toward Brinson Creek. Interceptor trenches were excavated and the captured fuel was ignited and burned.

Routinely, the ASTs at Site 35 supplied fuel to an adjacent dispensing pump that was supplied by an underground line. A leak in an underground line at the station was reportedly responsible for the loss of roughly 30 gallons per day of gasoline over an unspecified period (Law, 1992). The leaking line was subsequently sealed and replaced.

In April 1990, an undetermined amount of fuel was discovered by Camp Geiger personnel along two unnamed drainage channels north of the fuel farm. Apparently, the source of the fuel, believed to be diesel or jet fuel, was an unauthorized discharge from a tanker truck that was never identified. Camp Lejeune reportedly initiated an emergency cleanup which included the removal of approximately 20 cubic yards of soil.

The fuel farm was decommissioned and demolished during the spring of 1995. The ASTs were emptied, cleaned, dismantled, and removed along with all concrete foundations, slabs on grade, berms and associated underground piping. The fuel farm was demolished to make way for the U.S. Highway 17 Bypass.

In addition to the fuel farm dismantling, soil remediation activities were executed between the spring of 1995 and the spring of 1996 along the proposed U. S. Highway 17 Bypass right-of-way as directed by the Interim Remedial Action Record of Decision for Petroleum Hydrocarbon Contaminated Soil, that was executed on September 15, 1994.

Remedial Investigations

Site-wide comprehensive remedial investigation field activities were initiated by Baker in April 1994. The purpose of these activities was to provide additional data in order to assess the impact on aquatic and benthic species in Brinson Creek, support a site-wide risk assessment, determine the full nature and extent of halogenated organic contamination in the surficial aquifer, and support an interim FS. Field activities included the following: a soil gas and groundwater screening investigation; a soil investigation; a groundwater investigation; a surface water/sediment investigation; and an ecological investigation.

In general, the results were as follows:

- There were relatively few detection of VOCs and semivolatile organic compounds (SVOCs) in the subsurface and surface soil samples. Pesticides were detected in surface soil, but were not deemed to the site related.

- Extensive organic groundwater contamination was observed in both the upper and lower portions of the surficial aquifer. However, the extent of solvent-related contamination in the lower portion of the surficial aquifer appeared to extend beyond the southern limits of the RI, and was, therefore, not adequately defined.

- The northeastern edge of the solvent-related groundwater contamination plume was not delineated. From the RI data, it was impossible to determine if Brinson Creek was acting as a hydraulic barrier to groundwater contamination migrating off-site onto Onslow County property.

- Elevated levels of inorganic contaminants were also detected in groundwater samples collected from the surficial aquifer and appeared to be due to the sampling methods used.

- Significant levels of organic and inorganic contamination were detected in the sediment samples. However, some problems were experienced with this data. Detections of organic contamination were masked by a high number of tentatively identified compounds (TICs) and some inorganic data was rejected by professional data validators. Surface water contamination was limited to a single detection of lead and zinc at a sampling location downstream of Site 35.

- The human health risk associated with Site 35 was determined to be in excess of the acceptable range. The total risk was driven by future potential exposure to groundwater and current potential exposure to fish.

- The ecological risk assessment determined that there were no significant adverse impacts to terrestrial receptors from site-related contaminants.

1.2 SCOPE OF WORK

The project consists of installing and operating air sparging. The following tasks will be performed:

- Mobilization and site preparation
- Install and develop wells for monitoring air sparging
- Excavate trench and install piping for air sparging
- Installation of power, control and associated electrical equipment
- Equipment installation and plumbing
- System startup and testing
- System operation and maintenance
- Groundwater monitoring
- Decontaminate equipment
- Demobilization

These activities have been analyzed for potential hazards for which hazard control measures are provided in Section 3.4 Activity Hazard Analysis.

2.0 KEY PERSONNEL AND MANAGEMENT

The Project Manager (PM), Site Supervisor (SS), Certified Industrial Hygienist (CIH) and Site Safety Officer (SSO) are responsible for formulating and enforcing health and safety requirements, and implementing the HASP.

2.1 PROJECT MANAGER

The PM has the overall responsibility for the project and to assure that the goals of the construction remedial action are attained in a manner consistent with the HASP requirements. The PM will coordinate with the SS and the SSO to assure that the remedial action goals are completed in a manner consistent with the HASP. The PM will identify contacts and telephone numbers, with assistance from LANTDIV, of local health care providers, the NOSC/NOSCDR, the LEPC and other agencies that may be asked to provide emergency support during project activities. The PM will conduct a monthly health and safety audit of the project using the Management Health and Safety Report Form.

2.2 SITE SUPERVISOR

The SS is responsible for field implementation of the HASP. The SS will coordinate with the SSO to establish communications with local health care providers, the NOSC/NOSCDR, the LEPC and other outside organizations and agencies that may be asked to provide emergency support during project activities. The SS will be the main contact in any on-site emergency situation. The SS will conduct periodic inspection of the work site to confirm compliance with all health and safety requirements. The SS is also responsible for coordinating remedial actions for all deficiencies and for enforcing the OHM "Cardinal Safety Rules" (included in Appendix E) and the site specific health and safety procedures (included in Appendix B).

2.3 SITE SAFETY OFFICER

The SSO has responsibility for administering the HASP relative to site activities, and will be in the field full-time while site activities are in progress. The SSO's primary operational responsibilities include personal and environmental monitoring, coordination of job safety analyses, personal protective equipment maintenance, and assignment of protection levels. The SSO will direct all field activities involved with safety and is authorized to stop work when an imminent health or safety risk exists. The SSO is responsible for assuring that all on-site personnel understand all safety requirements.

2.4 CERTIFIED INDUSTRIAL HYGIENIST

The CIH is responsible for the contents of the HASP and ensures that the HASP complies with all federal, state and local health and safety requirements. If necessary, the CIH can modify specific aspects of the HASP to adjust for on-site changes that affect safety. The CIH

will coordinate with the SSO on all modifications to the HASP and will be available for consultation when required. The CIH will not necessarily be on site during OHM activities; however, he may perform site safety audits to confirm field compliance with the HASP.

2.5 EMPLOYEE SAFETY RESPONSIBILITY

Each employee is responsible for personal safety as well as the safety of others in the area. The employee will use all equipment provided in a safe and responsible manner as directed by the SS. All OHM personnel will follow the policies set forth in OHM's Health and Safety Procedures Manual, with particular emphasis on the OHM "Cardinal Safety Rules." which will be maintained on-site by the site safety officer. Specific health and safety procedures applicable to this project are provided in Appendix D of this plan.

2.6 KEY SAFETY PERSONNEL

The following individuals share responsibility for health and safety at the site.

Project Manager	Jim Dunn (770) 734-8072
Site Supervisor	Randy Smith (site phone)
Site Safety Officer	Stan Queener (site phone)
Program Manager for LANTDIV	John Franz, P.E. (609) 588-6477
SR Health and Safety Director/Project CIH	J. Angelo Liberatore, CIH (770) 453-7671 (office) 1-800-999-6710 PIN 997-6102 (pager)
Vice President, Health and Safety	Fred Halvorsen, Ph.D., PE, CIH 800-231-7031 (office)

3.0 JOB HAZARD ANALYSIS

This section outlines the potential chemical and physical hazards which workers may be exposed to during work on this project. Table 3.1 lists significant contaminants identified at the site and their respective published occupational exposure limits. The OSHA permissible exposure limits (PELs) and the ACGIH threshold limit values (TLVs) were reviewed for these contaminants, evaluated, and the more stringent value of the two selected as exposure guidelines. An MSDS list is included in Appendix C.

3.1 CHEMICAL HAZARDS

Petroleum Hydrocarbons Products (Organic Solvents)

Gasoline *Threshold Limit Value = 350 ppm*
Diesel *NA*
Jet Fuel *NA*
Fuel Oil *NA*

Petroleum products can cause dry skin, irritation, anesthetic effects, loss of coordination, central nervous system depression, and death. Overexposure may cause an exaggerated sense of well being, excitement, headache, dizziness, incoherent speech, narcosis, central nervous system stimulation and then depression, respiratory paralysis, respiratory irritation, vomiting, skin cancer, and death. Fuels have been associated with skin and kidney cancer.

Gasoline is a clear, colorless (dye may be added for color), flammable liquid with an aromatic odor. It will form flammable mixtures with air at -45 F. Vapors are heavier than air with a vapor density of 3 to 4 (air = 1), and the liquid is lighter than water with a specific gravity of 0.72 to 0.76 (water = 1). It is extremely flammable and vapors can travel great distances to an ignition source and flash back to the source.

Benzene Permissible Exposure Limit – 1 ppm

Benzene is listed as a cancer-causing substance. Liquid contact with skin or eyes causes painful irritation and possible burns. Vapors may cause irritation of the eyes, nose, and throat; dizziness; headache; slurred speech; double vision; central nervous system depression; coma, leukemia and death.

Benzene is a clear, colorless, volatile liquid with a sweet aromatic odor. Odor is not a good warning. Benzene will form flammable vapor-air mixtures at approximately 12°F. The vapor is heavier than air with a vapor density of 2.7 (air = 1) and the liquid is lighter than water with a specific gravity of 0.87 (water = 1).

Ethyl Benzene Permissible Exposure limit – 100 ppm

Ethyl benzene overexposure may cause irritation of the eyes, respiratory tract, and skin; dermatitis; headache; dizziness; fatigue; incoordination; central nervous system depression; coma; and death from respiratory center paralysis. Liquid splashed in the eyes may cause irritation and damage.

Ethyl benzene is a clear, colorless, flammable liquid with an aromatic odor. It will form flammable mixtures with air at 64°F. Vapors are heavier than air with a vapor density of 3.7 (air = 1) and the liquid is lighter than water with a specific gravity of 0.86 (water = 1).

Toluene Threshold Limit Value – 400 ppm
Toluene overexposure may cause irritation of the eyes, respiratory tract, and skin; headache; dermatitis; dizziness; fatigue; incoordination; central nervous system depression; coma; and death. Liquid splashed in the eyes may cause irritation and damage.

Toluene is a clear, colorless, flammable liquid with an aromatic odor. It will form flammable mixtures with air at 53°F. Vapors are heavier than air with a vapor density of 3.14 (air = 1) and the liquid is lighter than water with a specific gravity of 0.78 (water = 1.1).

Xylene Permissible Exposure Limit – 100 ppm
Xylene overexposure may cause irritation of the eyes, respiratory tract, and skin; dermatitis; headache; dizziness; fatigue; incoordination; liver and kidney damage, central nervous system depression; coma; and death. Liquid splashed in the eyes may cause irritation and damage.

Xylene is a clear, colorless, flammable liquid with an aromatic odor. It will form flammable mixtures with air at 81°F. Vapors are heavier than air with a vapor density of 3.7 (air = 1) and the liquid is greater than water with a specific gravity of 0.86 (water = 1).

Chlorinated Organic Solvents
Chlorinated organic solvents can cause dry skin, irritation, anesthetic effects, loss of coordination, depress the central nervous system, and death. Chlorinated organic solvents have been associated with various cancers and damage to the major organ system such as skin, lung, liver, heart, and blood.

1,2 dichloroethane Threshold Limit Value – 10 ppm
Dichloroethane vapors may cause irritation of the eyes, nose, and throat; dizziness; headache; slurred speech; double vision; central nervous system depression; coma, liver damage and death.

Dichloroethane is a clear, colorless, volatile liquid with a sweet chloroform like odor. Odor is not a good warning. Dichloroethane will form flammable vapor-air mixtures at approximately 56°F. The vapor is heavier than air with a vapor density of 3.4 (air = 1) and the liquid is heavier than water with a specific gravity of 1.25 (water = 1).

Perchloroethylene Threshold Limit Value = 25 ppm
Perchloroethylene overexposure may cause irritation of the eyes, respiratory tract, and skin; headache; dermatitis; dizziness; fatigue; incoordination; central nervous system depression; liver

damage, coma; and death. Liquid splashed in the eyes may cause irritation and damage.

Perchloroethylene is a clear, colorless, non-flammable liquid with an ether-like odor. Vapors are slightly heavier than air with a vapor density of 1.08 (air = 1), and the liquid is heavier than water with a specific gravity of 1.63 (water = 1).

Trichloroethylene *Threshold Limit Value – 50 ppm*
Liquid contact with skin or eyes causes painful irritation and dry skin. Vapors may cause irritation of the eyes, nose, and throat; dizziness; headache; slurred speech; double vision; central nervous system depression; liver damage, kidney damage; coma; and death.

Trichloroethylene is a clear, colorless, highly-flammable, volatile liquid with a pleasant, sweetish odor. It will form flammable mixtures with air at 90°F. Vapors are heavier than air with a vapor density of 2 (air = 1) and the liquid is heavier than water with a specific gravity of 1.27 (water = 1).

3.2 PHYSICAL HAZARDS

To minimize physical hazards, OHM has developed standard safety protocols which will be followed at all times. Failure to follow safety protocols will result in expulsion of an employee from the site and appropriate disciplinary actions.

The SS and SSO will observe the general work practices of each crew member and equipment operator, and enforce safe procedures to minimize physical hazards. Hard hats, safety glasses, and steel-toe safety boots are required in all areas of the site. Site-specific hazards and all necessary precautions will be discussed at the daily safety meetings. The Health and Safety Procedures Manual for LANTDIV will be maintained at the project site as a reference document.

The following sections are typical safety hazards that may occur at project site along with relevant hazard control procedures.

- **Heavy and Bulky Loads**
  Intelligent thought shall be exercised before heavy and bulky loads are lifted or handled manually by personnel. Mechanical equipment such as fork-lifts, wheel barrows, hand-trucks, loaders, and cranes shall be utilized when possible and needed. **Note: Back injuries are real, debilitating, unproductive, and costly to both employees and employers, and sometime permanent. Back injury prevention must be given high priority on all project sites. If you think the load you are about to lift is too heavy or bulky, it probably is! Get help or utilize mechanical equipment.**

- **Flame, Heat or Spark Producing Operations**
  Because of the possibilities of flammable materials being present at this site, flame, heat, or spark producing operations will be limited. If a case arises where hot work is necessary, OHM will follow the hot work procedures and permit detailed in the appendix.

- **High Pressure Washing**
  Washing or cleaning certain pieces of equipment may require the use of high pressure washers, referred to as lasers. These devices can be hazardous if not used properly. Specific laser safety instructions are provided in Procedure No. 30. The following protective equipment will be worn: safety shoes or boots, metal foot and shin guards, goggles and face shield, hard hat, heavy-duty PVC rain suit, heavy chemical resistant gloves. Only trained personnel will operate the high pressure washer. The operator must have an assistant to move the hose and back-up the operator. Other personnel must remain a minimum of 25 feet from the area. The equipment cannot be altered. (Trigger shall never be tied down.) Operator should be changed every hour. Hydroblasting lacerations are serious and must be reported.

- **Small Quantity Flammable Liquids**
  Small quantities of flammable liquids will be stored in "safety"cans and labeled according to contents.

- **Electrical Hazards**
  Overhead power lines, downed electrical wires, and buried cables all pose a danger of shock or electrocution if workers contact or sever them during site operations. Electrical equipment used on-site may also pose a hazard to workers. To help minimize this hazard, low-voltage equipment with ground-fault interrupters and water-tight, corrosion-resistant, connecting cables will be used on-site. In addition, lightning is a hazard during outdoor operations, particularly for workers handling metal containers or equipment. To eliminate this hazard, weather conditions will be monitored and work will be suspended during electrical storms. An additional electrical hazard involves capacitors that may retain a charge. All such items will be properly grounded before handling. OSHA's standard 29 CFR Part 1910.137 describes clothing and equipment for protection against electrical hazards.

  Electrical devices and equipment must be de-energized prior to working near them. All extension cords must be kept out of water, protected from crushing, and inspected regularly to ensure structural integrity. Temporary electrical circuits must be protected with ground fault interrupters. Only qualified electricians are authorized to work on electrical circuits.

- **Slip/Trip/Fall Hazards**
  Some areas may have wet surfaces which will greatly increase the possibility of inadvertent slips. Caution must be exercised when using steps and stairs due to slippery surfaces in conjunction with fall hazards. Use of handrails when climbing stairs will be enforced, and handrails will remain secure until the support itself is removed and lowered to ground level. Good housekeeping practices are essential to minimize trip hazards. Safety belts or harnesses will be required by personnel working four feet or more above surfaces, including manlifts.

  The work area shall be kept clean and orderly. Tools and debris must be picked up and placed in the proper place to prevent a tripping hazard. Walkways and grating shall be kept in good condition. Spills will be cleaned up immediately. Personnel shall not walk or climb on piping, valves, fittings, or any other equipment not designed as walking surfaces.

- **Ground Personnel**
  All ground personnel should be constantly aware of the possibility of slips, trips, and falls due to poor and possibly slippery footing in the work areas. before crossing either in front of or behind a piece of heavy equipment, ground personnel will signal the equipment operator and receive confirmation before moving.

- **Head and Back Injuries**
  As minimum requirements, hard hats and safety glasses will be donned prior to performing any site activities. This requirement will prevent minor injuries caused by bumping one's head while working around and under piping and other process related structures. At the daily safety meeting, personnel are instructed in proper lifting techniques and reminded not to lift heavy items without assistance.

- **Falling Objects**
  OHM believes that the dismantlement process as well as other remediation processes can be accomplished without any object, regardless of size, free falling to the ground. All support structures will be slowly lowered to the ground using a grapple and/or skip bucket. No personnel shall work under this equipment at any time. Also, the SSO will ensure that an adequate area is clear of personnel while the equipment is in operation.

- **Confined Space Entry**
  A Confined Space Entry (ES) is defined as an enclosed area having a limited means of egress where ventilation is not adequate to remove a toxic or flammable atmosphere or oxygen deficiency which may exist. Examples of ESs include, but are not limited to the following: tanks, boilers, vessels, bins, manholes, tunnels, pipelines, underground utility vaults, or any open top space more than 4 feet in depth, such as pits, tubes, trenches, or

vessels. Procedure No. 24 in the OHM Health and Safety Procedures Manual outlines OHM's entry procedures in detail.

The OHM Confined Space Permit will be completed before entry. The written rescue plan will include the type of equipment to be used and the names of the rescue and standby personnel. The atmosphere will be monitored for oxygen, combustible gases, and toxins. All personnel will be trained for confined space entry. The confined space will be ventilated, purged when possible and isolated. and locked out and tagged out if there are mechanical or electrical hazards.

The SS will be responsible for securing the permit. The permit will list employees performing work, monitoring the work, and will also list rescue personnel and employees conducting the pre-entry briefing. The permit will provide type of confined space preparation performed, pre-entry atmosphere testing results, emergency/rescue procedures, entry/egress requirements, other potential hazards, subcontractor notifications, and the permit authorization signature.

- **Equipment and Hand Tools**
  All hand tools and power tools shall be in good repair and will be used only for the task for which they were designed. All damaged tools will be tagged "Out of Service." All tools will be kept clean. Sharp tools shall not be carried in pockets. When working, overhead tools will be placed in a holding receptacle or secured when not in use. Tools cannot be thrown or dropped from heights. Only non-sparking tools will be used in flammable or explosive atmospheres. Cheater pipes will not be used.

- **Ladders**
  Access to high places will be obtained by using approved ladders and stairs in accordance with ANSI 14.1-3. Ladders will be used for access to and from the excavation.

3.3 ENVIRONMENTAL HAZARDS

Environmental factors such as weather, wild animals, insects, and irritant plants pose a hazard when performing outdoor work. The SSO and SS will take all necessary measures to alleviate these hazards should they arise.

3.3.1 Heat Stress

The combination of warm ambient temperature and protective clothing result in the potential for heat stress. Heat stress disorders include:

- Heat rash

- Heat cramps
- Heat exhaustion
- Heat stroke

Heat stress prevention is outlined in procedure No. 22 of the OHM Corp. Health and Safety Procedures manual. This information will be reviewed during safety meetings. Workers will be encouraged to increase consumption of water and electrolyte-containing beverages (eg, Gatorade).

The following is a summary of the signs and symptoms of heat stress disorders.

- Heat rash – characteristic rash which may develop on the skin in areas which may be chapped by clothing. Frequent clothing changes help to prevent chapping from contact with wet clothes.

- Heat cramps – caused by heavy sweating and inadequate electrolyte replacement. Provide frequent breaks with fluid replacement. Cramps are usually relieved when victim is moved to a cool resting place and provided fluids every 15 minutes for approximately 1 hour. Symptoms include:
  - Muscle spasms
  - Pain in the hands, feet, abdomen

- Heat exhaustion – caused by increased stress of various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Immediately remove the victim from the hot environment and provide rest while lying the victim down with feet elevated, and care for shock. Attempt to cool the victim by fanning or applying wet towels. Provide fluid replacement every 15 minutes and refer for medical evaluation if not improved within 30 minutes. Symptoms include:
  - Pale, cool, moist skin
  - Heavy sweating
  - Dizziness
  - Nausea
  - Fainting

- Heat stroke – temperature regulation fails and the body core temperature rises to critical levels. Immediate action must be taken to cool the body. Competent medical care must be obtained immediately since this is a life threatening disorder. Symptoms include:
  - Hot, dry skin, usually red, mottled or cyanotic
  - 104° temperature
  - Confusion, dizziness
  - Loss of consciousness

- Convulsions
- Strong, rapid pulse

It is recommended that workers break at least every two hours for 10 to 15 minute rest periods when temperatures rise above 72.5 degrees F and protective clothing is worn. Ambient temperatures will be determined from a Hg/glass thermometer shielded from radiant heat. In addition, workers are encouraged to take rests whenever they feel any adverse effects that may be heat-related. The frequency of breaks may need to be increased upon worker recommendation to the SSO and SS. Heat stress can be prevented by assuring an adequate work/rest schedule; guidelines are printed below.

AMBIENT TEMPERATURE	LEVEL D PPE	LEVEL C PPE/ MODIFIED LEVEL D
90° F or above	After 45 minutes of work	After 15 minutes of work
87.5 F-90 F	After 60 minutes of work	After 30 minutes of work
82.5-87.5 F	After 90 minutes of work	After 60 minutes of work
77.5-82.5 F	After 120 minutes of work	After 90 minutes of work
72.5-77.5 F	After 150 minutes of work	After 120 minutes of work

The work/rest schedule can be calculated based on heat stress monitoring results. Monitoring consists of taking the radial pulse of a worker for 30 seconds immediately after exiting the work area. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by 1/3 and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, decrease the work period by 1/3. The initial rest period should be at least 10 minutes.

Monitoring for heat stress will begin when the ambient temperature reaches or exceeds 70 degrees Fahrenheit when wearing Level C PPE, or 80 degrees Fahrenheit for site activities performed in Level D. Monitoring will include pulse rate,weight loss, oral temperature and signs and symptoms of heat stress. The employees radial pulse will be monitored for 30 seconds to determine heart rate. When monitored, oral temperatures (OT) will be obtained utilizing a clinical thermometer or equivalent. If the employees' OT exceeds 99.6°F, the work period will be reduced by 1/3. If after this work period, the oral temperature still exceeds 99.6°F, the work period will again be shortened by 1/3. If the employee's OT exceeds 100.6°F, the employee will not be permitted to wear PPE. See Procedure 22 LANTDIV Health and Safety Procedures Manual.

3.3.2 Exposure to Cold

With outdoor work in the winter months, the potential exists for hypothermia and frostbite. Protective clothing greatly reduces the possibility of hypothermia in workers. However, personnel will be instructed to wear warm clothing and to stop work to obtain more clothing if they become too cold. Employees will also be advised to change into dry clothes if their clothing becomes wet from perspiration or from exposure to precipitation. Since wind chill temperature takes into account the potential for loss of body heat through convection, the wind-chill adjusted temperature will be used to evaluate for potential cold stress occurrence.

In cold weather, the potential for frostbite exists, especially in body extremities. Personnel will be instructed to pay particular attention to hands, feet, and any exposed skin when dressing. Personnel will be advised to obtain more clothing if they begin to experience loss of sensation due to cold exposure.

Employees will be encouraged to use the heated shelters on site at regular intervals depending upon the severity of ambient temperatures. When temperatures are less than 20°F (actual or wind chill) workers should break regularly to the heated shelter to warm up (every 45 minutes at a minimum). Since cold weather does cause significant water loss as a result of the dryness of the air, fluid intake will be encouraged to prevent dehydration which directly affects blood volumes and flow to the extremities. Warm, sweet, caffeine-free, nonalcoholic drinks and soup offer the best fluid replacement and provide calorie energy. Symptoms of cold stress, including heavy shivering, excessive fatigue, drowsiness, irritability, or euphoria necessitate immediate return to the shelter.

3.3.3 Project Hazard Communication

The purpose of hazard communication (Employee Right-to-Know) is to ensure that the hazards of all chemicals located at this field project site are transmitted (communicated) according to 29 CFR 1926.59 to all OHM personnel and OHM subcontractors. OHM's Corporate Hazard Communication Program is included in Appendix B for reference. Hazard communication will include the following:

- **Container Labeling**
  OHM personnel will ensure that all drums and containers are labeled according to contents. These drums and containers will include those from manufacturers and those produced on site by operations. All incoming and outgoing labels shall be checked for identity, hazard warning, and name and address of responsible party.

- **Material Safety Data Sheets (MSDSs)**
  There will be an MSDS located on site for each hazardous chemical known to be used on site. All MSDSs will be located in Appendix C of the SHSP. The site safety plan can be found in the project office trailer.

- **Employee Information and Training**
  Training employees on chemical hazards is accomplished through on ongoing corporate training program. Additionally, chemical hazards are communicated to employees through daily safety meetings held at OHM field projects and by an initial site orientation program.

At a minimum, OHM and related subcontractor employees will be instructed on the following:

- Chemicals and their hazards in the work area
- How to prevent exposure to these hazardous chemicals
- What the company has done to prevent workers' exposure to these chemicals
- Procedures to follow if they are exposed to these chemicals.
- How to read and interpret labels and MSDSs for hazardous substances found on OHM sites
- Emergency spill procedures
- Proper storage and labeling

Before any new hazardous chemical is introduced on site, each OHM and related subcontractor employee will be given information in the same manner as during the safety class. The site supervisor will be responsible for seeing that the MSDS on the new chemical is available for review by on site personnel. The information pertinent to the chemical hazards will be communicated to project personnel.

Morning safety meetings will be held and the hazardous materials used on site will be discussed. Attendance is mandatory for all on site employees.

Refer to Appendix C of the site safety plan to find a list of hazardous chemicals anticipated to be brought to the site and the corresponding MSDSs for these chemicals.

3.3.4 Noise

Hearing protection is required for workers operating or working near heavy equipment, where the noise level is greater than 85 dbA (Time Weighted Average) as well as personnel working around heavy equipment. The SSO will determine the need and appropriate testing procedures, (i.e., sound level meter and/or dosimeter) for noise measurement.

3.4 TASK-SPECIFIC RISK ASSESSMENT/ACTIVITY HAZARD ANALYSIS

Prior to beginning each major phase of work, an activity hazard analysis (form included in Appendix E) will be performed. The analysis will define the activity being performed, identify the sequence of work, the specific hazards anticipated and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level.

Work will not proceed on that project phase until the activity hazard analysis has been accepted by the designated on-site authority, as well as being discussed with all site personnel that will perform the activity. The following Task-Specific Risk Assessment/Activity Hazard Analysis identifies the major project phases and anticipated hazards to be encountered and control measures that will be instituted during the execution of the scope of work, previously approved by LANTDIV for this project.

Task Breakdown	Potential Hazards	Hazard Control Measures
Mobilization and Site Preparation Subtasks: Equipment mobilization Installation facilities Utility connections	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Use reflective warning vests when exposed to vehicular traffic • Isolate equipment swing areas • Make eye contact with operators before approaching equipment • Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times • Understand and review posted hand signals
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads • Do not exceed equipment/crane load specifications when hoisting loads • Do not suspend loads over ground personnel
	Electrical Shock	• De-energize or shut off utility lines at their source before work begins • Use double insulated or properly grounded electric power-operated tools • Provide an equipment-grounding conductor program or employ ground-fault circuit interrupters • Use qualified electricians to hook up electrical circuits • Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation • Cover or elevate electric wire or flexible cord passing through work areas to protect from damage • Keep all plugs, cords, and receptacles out of water • Use approved water-proof, weather-proof type if exposure is likely • Inspect all electrical power circuits prior to commencing work • Follow Lockout/Tagout procedures in accordance with OHM Health and Safety Procedures Manual
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 10 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear specified level of protection when entering building to identify salvageable materials
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work areas, flammable storage areas, generator and compressor facilities • Store flammable liquids in well ventilated areas • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate Flammables and Oxidizers by 20 feet
	Contact Dermatitis	• Wear PPE to avoid skin contact with contaminated surfaces or other skin irritants when installing testing/water treatment system or handling treatment chemicals

Task Breakdown	**Potential Hazards**	**Hazard Control Measures**
Install Wells for Monitoring Air Sparging	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 6 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and contact with hazardous substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear splash shield and saran coveralls when soaking, handling wet materials, pressure washing
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work areas, flammable storage areas, generator and compressor facilities • Store flammable liquids in well ventilated areas • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate flammables and oxidizers by 20 feet.
	Rotating Equipment	• Stay clear of rotating equipment • Wear close fitting clothes • Place four guide wires on drilling rig • Place cowl on drill string to prevent airborne dust • Use wetting agents for dust suppression
	Buried and Overhead Electrical Utility Hazards	• Maintain 15-foot buffer between heavy equipment and overhead electrical utilities • Locate all buried utilities prior to drilling
	Noise	• Personnel will wear hearing protection above 85 dBa • Personnel will be included in a hearing conservation program

Task Breakdown	**Potential Hazards**	**Hazard Control Measures**
Trenching and Pipe Installation for air sparging; trench will be 40 feet deep; place slurry in trench	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 6 feet or more above the ground or leading edge of trench • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and contact with hazardous substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear specified level of protection
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work areas, flammable storage areas, generator and compressor facilities • Store flammable liquids in well ventilated areas • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate Flammables and Oxidizers by 20 feet
	Excavation Cave-in	• All underground installations will be located and marked • All materials must be kept 2 feet from the excavation edge • Daily inspections of the excavations will be conducted by a competent person and soil type determined • The OHM excavation permit will be used • Excavations for piping trenches and others requiring personnel entry will not be greater than 4 feet deep • Excavations with potential hazardous atmosphere must be tested O_2/LEL/toxic • Follow OHM SOP for excavation
	Utility (electric/gas)	• Locate all buried utilities prior to excavation operations • Maintain 15-foot buffer between heavy equipment and overhead electrical utilities

Task Breakdown	Potential Hazards	Hazard Control Measures
Installation of power control, associated electrical equipment	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work areas, flammable storage areas, generator and compressor facilities • Store flammable liquids in well ventilated areas • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate flammables and oxidizers by 20 feet.
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 6 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and contact with hazardous substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear specified level of protection
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work areas, flammable storage areas, generator and compressor facilities • Store flammable liquids in well ventilated areas • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate Flammables and Oxidizers by 20 feet

Task Breakdown	Potential Hazards	Hazard Control Measures
Equipment Installation and Plumbing	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads
	Electrical Shock	• De-energize or shut off utility lines at their source before work begins • Use double insulated or properly grounded electric power-operated tools • Provide an equipment-grounding conductor program or employ ground-fault circuit interrupters • Use qualified electricians to hook up electrical circuits • Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation • Cover or elevate electric wire or flexible cord passing through work areas to protect from damage • Keep all plugs, cords, and receptacles out of water • Use approved water-proof, weather-proof type if exposure is likely • Inspect all electrical power circuits prior to commencing work • Follow Lockout/Tagout procedures in accordance with OHM Health and Safety Procedures Manual
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 6 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Crane Operation	• Prepare lift plan • Inspect all rigging prior to use • Load limits on crane, hooks, hoist, sling, wire rope cannot be exceeded

Task Breakdown	**Potential Hazards**	**Hazard Control Measures**
System Start-up and Testing	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads
	Electrical Shock	• De-energize or shut off utility lines at their source before work begins • Electrical circuits must be tested and proved to be de-energized before work begins • Use double insulated or properly grounded electric power-operated tools • Provide an equipment-grounding conductor program or employ ground-fault circuit interrupters • Use qualified electricians to hook up electrical circuits • Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation • Cover or elevate electric wire or flexible cord passing through work areas to protect from damage • Keep all plugs, cords, and receptacles out of water • Use approved water-proof, weather-proof type if exposure is likely • Inspect all electrical power circuits prior to commencing work • Follow Lockout/Tagout procedures in accordance with OHM Health and Safety Procedures Manual
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 6 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and contact with hazardous substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear specified level of protection
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work areas, flammable storage areas, generator and compressor facilities • Store flammable liquids in well ventilated areas • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate Flammables and Oxidizers by 20 feet
	Contact Dermatitis	• Wear PPE to avoid skin contact with contaminated surfaces
	Pumping equipment operation	• Inspect hoses and pumping equipment before use • Do not leave pumps and pressurized hoses unattended while operating • Use double diaphragm pumps for flammable liquids • Ensure proper grounding and bonding of equipment
	Spills/Splash	• Wear splash protection • Clean up spills immediately

Task Breakdown	Potential Hazards	Hazard Control Measures
Collect groundwater samples	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 10 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear splash protection when sampling liquids, sludges
	Contact Dermatitis	• Wear PPE to avoid skin contact with contaminated surfaces or other skin irritants when sampling water treatment influent, effluent, or treatment chemicals

Task Breakdown	Potential Hazards	Hazard Control Measures
Equipment Decontamination	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Use reflective warning vests when exposed to vehicular traffic • Isolate equipment swing areas • Make eye contract with operators before approaching equipment • Barricade or enclose the work area • Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period)
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads • Do not exceed equipment load specifications • Do not suspend loads over ground personnel • Ground personnel near cleaning vats wear splash shield and apron
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 10 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear splash shield and saran coveralls when soaking, handling wet materials, pressure washing • Collect and contain spent wash water for proper disposal
	Burns	• Use proper gloves, face shield/safety goggles, shin and toe guards, and splash suits to protect workers from skin burns and injury when operating hot water/steam laser (high pressure washers)

Task Breakdown	Potential Hazards	Hazard Control Measures
Demobilization	Struck by, Against Heavy Equipment, Flying Debris, Protruding Objects	• Use reflective warning vests when exposed to vehicular traffic • Isolate equipment swing areas • Make eye contact with operators before approaching equipment • Restrict entry to the work area to authorized personnel • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 pounds maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large awkward loads • Do not exceed equipment/crane load specifications when hoisting loads • Do not suspend loads over ground personnel
	Electrical Shock	• De-energize or shut off utility lines at their source before work begins • Use double insulated or properly grounded electric power-operated tools • Provide an equipment-grounding conductor program or employ ground-fault circuit interrupters • Use qualified electricians to hook up electrical circuits • Inspect all extension cords daily for structural integrity, ground continuity, and damaged insulation • Cover or elevate electric wire or flexible cord passing through work areas to protect from damage • Keep all plugs, cords, and receptacles out of water • Use approved water-proof, weather-proof type if exposure is likely • Inspect all electrical power circuits prior to commencing work • Follow Lockout/Tagout procedures in accordance with OHM Health and Safety Procedures Manual
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Use body harness and lifeline when working 10 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual
	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Wear specified level of protection when entering building to identify salvageable materials
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking • Provide ABC (or equivalent) fire extinguishers in all work areas, flammable storage areas, generator and compressor facilities • Store flammable liquids in well ventilated areas • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate Flammables and Oxidizers by 20 feet
	Contact Dermatitis	• Wear PPE to avoid skin contact with contaminated surfaces or other skin irritants when dismantling testing, water treatment system or handling treatment chemicals

4.0 WORK AND SUPPORT AREAS

To prevent migration of contamination caused through tracking by personnel or equipment, work areas and personal protective equipment will be clearly specified prior to beginning operations. OHM has designated work areas or zones as suggested by the NIOSH/OSHA/ USCG/EPA'S document titled, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities." Each work area will be divided into three zones as follows:

- An Exclusion or "hot" Zone (EZ)
- A Contamination Reduction Zone (CRZ)
- A Support Zone (SZ)

4.1 EXCLUSION ZONE

The EZ is the area suspected of contamination and presents the greatest potential for worker exposure. Personnel entering the area must wear the mandated level of protection for that area. In certain instances, different levels of protection will be required depending on the tasks and monitoring performed within that zone.

4.2 CONTAMINATION REDUCTION ZONE

The CRZ or transition zone will be established between the EZ and SZ. In this area, personnel will begin the sequential decontamination process required to exit the EZ. To prevent off-site migration of contamination and for personnel accountability, all personnel will enter and exit the EZ through the CRZ.

4.3 SUPPORT ZONE

The SZ serves as a clean, control area. Operational support facilities are located within the SZ. Normal work clothing and support equipment are appropriate in this zone. Contaminated equipment or clothing will not be allowed in the SZ. The support facilities should be located upwind of site activities. There will be a clearly marked controlled access point from the SZ into the CRZ and EZ that is monitored closely by the SSO and the SS to ensure proper safety protocols are followed.

4.4 SITE CONTROL LOG

A log of all personnel visiting, entering or working on the site shall be maintained in the main office trailer location. The log will record the date, name, company or agency, and time entering or exiting the site.

No visitor will be allowed in the EZ without showing proof of training and medical certification. Visitors will supply their own boots and respiratory equipment, if required. Visitors will attend a site orientation given by the SSO and sign the HASP.

4.5 GENERAL

The following items are requirements to protect the health and safety of workers and will be discussed in the safety briefing prior to initiating work on the site.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth transfer and ingestion of contamination is prohibited in the EZ and CRZs.

- All personnel exiting the exclusion zone or the contamination reduction zone, must at a minimum, thoroughly wash their face and hands.

- A buddy system will be used. Hand signals will be established to maintain communication.

- During site operations, each worker will consider himself as a safety backup to his partner. Off-site personnel provide emergency assistance. All personnel will be aware of dangerous situations that may develop.

- Visual contact will be maintained between buddies on site when performing hazardous duties.

- No personnel will be admitted to the site without the proper safety equipment, training, and medical surveillance certification.

- All personnel must comply with established safety procedures. Any staff member who does not comply with safety policy, as established by the SSO or the SS, will be immediately dismissed from the site.

- Proper decontamination procedures must be followed before leaving the site.

- All employees and visitors must sign in and out of the site.

5.0 PROTECTIVE EQUIPMENT

This section addresses the various levels of personal protective equipment (PPE) which are or may be required at this job site. OHM personnel are trained in the use of all PPE utilized.

5.1 ANTICIPATED PROTECTION LEVELS

Task	Protection Level
Mobilization and site preparation	Level D
Drill and install well	Level C/Modified D
Trenching and install piping	Level D clean soil Modified D/Level C contaminated soil
Installation of power, control and associated electrical equipment	Level D
Equipment installation and plumbing	Level D
System startup and testing	Modified D with tyvek
System operation and maintenance	Modified D with tyvek
Groundwater monitoring	Modified D with tyvek and face shield
Equipment Decontamination	Modified D with full face shield and saran
Demobilization	Level D

Hearing protection will be required for all personnel whenever the noise level is above 85 dBa.

5.2 PROTECTION LEVEL DESCRIPTIONS

This sections lists the minimum requirements for each protection level. Modification to these requirements will be noted above.

5.2.1 Level D

Level D consists of the following:

- Safety glasses with side shields
- Hard hat
- Steel-toed work boots
- Work clothing as prescribed by weather

5.2.2 Modified Level D

Modified Level D consists of the following:

- Safety glasses with side shields
- Hard hat
- Steel-toed work boots
- Nitrile, neoprene, latex or PVC overboots
- Outer nitrile, neoprene, or PVC gloves over latex sample gloves
- Face shield (when projectiles or splashes pose a hazard)
- Tyvek coverall [Polyethylene-coated Tyveks required when workers have a potential to be exposed to contaminated liquids or sludges.]

5.2.3 Level C

Level C consists of the following:

- Full-face, air-purifying respirator with appropriate cartridges
- Hooded Tyvek Coveralls [Polyethylene- or saran-coated Tyveks required when workers have a potential to be exposed to contaminated liquids or sludges].
- Hard hat
- Steel-toed work boots
- Nitrile, neoprene, latex or PVC overboots
- Nitrile, neoprene, or PVC gloves over latex sample gloves
- Face shield (when projectiles or splashes pose a hazard)

5.2.4 Level B

Level B protection consists of the items required for Level C protection with the exception that an air-supplied respirator is used in place of the air-purifying respirator.

5.2.5 Level A

Level A protection consists of the items required for Level B protection with the addition of a fully-encapsulating, vapor-proof suit capable of maintaining positive pressure.

5.3 SUPPLIED-AIR RESPIRATORS

If air monitoring shows that Level B protection is needed, OHM personnel will wear Survivair 9881-02 Hippack Airline respirators with 5-minute egress bottles. Personnel requiring Level "B" protection and high mobility will wear Survivair Mark 2 SCBA units.

5.4 BREATHING-AIR QUALITY

Code of Federal Regulations 29 CFR 1910.134 states breathing air will meet the requirement of the specification for Grade D breathing air as described in the ANSI/CGA Specification G-7.1-1989. OHM requires a certificate of analysis from vendors of breathing air in order to show that the air meets this standard. Breathing air will be obtained in cylinders exclusively and will be stationed in the exclusion zone (EZ).

5.5 AIR-PURIFYING RESPIRATORS

A NIOSH-approved full-face respirator with appropriate air-purifying cartridges will be used for Level C work.

5.6 RESPIRATOR CARTRIDGES

The crew members working in Level C will wear respirators equipped with air-purifying cartridges approved for the following contaminants.

- Organic vapors <1,000 ppm
- Chlorine gas <10 ppm
- Hydrogen chloride <50 ppm
- Sulfur dioxide <50 ppm
- Dusts, fumes and mists with a TWA <0.05 mg/m^3
- Asbestos-containing dusts and mists
- Radionuclides

5.7 CARTRIDGE CHANGES

All cartridges will be changed a minimum of once daily, or more frequently if personnel begin to experience increased inhalation resistance or breakthrough of a chemical warning property. Cartridges will be labeled with the date service began.

5.8 INSPECTION AND CLEANING

Respirators are checked periodically by a qualified individual and inspected before each use by the wearer. All respirators and associated equipment will be decontaminated and hygienically cleaned after each use.

5.9 FIT TESTING

All personnel required to wear an air-purifying respirator as part of their employment will be fit-tested at the time of assignment and a minimum of annually thereafter. The test will use isoamyl acetate or irritant smoke. The fit test must be for the style and size of the respirator to be used.

5.10 FACIAL HAIR

Personnel who have facial hair which interferes with the respirator's sealing surface will not be permitted to wear a respirator and will not be permitted to work in areas requiring respirator use.

5.11 CORRECTIVE LENSES

Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the respirator's sealing surfaces. For workers requiring corrective lenses, special spectacles designed for use with respirators will be provided.

5.12 CONTACT LENSES

Contact lenses will not be worn with any type of respirator.

5.13 MEDICAL CERTIFICATION

Only workers who have been certified by a physician as being physically capable of respirator usage will be issued a respirator. Personnel unable to pass a respiratory fit test or without medical clearance for respirator use will not be permitted to enter or work in areas on site that

require respiratory protection. Employees receive a written physicians opinion that they are fit for general hazardous waste operations as per 29 CFR 1910.120(f)(7).

5.14 SITE-SPECIFIC RESPIRATORY PROTECTION PROGRAM

The primary objective of respiratory protection is to prevent employee exposure to atmospheric contamination. When engineering measures to control contamination are not feasible, or while they are being implemented, personal respiratory protective devices will be used.

The criteria for determining respirator need have been evaluated based on the site contaminants and expected levels of protection are outlined in Section 5.1. Air monitoring will be conducted to confirm that respiratory protection levels are adequate (Section 7.0). All respirator users are OSHA trained in proper respirator use and maintenance. The SS and SSO will observe workers during respirator use for signs of stress. The SS, CIH, and SSO will also evaluate this HASP periodically to determine its continued effectiveness with regard to respiratory protection. All persons assigned to use respirators will have medical clearance to do so.

6.0 DECONTAMINATION PROCEDURES

This section describes the procedures necessary to ensure that both personnel and equipment are free from contamination when they leave the work site.

6.1 PERSONNEL DECONTAMINATION

Decontamination procedures will ensure that material which workers may have contacted in the EZ does not result in personal exposure and is not spread to clean areas of the site. This sequence describes the general decontamination procedure. The specific stages will vary depending on the work area, the task, the protection level, etc.

1. Go to end of EZ
2. Wash outer boots and gloves in detergent solution
3. Rinse outer boots and gloves in water
4. Remove outer boots and let dry
5. Remove outer gloves and let dry
6. Cross into CRZ
7. Remove SCBA or hip pack (Level B)
8. Remove first pair sample gloves
9. Remove outer saran or tyvek
10. Remove and wash respirator
11. Rinse respirator and hang to dry
12. Remove second pair sample gloves and discard

6.1.1 Suspected Contamination

Any employee suspected of sustaining skin contact with chemical materials will first use the emergency shower. Following a thorough drenching, the worker will proceed to the decontamination facility. Here the worker will remove clothing, shower, don clean clothing, and immediately be taken to the first-aid station. Medical attention will be provided as determined by the degree of injury.

6.1.2 Personal Hygiene

Before any eating, smoking, or drinking, personnel will wash hands, arms, neck and face. A personnel decontamination facility will be provided for site operations consisting of showers, change rooms, and separate lockers for street clothes and work clothes. Site personnel are required to shower daily at the completion of that day's work. Also, eye wash facilities and emergency showers will be provided at personnel decontamination facilities and at the water treatment system where hazardous chemicals are handled.

6.2 EQUIPMENT DECONTAMINATION

All contaminated equipment will be decontaminated before leaving the site. Decontamination procedures will vary depending upon the contaminant involved, but may include sweeping, wiping, scraping, hosing, or steaming the exterior of the equipment. Personnel performing this task will wear the proper PPE as prescribed by the SSO.

6.3 DISPOSAL

All decontamination liquids and disposable clothing will be collected, containerized and treated as contaminated waste, unless determined otherwise by accepted testing methods. Wastes will be disposed of according to state and federal regulations.

7.0 AIR MONITORING

Air monitoring will be conducted in order to determine airborne contamination levels. This ensures that respiratory protection is adequate to protect personnel against the chemicals that are encountered. The following air monitoring efforts will be used at this site. Additional air monitoring may be conducted at the discretion of the SSO.

The following chart describes the air monitoring required and appropriate action levels.

Monitoring Device	*Action Level*	*Action*
LEL/O_2 (work area) To be performed when drilling, excavation and trenching	>10% LEL <20.8% O_2	Evacuate area, ventilate, upgrade to Level B if necessary, continue to monitor
PID (Breathing Zone) To be performed when drilling, excavation and trenching	1-50 meter units for 5 min. 50 meter units or greater for 5 min.	Level C Level B

7.1 LOWER EXPLOSIVE LIMIT/OXYGEN (LEL/O2) METER

Prior to entering a confined-space area or performing hot work involving welding, cutting, or other high heat-producing operations where flammable or combustible vapors may be present, LEL/O_2 measurements will be taken.

7.2 PHOTOIONIZATION DETECTOR (PID)

A PID will be used to monitor total ionizable organic content of the ambient air. A PID will prove useful as a direct reading instrument to aid in determining if respiratory protection needs to be upgraded and to define the EZ.

For known contaminants only, to determine a protection level from PID data, the SSO will multiply the TLV of the known compound by 25. This will be the limit for Level C protection for that compound. If PID readings exceed 25 times the TLV, Level B protection will be required. Also, regardless of the TLV, a PID reading of 1,000 ppm or more will indicate that the GMC-H cartridges may become overloaded and will necessitate Level B protection. (Note: PID readings do not always indicate the actual air concentration of a compound. Consult the manual, HNU, or the CIH for clarification.)

The SSO will take measurements before operations begin in an area to determine the amount of organic compounds naturally occurring in the air. This is referred to as a

background level.

Levels of volatile organic compounds will be measured in the air at active work sites once every hour and at the support zone once every hour when levels are detected above background in the exclusion zone. If levels exceed background at any time in the support zone, work in the exclusion zone will cease and corrective actions will be taken, e.g., cover soil with polyethylene sheeting. Work will not resume until levels reach background in the support zone.

7.3 AIR MONITORING LOG

The SSO will ensure that all air-monitoring data is logged into a monitoring notebook. Data will include all information identified in Procedure 12 of the ER Safety Procedures Manual. The Project CIH will periodically review this data

7.4 CALIBRATION REQUIREMENTS

The PID, LEL/O_2 meter and sampling pumps required with fixed-media air sampling will be calibrated daily prior to and after each use. A separate log will be kept detailing date, time, span gas, or other standard, and name of person performing the calibration.

7.5 AIR MONITORING RESULTS

Air monitoring results will be posted for personnel inspection, and will be discussed during morning safety meetings.

8.0 EMERGENCY RESPONSE

8.1 PRE-EMERGENCY PLANNING

Prior to engaging in construction/remediation activities at the site, OHM will plan for possible emergency situations and have available adequate supplies and manpower to respond. The PM will coordinate this plan with the NOSC/NOSCDR prior to commencing work. In addition site personnel will receive training during the site orientation concerning proper emergency response procedures. This training will include review of the elements of this plan and all action procedures described herein.

The following situations would warrant implementation of the Emergency Response and Contingency Plan (ERCP):

Fire/Explosion	•The potential for human injury exists •Toxic fumes or vapors are released •The fire could spread on site or off site and possibly ignite other flammable materials or cause heat-induced explosions •The use of water and/or chemical fire suppressants could result in contaminated run-off •An imminent danger of explosion exists
Spill or Release of Hazardous Materials	•The spill could result in the release of flammable liquids or vapors, thus causing a fire or gas explosion hazard •The spill could cause the release of toxic liquids or fumes in sufficient quantities or in a manner that is hazardous to or could endanger human health
Spill or Release of High Temperature Liquid or Vapor	•The spill can be contained on site, but the potential exists for ground-water contamination •The spill cannot be contained on site, resulting in off-site soil contamination and/or ground-water or surface water pollution •The spill quantity is greater than the reportable quantity limit for the material
Natural Disaster	•A rain storm exceeds the flash flood level •The facility is in a projected tornado path or a tornado has damaged facility property •Severe wind gusts are forecasted or have occurred and have caused damage to the facility
Medical Emergency	•Overexposure to hazardous materials •Trauma injuries (broken bones, severe lacerations/bleeding, burns) •Eye/skin contact with hazardous materials •Loss of consciousness •Heat stress (Heat stroke) •Cold stress (Hypothermia) •Heart attack •Respiratory failure •Allergic reaction

The following measures will be taken to assure the availability of adequate equipment and manpower resources:

- Sufficient equipment and materials will be kept on site and dedicated for emergencies only. The inventory will be replenished after each use.

- On-site emergency responders will be current in regards to training and medical surveillance programs. Copies of all applicable certificates will be kept on file for on-site personnel required to respond.

- It will be the responsibility of the emergency coordinator to brief the on-site response team on anticipated hazards at the site. The emergency coordinator shall also be responsible for anticipating and requesting equipment that will be needed for response activities.

- Emergency response activities will be coordinated with the Local Emergency Planning Committee (LEPC) in compliance with SARA Title III requirements.

Communications will be established prior to commencement of any activities at the remediation site. Communication will be established so that all responders on site have availability to all pertinent information to allow them to conduct their activities in a safe and healthful manner. The primary communication device will be two-way radios. Air horns may be used to alert personnel of emergency conditions. A telephone will be located at the command post to summon assistance in an emergency.

Primary communication with local responders in the event of an emergency will be accomplished using commercial telephone lines.

8.2 EMERGENCY RECOGNITION AND PREVENTION

Because unrecognized hazards may result in emergency incidents, it will be the responsibility of the Site Supervisor and Site Safety Officer, through daily site inspections and employee feedback (Safety Observation Program, daily safety meetings, and activity hazard analyses) to recognize and identify all hazards that are found at the site. These may include:

Chemical Hazards	• Materials at the site • Materials brought to the site
Physical Hazards	• Fire/explosion • Slip/trip/fall • Electrocution • Confined space • IDLH atmospheres • Excessive noise
Mechanical Hazards	• Heavy equipment • Stored energy system • Pinch points • Electrical equipment • Vehicle traffic
Environmental Hazards	• Electrical Storms • High winds • Heavy Rain/Snow • Temperature Extremes (Heat/Cold Stress) • Poisonous Plants/Animals

Once a hazard has been recognized, the Site Supervisor and/or the SSO will take immediate action to prevent the hazard from becoming an emergency. This may be accomplished by the following:

- Daily safety meeting
- Task-specific training prior to commencement of activity
- Lockout/tagout
- Personal Protective Equipment (PPE) selection/use
- Written and approved permits for hot work, confined space
- Trenching/shoring procedure
- Air monitoring
- Following all OHM standard operating procedures
- Practice drills for fire, medical emergency, and hazardous substances spills

Table 8.1
Emergency Telephone Numbers

Local Agencies All services	
Police Dept.	911 on-base (910) 451-3855 (off-base)
Fire Department	911 on-base
Ambulance	911 on-base (910) 455-9119 (off-base)
Hospital	
Onslow County Hospital	(910) 577-2240
On-Base Facilities	(910) 451-4840
USMC Hospital	
Federal Agencies	
EPA Region Branch Response Center	(404) 347-3931
National Response Center	800-424-8802
Agency for Toxic Substances and Disease Registry	(404) 639-0615 (24 HR)
Navy ROICC / NTR	
National Response Center	800-424-8802
Project Manager	
James Dunn	(770) 734-8072
Director, Health and Safety, Angelo Liberatore, CIH	(770) 453-7671
OHM Corporation (24 hour)	800-537-9540
NOSC/NOSC DR	
Vann Marshbern	(910) 451-5006
Note:	
Additional Phone Nos's in Section 2.0 this HASP	

Routes to Hospital: (MAPS ARE POSTED ON-SITE)
ON-BASE

1. From Bldg. 25, proceed west to Holcomb Blvd. and turn left (north).
2. Proceed north on Holcomb Boulevard and turn left on Brewster Street
3. Base hospital is approximately 1/2-mile ahead on right.
4. Follow signs to the emergency room entrance.

OFF-BASE

1. From Bldg. 25, proceed west to Holcomb Blvd. and turn left (north).
2. Proceed north on Holcomb Boulevard and exit MCB Camp Lejeune through the main gate.
3. Follow Highway 24 West (approximately 2.4 miles) to Western Boulevard and turn right (north).
4. Continue on Western Boulevard (approximately 1.5 miles) to the firth stoplight and the hospital is on the left side of the street.
5. Follow signs to the emergency room entrance.

A map depicting the route to the Onslow County Memorial Hospital and the Base Naval Hospital will be posted in each trailer.

8.3 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS

This section of the ERCP describes the various roles, responsibilities, and communication procedures that will be followed by personnel involved in emergency responses.

The primary emergency coordinator for this site is the Site Supervisor. In the event an emergency occurs and the emergency coordinator is not on site, the Site Safety Officer or the highest ranking employee on site will serve as the emergency coordinator until he arrives. The emergency coordinator will determine the nature of the emergency and take appropriate action as defined by this ERCP.

The emergency coordinator will implement the ERCP immediately as required. The decision to implement the plan will depend upon whether the actual incident threatens human health or the environment. Immediately after being notified of an emergency incident, the emergency coordinator or his designee will evaluate the situation to determine the appropriate action.

8.3.1 Responsibilities and Duties

This section describes the responsibilities and duties assigned to the emergency coordinator.

It is recognized that the structure of the "Incident Command System" will change as additional response organizations are added. OHM will follow procedures as directed by the fire department, LEPC, State and Federal Agencies as required. OHM will defer to the local Fire Department chief to assume the role of Incident Commander upon arriving on site. Additional on-site personnel may be added to the Site Emergency Response Team as required to respond effectively.

8.3.2 On-site Emergency Coordinator Duties

The on-site emergency coordinator is responsible for implementing and directing the emergency procedures. All emergency personnel and their communications will be coordinated through the emergency coordinator. Specific duties are as follows:

- Identify the source and character of the incident, type and quantity of any release. Assess possible hazards to human health or the environment that may result directly from the problem or its control.

- Discontinue operations in the vicinity of the incident if necessary to ensure that fires,

explosions, or spills do not recur or spread to other parts of the site. While operations are dormant, monitor for leaks, pressure build-up, gas generation, or ruptures in valves, pipes, or other equipment, where appropriate.

- Notify the NOSC/NOSCDR if outside emergency response help is necessary to control the incident. Table 8.1 provides telephone numbers for emergency assistance.

- Direct on-site personnel to control the incident until, if necessary, outside help arrives.

- Ensure that the building or area where the incident occurred and the surrounding area are evacuated and shut off possible ignition sources, if appropriate. The Emergency Response Team is responsible for directing site personnel such that they avoid the area of the incident and leave emergency control procedures unobstructed.

- If fire or explosion is involved, notify Base Fire Department.

- Notify LANTDIV ROICC

- Notify OHM Project Manager

- Have protected personnel, in appropriate PPE, on standby for rescue.

If the incident may threaten human health or the environment outside of the site, the emergency coordinator should immediately determine whether evacuation of area outside of the site may be necessary and, if so, notify the Police Department and the Office of Emergency Management.

When required (as determined by the NOSC/NOSCDR), notify the National Response Center. The following information should be provided to the National Response Center:

- Name and telephone number
- Name and address of facility
- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside of the facility.

The emergency telephone number for the National Response Center is 800-424-8802.

If hazardous waste has been released or produced through control of the incident, ensure that:

- Waste is collected and contained.
- Containers of waste are removed or isolated from the immediate site of the emergency.
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided.
- Ensure that no waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed.
- Ensure that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.
- Notify the USEPA Regional Administrator that cleanup procedures have been completed and that all emergency equipment is fit for its intended use before resuming operations in the affected area of the facility. The USEPA Regional Administrator's telephone number is included in the Emergency Contacts.
- Record time, date, and details of the incident, and submit a written report to the USEPA Regional Administrator. Report is due to USEPA within 15 days of the incident.
- Perform post incident evaluation and response critique and submit a written report to the Regional Health and Safety Director within 30 days of the incident conclusion.

8.4 SAFE DISTANCES AND PLACES OF REFUGE

The emergency coordinator for all activities will be the SS. No single recommendation can be made for evacuation or safe distances because of the wide variety of emergencies which could occur. Safe distances can only be determined at the time of an emergency based on a combination of site and incident-specific criteria. However, the following measures are established to serve as general guidelines.

In the event of minor hazardous materials releases (small spills of low toxicity), workers in the affected area will report initially to the contamination reduction zone. Small spills or leaks (generally less than 55 gallons) will require initial evacuation of at least 50 feet in all directions to allow for cleanup and to prevent exposure. After initial assessment of the extent of the release and potential hazards, the emergency coordinator or his designee will determine the

specific boundaries for evacuation. Appropriate steps such as caution tape, rope, traffic cones, barricades or personal monitors will be used to secure the boundaries.

In the event of a major hazardous material release (large spills of high toxicity/greater than 55 gallons), workers will be evacuated from the building/site. Workers will assemble at the entrance to the site for a head count by their foremen and to await further instruction.

If an incident may threaten the health or safety of the surrounding community, the public will be informed and, if necessary, evacuated from the area. The emergency coordinator, or his designee will inform the proper agencies in the event that this is necessary. Telephone numbers are listed in Table 8.1.

Places of refuge will be established prior to the commencement of activities. These areas must be identified for the following incidents:

- Chemical release
- Fire/explosion
- Power loss
- Medical emergency
- Hazardous weather

In general, evacuation will be made to the crew trailers, unless the emergency coordinator determines otherwise. It is the responsibility of the emergency coordinator to determine when it is necessary to evacuate personnel to off-site locations.

In the event of an emergency evacuation, all the employees will gather at the entrance to the site until a head count establishes that all are present and accounted for. No one is to leave the site without notifying the emergency coordinator.

8.5 EVACUATION ROUTES AND PROCEDURES

All emergencies require prompt and deliberate action. In the event of an emergency, it will be necessary to follow an established set of procedures. Such established procedures will be followed as closely as possible. However, in specific emergency situations, the emergency coordinator may deviate from the procedures to provide a more effective plan for bringing the situation under control. The emergency coordinator is responsible for determining which situations require site evacuation.

8.5.1 Evacuation Signals and Routes

Two-way radio communication and an air horn will be used to notify employees of the

necessity to evacuate an area or building involved in a release/spill of a hazardous material. Each crew supervisor will have a two way radio. A base station will be installed in the OHM office trailer to monitor for emergencies. Total site evacuation will be initiated only by the emergency coordinator; however, in his absence, decision to preserve the health and safety of employees will take precedence. Evacuation routes will be posted in each outside work area. Signs inside buildings will be posted on walls or other structural element of a building. Periodic drills will be conducted to familiarize each employee with the proper routes and procedures.

8.5.2 Evacuation Procedures

In the event evacuation is necessary, the following actions will be taken:

- The emergency signal will be activated.
- No further entry of visitors, contractors, or trucks will be permitted. Vehicle traffic within the site will cease in order to allow safe exit of personnel and movement of emergency equipment.
- Shut off all machinery if safe to do so.
- ALL on-site personnel, visitors, and contractors in the support zone will assemble at the entrance to the site for a head count and await further instruction from the emergency coordinator.
- ALL persons in the exclusion zone and contamination reduction zone will be accounted for by their immediate crew leaders (e.g., foreman). Leaders will determine the safest exits for employees and will also choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader should try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the emergency coordinator.
- Contract personnel and visitors will also be accounted for.
- The names of emergency response team members involved will be reported to the emergency spill control coordinator.

- A final tally of persons will be made by the emergency coordinator or designee. No attempt to find persons not accounted for will involve endangering lives of OHM or other employees by reentry into emergency areas.

- In all questions of accountability, immediate crew leaders will be held responsible for those persons reporting to them. Visitors will be the responsibility of those employees they are seeing. Contractors and truck drivers are the responsibility of the Site Supervisor. The security guard will aid in accounting for visitors, contractors, and truckers by reference to sign-in sheets available from the guard shack.

- Personnel will be assigned by the emergency coordinator to be available at the main gate to direct and brief emergency responders.

- Reentry into the site will be made only after clearance is given by the emergency coordinator. At his direction, a signal or other notification will be given for reentry into the facility.

- Drills will be held periodically to practice all of these procedures and will be treated with the same seriousness as an actual emergency.

8.6 EMERGENCY SPILL RESPONSE PROCEDURES AND EQUIPMENT

In the event of an emergency involving a hazardous material spill or release, the following general procedures will be used for rapid and safe response and control of the situation. Emergency contacts found in Table 8.1 provide a quick reference guide to follow in the event of a major spill.

8.6.1 Notification Procedures

If an employee discovers a chemical spill or process upset resulting in a vapor or material release, he or she will immediately notify the on-site emergency coordinator.

The on-site Emergency Coordinator will obtain information pertaining to the following:

- The material spilled or released.
- Location of the release or spillage of hazardous material.
- An estimate of quantity released and the rate at which it is being released.
- The direction in which the spill, vapor or smoke release is heading.
- Any injuries involved.
- Fire and/or explosion or possibility of these events.
- The area and materials involved and the intensity of the fire or explosion.

This information will help the on-site emergency coordinator to assess the magnitude and potential seriousness of the spill or release.

8.6.2 Procedure for Containing/Collecting Spills

The initial response to any spill or discharge will be to protect human health and safety, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response.

If for some reason a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or a pipeline rupture, an initial isolation of at least 100 ft. in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 ft. in all directions to allow cleanup and repair and to prevent exposure. When any spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed within the designated hazard area. If possible the area will be roped or otherwise blocked off.

If the spill results in the formation of a toxic vapor cloud (by reaction with surrounding materials or by outbreak of fire) and its release (due to high vapor pressures under ambient conditions), further evacuation will be enforced. In general an area at least 500 feet wide and 1,000 feet long will be evacuated downwind if volatile materials are spilled. (Consult the DOT Emergency Response Guide for isolation distances for listed hazardous materials.)

If an incident may threaten the health or safety of the surrounding community, the public will be informed and possibly evacuated from the area. The on-site emergency coordinator will inform the proper agencies in the event this is necessary. (Refer to Table 8.1)

As called for in regulations developed under the Comprehensive Environmental Response Compensation Liability Act of 1980 (Superfund), OHM's practice is to report a spill of a pound or more of any hazardous material for which a reportable quantity has not been established and which is listed under the Solid Waste Disposal Act, Clean Air Act, Clean Water Act, or TSCA. OHM also follows the same practice for any substances not listed in the Acts noted above but which can be classified as a hazardous waste under RCRA.

Clean up personnel will take the following measures:

- Make sure all unnecessary persons are removed from the hazard area.

- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources, and use spark and explosion proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- If wastes reach a storm sewer, try to dam the outfall by using sand, earth, sandbags, etc. If this is done, pump this material out into a temporary holding tank or drums as soon as possible.
- Place all small quantities of recovered liquid wastes (55 gallons or less) and contaminated soil into drums for incineration or removal to an approved disposal site.
- Spray the spill area with foam, if available, if volatile emissions may occur.
- Apply appropriate spill control media (e.g. clay, sand, lime, etc.) to absorb discharged liquids.
- For large spills, establish diking around leading edge of spill using booms, sand, clay or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank.

8.6.3 Emergency Response Equipment

The following equipment will be staged in the support zone and throughout the site, as needed, to provide for safety and first aid during emergency responses:

- ABC-type fire extinguisher
- First-aid kit, industrial size
- Eyewash/safety shower (This equipment will be in conformance with ANSI Z358.1-1990.)
- Emergency oxygen unit
- Emergency signal horn
- Self contained breathing apparatus (two)
- Stretcher/backboard

In addition to the equipment listed above, OHM maintains direct reading instrumentation that may be used in emergency situations to assess the degree of environmental hazard. This equipment will only be used by the Site Safety Officer or other specially trained personnel.

This equipment will be stored, charged and ready for immediate use in evaluating hazardous chemical concentrations. The equipment will be located at the OHM office trailer.

EQUIPMENT NAME	*APPLICATION*
Portable H-NU Photoionization Meter	Measures selected inorganic and organic chemical concentrations
MSA Oxygen and Combustible Gas Meter	Measures oxygen and combustible gas levels
Draeger Detector Tubes	Assorted detector tubes to measure specific chemical concentrations

8.6.4 Personal Protective Equipment

A supply of two (minimum) SCBAs will be located in the support zone for use in emergency response to hazardous materials releases. They will be inspected at least monthly, according to OSHA requirements. In addition, all emergency response personnel will have respirators available for use with cartridge selection determined by the Site Safety Officer based on the results of direct reading instruments. Emergency response personnel will also be provided with protective clothing as warranted by the nature of the hazardous material and as directed by the Site Safety Officer. All OHM personnel who may be expected to wear SCBAs are trained at assignment and annually thereafter on the proper use and maintenance of SCBAs and airline respirators.

8.6.5 Emergency Spill Response Clean-Up Materials and Equipment

A sufficient supply of appropriate emergency response clean-up and personal protective equipment will be inventoried and inspected, visually, on a weekly basis.

The materials listed below will be kept on site for spill control, depending on the types of hazardous materials present on site. The majority of this material will be located in the support zone, in a supply trailer or storage area. Small amounts will be placed on pallets and located in the active work areas.

- Sand or clay to solidify/absorb liquid spills.
- Lime (calcium oxide), soda ash (sodium carbonate), or baking soda (sodium bicarbonate) for neutralizing acid (pH <7) spills.
- Activated charcoal (carbon) to adsorb organic solvents (hydrocarbons) and to reduce flammable vapors.

- Citric acid for neutralizing caustic (pH >7) spills.

- Vapor-suppressing foam, if required by the Client, for controlling the release of volatile organic compounds.

- Appropriate solvents e.g. CITRIKLEEN, for decontamination of structures or equipment.

The following equipment will be kept on site and dedicated for spill cleanup:

- Plastic shovels for recovering corrosive and flammable materials.
- Sausage-shaped absorbent booms for diking liquid spills, drains, or sewers.
- Sorbent sheets (diapers) for absorbing liquid spills.
- Overpack drums for containerizing leaking drums.
- 55-gallon open-top drums for containerization of waste materials.

*NOTE: All contaminated soils, absorbent materials, solvents and other materials resulting from the clean-up of spilled or discharged substances shall be properly stored, labelled, and disposed of off-site.

8.7 EMERGENCY CONTINGENCY PLAN

This section of the ERCP details the contingency measures OHM will take to prepare for and respond to fires, explosions, spills and releases of hazardous materials, hazardous weather, and medical emergencies.

8.7.1 Medical Emergency Contingency Measures

The procedures listed below will be used to respond to medical emergencies. The SSO will contact the local hospital and inform them of the site hazards and potential emergency situations. A minimum of two First-Aid/CPR trained personnel will be maintained on site. All OHM first aid and CPR Responders have received training as required by 29 CFR 1910.1030 Bloodborne Pathogen Standard. A copy of the OHM exposure control plan may be obtained from the Site Safety Officer or Regional Health and Safety Director.

8.7.1.1 Response

The nearest workers will immediately assist a person who shows signs of medical distress or who is involved in an accident. The crew foreman will be summoned.

The crew foreman will immediately make radio contact with the on-site emergency coordinator to alert him of a medical emergency situation. The foreman will advise the following information:

- Location of the victim at the work site
- Nature of the emergency
- Whether the victim is conscious
- Specific conditions contributing to the emergency, if known

The Emergency Coordinator will notify the Site Safety Officer. The following actions will then be taken depending on the severity of the incident:

- Life-Threatening Incident--If an apparent life-threatening condition exists, the crew foreman will inform the emergency coordinator by radio, and the local Emergency Response Services (EMS) will be immediately called. An on-site person will be appointed who will meet the EMS and have him/her quickly taken to the victim. Any injury within the EZ will be evacuated by OHM personnel to a clean area for treatment by EMS personnel. No one will be able to enter the EZ without showing proof of training, medical surveillance and site orientation.

- Non Life-Threatening Incident--If it is determined that no threat to life is present, the Site Safety Officer will direct the injured person through decontamination procedures (see below) appropriate to the nature of the illness or accident. Appropriate first aid or medical attention will then be administered.

*NOTE: The area surrounding an accident site must not be disturbed until the scene has been cleared by the Site Safety Officer.

Any personnel requiring emergency medical attention will be evacuated from exclusion and contamination reduction zones if doing so would not endanger the life of the injured person or otherwise aggravate the injury. Personnel will not enter the area to attempt a rescue if their own lives would be threatened. The decision whether or not to decontaminate a victim prior to evacuation is based on the type and severity of the illness or injury and the nature of the contaminant. For some emergency victims, immediate decontamination may be an essential part of life-saving first aid. For others, decontamination may aggravate the injury or delay life-saving first aid. Decontamination will be performed if it does not interfere with essential treatment.

If decontamination can be performed, observe the following procedures:

- Wash external clothing and cut it away.

If decontamination cannot be performed, observe the following procedures:

- Wrap the victim in blankets or plastic to reduce contamination of other personnel.
- Alert emergency and off-site medical personnel to potential contamination, instruct them about specific decontamination procedures.
- Send site personnel familiar with the incident and chemical safety information, e.g. MSDS, with the affected person.

All injuries, no matter how small, will be reported to the SSO or the Site Supervisor. An accident/injury/illness report will be completely and properly filled out and submitted to the Regional Health and Safety Director/Project CIH, in accordance with OHM's reporting procedures.

A list of emergency telephone numbers is given in Table 8.1.

8.7.1.2 Notification

The following personnel/agencies will be notified in the event of a medical emergency:

- Local Fire Department or EMS
- On-site Emergency Coordinator
- Workers in the affected areas
- Client Representative

8.7.2 Fire Contingency Measures

OHM personnel and subcontractors are not trained professional firefighters. Therefore, if there is any doubt that a fire can be quickly contained and extinguished, personnel will notify the emergency coordinator by radio and vacate the structure or area. The emergency coordinator will immediately notify the local Fire Department.

The following procedures will be used to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- The air will be monitored for explosivity before and during hot work and periodically

where flammable materials are present. Hot work permits will be required for all such work.

- "No smoking" signs will be conspicuously posted in areas where flammable materials are present.
- Fire extinguishers will be placed in all areas where a fire hazard may exist.
- Before workers begin operations in an area the foreman will give instruction on egress procedures and assembly points. Egress routes will be posted in work areas and exit points clearly marked.

The following procedures will be used in the event of a fire:

- Anyone who sees a fire will notify their supervisor who will then contact the Emergency Coordinator by radio. The emergency coordinator will activate the emergency air horns and contact the local Fire Department.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will be comprised of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a small fire has been extinguished by a worker, the emergency coordinator will be notified.

8.7.3 Hazardous Weather Contingency Measures

Operations will not be started or continued when the following hazardous weather conditions are present:

- Lightning
- Heavy Rains/Snow
- High Winds

8.7.3.1 Response

- Excavation/soil stock piles will be covered with plastic liner.

- All equipment will be shut down and secured to prevent damage.

- Personnel will be moved to safe refuge, initially crew trailers. The emergency coordinator will determine when it is necessary to evacuate personnel to off-site locations and will coordinate efforts with fire, police and other agencies.

8.7.3.2 Notification

The emergency coordinator will be responsible for assessing hazardous weather conditions and notifying personnel of specific contingency measures. Notifications will include:

- OHM employees and subcontractors
- Client Representative
- Local Civil Defense Organization

8.7.4 Spill/Release Contingency Measures

In the event of release or spill of a hazardous material the following measures will be taken.

Any person observing a spill or release will act to remove and/or protect injured/contaminated persons from any life-threatening situation. First aid and/or decontamination procedures will be implemented as appropriate.

First aid will be administered to injured/contaminated personnel. Unsuspecting persons/vehicles will be warned of the hazard. All personnel will act to prevent any unsuspecting persons from coming in contact with spilled materials by alerting other nearby persons. Without taking unnecessary risks, personnel will attempt to stop the spill at the source. This may involve activities such as uprighting a drum, closing a valve or temporarily sealing a hole with a plug.

Utilizing radio communications, the emergency coordinator will be notified of the spill/release, including information on material spilled, quantity, personnel injuries and immediate life threatening hazards. Air monitoring will be implemented by the emergency coordinator and SSO to determine the potential impact on the surrounding community. Notification procedures will be followed to inform on-site personnel and off-site agencies. The emergency coordinator will make a rapid assessment of the spill/release and direct confinement, containment and control measures. Depending upon the nature of the spill, measures may include:

- Construction of a temporary containment berm utilizing on-site clay absorbent earth

- Digging a sump, installing a polyethylene liner and diverting the spill material into the sump placing drums under the leak to collect the spilling material before it flows over the ground

- Transferring the material from its original container to another container

The emergency coordinator will notify the LANTDIV ROICC, of the spill and steps taken to institute clean-up. Emergency response personnel will clean-up all spills following the spill clean-up plan developed by the emergency coordinator. Supplies necessary to clean up a spill will be immediately available on-site. Such items may include, but are not limited to:

- Shovel, rake
- Clay absorbent
- Polyethylene liner
- Personal safety equipment
- Steel drums
- Pumps and miscellaneous hand tools

The major supply of material and equipment will be located in the Support Zone. Smaller supplies will kept at active work locations. The emergency coordinator will inspect the spill site to determine that the spill has been cleaned up to the satisfaction of the ROICC. If necessary, soil, water or air samples may be taken and analyzed to demonstrate the effectiveness of the spill clean-up effort. The emergency coordinator will determine the cause of the spill and determine remedial steps to ensure that recurrence is prevented. The emergency coordinator will review the cause with the ROICC and obtain his concurrence with the remedial action plan.

9.0 TRAINING REQUIREMENTS

As a prerequisite to employment at OHM, all field employees are required to take a 40-hour training class and pass a written examination. This training covers all forms of personal protective equipment, toxicological effects of various chemicals,hazard communication, bloodborne pathogens, handling of unknown tanks and drums confined-space entry procedures, and electrical safety. This course is in full compliance with OSHA requirements in 29 CFR 1910.120. In addition, all employees receive annual 8-hour refresher training and three day on-site training under a trained experienced supervisor. Supervisory personnel receive an additional 8-hour training in handling hazardous waste operations. Copies of certification of this training will be maintained on-site for all workers assigned to this project.

All personnel entering the exclusion zone will be trained in the provisions of this site safety plan and be required to sign the Health and Safety Plan Certification in Appendix A.

10.0 MEDICAL SURVEILLANCE PROGRAM

All OHM personnel participate in a medical and health monitoring program. This program is initiated when the employee starts work with a complete physical and medical history and is continued on a regular basis. A listing of OHM's worker medical profile is shown below. This program was developed in conjunction with a consultant toxicologist and OHM's occupational health physician. Other medical consultants are retained when additional expertise is required. Medical certification for all site workers assigned to the project will be maintained on-site.

The medical surveillance program meets the requirements of the OSHA Standard 29 CFR 1910.120 (f).

Table 10.1
Worker Medical Profile

Item	*Initial*	*Annual*
Medical History	X	X
Work History	X	X
Visual Acuity and Tonometry	X	X
Pulmonary Function Tests	X	X
Physical Examination	X	X
Audiometry Tests	X	X
Chest X-Ray	X	X
Complete Blood Counts	X	X
Blood Chem. (SSAC-23 or equivalent)	X	X
Urinalysis	X	X
Dermatology Examination	X	X
Electrocardiogram/Stress Test	X	X (based on age)

Specific Tests (as required): None

10.1 EXAMINATION SCHEDULE

Employees are examined initially upon start of employment, annually thereafter, and may be examined upon termination of employment. Unscheduled medical examinations are conducted:

- At employee request after known or suspected exposure to toxic or hazardous materials
- At the discretion of the client, the CIH, SSO, or OHM occupational physician after known or suspected exposure to toxic or hazardous materials
- At the discretion of the OHM occupational physician

All nonscheduled medical examinations will include, as a minimum, all items specified above for periodic surveillance examination, with the exception of the chest x-ray, which will be conducted at the discretion of the occupational physician performing the examination.

APPENDIX A

HEALTH AND SAFETY PLAN CERTIFICATION

HEALTH-AND-SAFETY PLAN CERTIFICATION

By signing this document, I am stating that I have read and understand the Site Specific Health-and-Safety Plan for OHM Remediation Services Corp. personnel and visitors entering the site.

REPRESENTING	*NAME (PRINT)*	*SIGNATURE*	*DATE*

APPENDIX B

OHM HAZARD COMMUNICATION PROGRAM

APPENDIX B - OHM HAZARD COMMUNICATION PROGRAM

1.0 GENERAL

The following written hazard communication program has been established for OHM Corporation. The purpose of this program is to transmit information about the various Chemical hazards in the work place to the workers using various media. The transmittal of information will be accomplished by means of a comprehensive hazard communication program, which will include container labeling and other forms of warning, material safety data sheets, and employee training in accordance with 29 CFR 1910.1200 and 29 CFR 1926.59.

The program will be available in corporate and regional Health and Safety Departments for reviews by all employees. It will also be available in the corporate library and clearly marked "Employee Right-to-Know" stations located within each individual shop and on each job site. OHM Corporation will accomplish the hazard communication requirements through formal safety training, departmental safety meetings, and job site safety meetings.

2.0 RESPONSIBILITIES

Purpose: Overall responsibility rests with all corporate officers of OHM Corporation. A brief outline of responsibilities for those persons directly involved with the program will follow. These responsibilities are not all inclusive, but are designed to give guidance in initial and long-term program development since each area is different. These responsibilities may vary.

Scope: This program is intended to cover those employees who are directly involved with the handling of hazardous materials or supervision of those activities.

2.1 Health and Safety Department Responsibilities

1. Review operations with supervisors to determine what tasks require hazard communication training.

2. Advise supervisory people as to which materials may need to be considered hazardous initially and eventually to ensure that hazard task determination is being done according to the written policy.

3. Follow up through safety meetings and safety audits to ensure that supervisors are carrying out prescribed company policy.

4. Notify supervisors of any operating changes affecting the hazardous materials being used.

5. Periodically audit the Hazard Communication Program's progress. Initially, this should be done biweekly, but later the audit may be done on a monthly or quarterly basis.

2.2 Training Department Responsibilities

1. Ensure that up-to-date records are maintained on training of all employees required to handle hazardous materials. The supervisor should keep copies of these records and should also send copies of the initial training to the corporate training secretary for the training file.

2. Educate personnel upon initial training to the requirements of the Hazard Communication Standard.

2.3 Supervisor Responsibilities

1. Identify jobs requiring the use of hazardous chemicals and provide lists of those jobs and chemicals to the Health and Safety Department.

2. Provide the training required by the Hazard Communication Standard and document training of employees in the safe handling of hazardous materials.

3. Inspect engineering controls and personal protective equipment before each use. Health and Safety can help determine a suitable inspection plan for each application as needed.

4. Make daily surveys of the work area to ensure that safe practices are being followed. Advise employees of unsafe work practices on the first occasion and consider further violations as disciplinary violations.

5. Ensure required labeling practices are being followed. Labeling should be affixed to the container when it arrives. If the contents are transferred to another container, then all label information (manufacturer, product name, and product number) must also be affixed to the new container, so that all containers of the material, regardless of size, are labeled

6. Enforce all applicable safety and health standards through periodic audits.

7. Before ordering a material, determine if a Material Safety Data Sheet exist on file. Request an MSDS for any material without one.

8. Send all new MSDSs to the Health and Safety Department after making a copy for the Employee Right-to-Know file.

2.4 Employee Responsibilities

1. Obey established safety rules and regulations

2. Use all safety procedures and personnel protective equipment as required by company procedures

3. Notify supervisor of the following:

   a. Any symptoms or unusual effects that may be related to the use of hazardous chemicals.

   b. Any missing or unreadable labels on containers.

   c. Missing, damaged, or malfunctioning safety equipment.

4. Use approved labels on containers; do not remove labels (labels will be located in the warehouse).

5. Do not use unapproved containers for hazardous materials. (are materials and containers compatible?)

6. Know where emergency equipment and first-aid supplies are located before considering a possibly dangerous task.

7. Know location of Material Safety Data Sheets (MSDSs). These will be located in the "Employee Right-to-know" station for the respective shop/job site.

8. Know what you are expected to do in case of an emergency. Before the commencement of any task, emergency considerations shall be made.

2.5 Shipping/Receiving Personnel Responsibilities

1. Ensure MSDS are received with initial shipment of a hazardous material; if not, contact purchasing to request the appropriate MSDS and also call the Health and Safety Department to determine if there is an MSDS available until the requested MSDS arrives.

2. Ensure labels are affixed to all containers.

3. Store hazardous materials in designated locations.

4. Use proper personal protective equipment when handling hazardous materials.

5. Report damaged containers or spills to the appropriate Health and Safety Department immediately.

6. Request an MSDS from the manufacturer for any hazardous material that arrives in Findlay from a job. Also, a MSDS shall accompany any hazardous material that is sent to a job.

3.0 HAZARD DETERMINATION

OHM Corporation will rely on Material Safety Data Sheets from hazardous chemical supplier to meet hazard determination requirements. Other relevant data from laboratory analyses, chemical reference materials, and chemical manufacturers', written evaluation procedures will be utilized when warranted. No other method shall be used to determine chemical hazard unless approved by the Health and Safety Department.

4.0 LABELING

The shipping and receiving supervisors will be responsible for seeing that all containers arriving at OHM Corporation are properly and clearly labeled. Shipping and receiving supervisors shall also check all labels for chemical identity and appropriate hazard warnings. If the hazardous chemical is regulated by OSHA in a substance specific health standard, the supervisor or department manager shall ensure that the labels or other forms of warning used are in accordance with the requirements of that standard. Any container that is not labeled shall be immediately labeled correctly after initial discovery.

Each supervisor or department manager shall be responsible for seeing that all portable containers used in their work area are properly labeled with chemical identity and hazard warning.

Supervisors or department managers shall also ensure that labels on hazardous chemical containers are not removed or defaced unless the container is immediately marked with the required information and that all labels are legible in English and prominently displayed on the container or readily available in the work area throughout each shift.

If any container is found and the contents cannot be identified, the supervisor or manager shall be contacted immediately. When proper identification is made, a label shall be affixed to the container immediately. If it is discovered that no MSDS is available, the manufacturer and the Health and Safety Department shall be contacted to assist in locating the proper MSDS. If there is no way to identify the material in the container, the container should be set aside, away from all personnel until it can be tested by the Health and Safety Department or laboratory personnel. Supervisors and managers shall communicate their findings or awareness of such containers to all personnel in the area and to those who enter later.

5.0 MATERIAL SAFETY DATA SHEETS (MSDSs)

Each supervisor or department manager at OHM Corporation will be responsible for maintaining a current MSDS relevant to the hazardous chemicals used in their area. The Health and Safety Department will be responsible for compiling the master MSDS file for the facility and aiding all shops/job sites with the completion and maintenance of their respective MSDS files.

All MSDSs will be readily available for review by all employees during each work shift. Each shop/job site will designate a clearly marked "Employee Right-to-Know" station where employees can immediately obtain a MSDS and the required information in an emergency.

Although manufacturers are required to provide employers with MSDSs on an initial chemical shipment, OHM Corporation purchasing agents (and supervisors purchasing their own material) shall request MSDSs and updates to MSDSs on all purchase orders. Supervisors and department managers that are without proper MSDSs shall be responsible for requesting this information from manufacturers for chemicals. A file of follow-up letters shall be maintained for all hazardous chemical shipments received without MSDSs.

6.0 EMPLOYEE INFORMATION AND TRAINING

It is the responsibility of the supervisor in charge of each employee to ensure that the employee is properly trained. Training employees on chemical hazards and chemical handling is accomplished at the time of initial employment at OHM Corporation, whenever a new chemical (or physical) hazard is introduced into the work area, and through ongoing formal and informal training programs. Additionally, chemical hazards are communicated to employees through daily, morning, shop specific safety meetings, which shall be documented according to topic, major points discussed, and names of those attending (attendance is mandatory). Also, biweekly hazardous chemical safety meetings will be prepared by the Health and Safety Department using similar documentation for shop areas. Attendance is mandatory for these meetings also. Documentation for shop safety meetings will be available in the respective Employee Right-to-know stations and biweekly safety meeting documentation will be available in the Health and Safety Department to all employees for further referencing and questioning. Records of all formal training conducted at OHM Corporation are coordinated and maintained by the Training Department secretary.

At a minimum, OHM Corporation will inform employees on the following:

- The requirements of 29 CFR 1910.1200--Hazard Communication--Evaluating the potential hazards of chemicals and communication of information concerning hazards and appropriate protective measures to employees. This is accomplished in several different ways including, but no limited to, 40-hour OSHA Hazardous Waste Worker Training (29 CFR 1910.120), shop safety meetings, job site safety meetings, Health and Safety Department safety meetings, and formal and informal training about specific chemical hazards.

- The location and availability of the written hazard communication program, list of hazardous chemicals, and MSDS sheets--Notices will be periodically posted on the employee bulletin boards providing the location of the above material.

- Any operations in their work area where hazardous chemicals are present.

- What the company has done to lessen or prevent workers' exposure to these chemicals.

Employee training shall include at least:

- Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (monitoring instruments, visual appearance or odor), and acute and chronic health effects.

- The physical and health hazards of chemicals in the work area (accomplished through periodic physical and chemical hazard awareness sessions developed by the Health and Safety Department). These sessions shall serve as chemical hazards refreshers.

- The methods of preventing exposure to hazardous chemicals including the measures OHM Corporation has taken to protect the employees.

- Procedures to follow if OHM Corporation employees are exposed to hazardous chemicals (location of nearest phone, emergency eyewash, and shower will be included). These discussions shall include proper operating procedures for all emergency equipment.

- The details of the hazard communication program developed by OHM Corporation, including an explanation of the labeling system and the Material Safety Data Sheets, and how employees can obtain and use the appropriate hazard information.

- Standard operating procedures within each respective shop. OHM Corporation company policy determines what is considered standard operating procedures.

- Procedures for workers involved in non-routine tasks.

Each supervisor or department manager shall ensure that the above training is emphasized to OHM Corporation employees. The Health and Safety Department will ensure that each shop, department, and job site is properly informing and training all employees through daily group meetings and individual discussions. Whenever a new hazardous chemical is placed into use, the supervisor or department manager shall inform the employees of the hazards which that chemical may pose. The supervisor or manager shall also be responsible for obtaining and making available a MSDS for the new chemical.

7.0 HAZARDOUS NON-ROUTINE TASKS

Occasionally, employees at OHM Corporation are required to perform tasks which are considered to be non-routine. All tasks considered to be non-routine shall be carefully discussed among the supervisor and those performing the task. This safety briefing shall include all possible hazards that may be encountered while completing the task, including:

- Hazard recognition

- Chemicals involved and their hazardous properties

- Physical hazards

- Methods of avoiding all hazards (technical instruments, proper personal protective equipment, etc.)

The following is list of some of the non-routine tasks which may occur at OHM Corporation together with some information needed to complete the tasks safely.

- Confined Space Entry

  - Obtain confined space entry procedure/permit from Health and Safety Department and follow all protocol before beginning task. Complete and

have supervisor sign permit before any work begins.

- Monitor atmosphere with explosimeter, oxygen meter, and any toxic gas meter as may be appropriate.
- Discuss specific chemical hazards.
- Discuss protective/safety measures the employee can take (e.g., Personal protective equipment and engineering controls, use of life lines, lock-out/tagout procedures, etc).
- Measures the company has taken to lessen the hazards including ventilation, respirator, presence of another employee, and emergency procedures.

• Excavation, Trenching, and Shoring

- Obtain guidelines from Health and Safety Department before beginning task.
- Comply with all requirements set forth for this activity in 29 CFR Subpart P(excavating, trenching, shoring).
- Discuss specific chemical hazards.
- Follow confined space entry procedure above if trench is above shoulder height.
- Discuss protective/safety measures the employee can take.
- Review appropriate accident prevention steps.

• Decontamination of Equipment

- Determine possible contaminants and the hazards associated with them.
- Determine personal protection needed by contacting the Health and Safety Department.
- Alert all personnel in areas of contamination and decontamination
- Contain and secure all contaminated materials and decontamination materials.
- Contact the Health and Safety Department for proper disposal.

It is company policy that no OHM Corporation employee will begin work on any non-routine task without first receiving a safety briefing from their supervisor or a Health and Safety Department representative.

8.0 INFORMING CONTRACTORS

• Hazardous chemicals to which they may be exposed while performing a task including the following:

- Chemical properties

  - Physical properties
  - Acute/Chronic health effects

- Location of "Employee Right-to Know" station which includes the following:

  - MSDS for work area
  - Hazard Communication Program
  - Other relevant safety material

- Precautionary measures to be taken to protect employees from chemical and physical hazards.

- Location of nearest emergency equipment (fire extinguisher, eyewash, shower, phone, first-aid kit, etc.)

- Procedures to follow in the event of employee exposure.

- Steps OHM Corporation has taken to reduce the risk of exposure to physical and chemical hazards including the following:

  - Safety meetings
  - Hazard Communication Program
  - Proper storage and labeling of hazardous chemicals
  - Health and Safety Department shop audits

- The methods used to label all hazardous chemicals.

The Health and Safety Department shall offer assistance in providing the above information to contractors working at OHM Corporation. On initial visit by a contractor to OHM Corporation, a "Contractor Right-to-Know" release form shall be completed. This form will state that the above information has been communicated to the perspective contractor.

APPENDIX C

MATERIAL SAFETY DATA SHEETS

Site Chemicals
Trichloroethene
1,2-dichloroethene
Vinyl chloride

Anti-fog
Bleach
Breathing air
Diesel fuel
Fire extinguishers
Gasoline
Grease
Hydraulic Oil
Hydrogen cyanide (calibration)
Hydrogen sulfide (calibration)
Isobutylene (calibration gas)
Isopropyl alcohol
Liquid detergent
Methane (calibration gas)
Motor oil
Oil (hydraulic)
Pentane (calibration gas)
Starting fluid
WD-40

MATERIAL SAFETY DATA SHEET

BAUSCH & LOMB, INCORPORATED
PERSONAL PRODUCTS DIVISION

Effective Date: August 30, 1995 Supersedes: NA

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: SIGHT SAVERS brand ANTI-FOG LIQUID
Product Code: 24, 25, 68, 69, 8565, 8569, 8570, 143060
Chemical Family: NA

For Information: 1-800-553-5340
For Emergency: 1-800-553-5340

Manufacturer: Bausch & Lomb, Inc.
Personal Products Division
P. O. Box 450
1400 N. Goodman St.
Rochester, New York 14692

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT:	CAS #	PERCENTAGE (W/V)	EXPOSURE STANDARDS/GUIDELINES*				
			OSHA		ACGIH		
			TWA	STEL	TWA	STEL	UNITS
Isopropyl alcohol	67-63-0	12	400	500	400	500	ppm
Dipropylene glycol methyl ether	34590-94-8	2	100	150	100	150	ppm

Other components considered as non-hazardous ingredients

NE = Not Established
STEL = Short Term Exposure Limit
OSHA = Occupational Safety & Health Administration

NA = Not Applicable
TWA = Time Weighted Average
ACGIH = American Conference of Governmental Industrial Hygienists

Section 3: HAZARDS IDENTIFICATION

PRECAUTIONS TO CONSIDER: This product is intended to be used to clean lenses in personal items such as eyeware, face shields, etc. This product is not intended to be ingested nor administered through any other routes of exposure. If you are sensitive to any ingredient in this product, do not use.

EYE CONTACT: This product is intended to be used per label instructions. Avoid eye contact. In the event of accidental eye contact flush with water for 15 minutes and obtain medical assistance.

SKIN CONTACT: This product is intended to be used per label instructions. Discontinue use if skin irritation develops.

INGESTION: In the event of ingestion of this product or any other untoward events, contact a Poison Control Center or other emergency service and obtain the appropriate medical attention. Accidental ingestion of Sight Savers Anti-fog liquid may cause gastric and intestinal irritation. Ingestion of larger quantities may cause nausea, vomiting, headache, dizziness, abdominal pain or related gastrointestinal disturbance. Give fluids and seek medical care.

INHALATION: Normal use of this product will not present an inhalation hazard. An acute exposure to high concentrations, as from a large spill, may result in upper respiratory tract irritation and central nervous system depression. Move to fresh air and seek medical attention.

CARCINOGENICITY: None of the ingredients contained in this product are listed under IARC, NTP or 29 CFR 1910 subpart Z (as a suspect or known carcinogen).

Section 4: FIRST AID MEASURES

SKIN, INGESTION, INHALATION: Skin irritation is not expected. Should irritation develop discontinue use. This product is not intended to be ingested or taken internally. In the event of ingestion of contents or any untoward events, contact a Poison Control Center or other emergency service and obtain the appropriate medical attention. Refer to the statements in sections 3 and 11.

Section 5: FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: This product is flammable.

FLASH POINT: 88° F Method: closed cup
FLAMMABLE LIMITS: Lower Flammable Limit: NA Upper Flammable Limit: NA
AUTO IGNITION TEMPERATURE: NA

HAZARDOUS DECOMPOSITION/ COMBUSTION PRODUCTS: Carbon dioxide and carbon monoxide.

Section 5: FIRE FIGHTING MEASURES - CONTINUED

FIRE FIGHTING INSTRUCTIONS:	As with all fires, evacuate personnel to safe area. Normal fire fighting procedures may be used.
EXTINGUISHING MEDIA:	Use foam, CO_2, dry chemical, or water fog.

Section 6: ACCIDENTAL RELEASE MEASURES

SPILL: Remove sources of ignition and absorb with vermiculite or other absorbent. Use respiratory protection and gloves.

DISPOSAL: Dispose of in accordance with all applicable Federal, State, and local environmental regulations. This product does not meet the definition of hazardous waster per 40 CFR, Part 261.11

Section 7: HANDLING AND STORAGE

HANDLING/STORAGE CONDITIONS: This product is stable and non-reactive. Keep away from heat, sparks and flame.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

The following information assumes and pertains to situations where an event (such as warehouse storage or an industrial accident) occurs with large quantities of this product.

ENGINEERING CONTROLS: Not Applicable

RESPIRATORY PROTECTION:
Ventilation: General room ventilation
Respirator: A respirator with organic vapor cartridges should be used for spill cleanup.

SKIN AND EYE PROTECTION: Eye protection should worn to protect against splash hazards and gloves should be used to prevent prolonged skin contact during spill cleanup.

ADDITIONAL PROTECTIVE CLOTHING & EQUIPMENT: Not Applicable

HYGIENIC WORK PRACTICES: No special work practices are required.

Section 9 PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT APPEARANCE:	Purple liquid. Refer to product labeling for description.
ODOR:	Slight odor of rubbing alcohol.
PHYSICAL STATE:	Liquid

CHEMICAL PROPERTIES:

BOILING POINT:	212 ° F	MELTING POINT:	NA
VAPOR PRESSURE:	30 mm @ 77 ° F	VAPOR DENSITY:	NA
SOLUBILITY IN WATER:	Soluble	SPECIFIC GRAVITY:	1.0
VISCOSITY:	Same as water	EVAPORATION RATE:	<1 (i.e. Butyl Acetate = 1)
pH:	7	% VOLATILE:	100%
MOLECULAR WEIGHT:	NA	FREEZING POINT:	0 ° C or 32 ° F

Section 10: STABILITY AND REACTIVITY

GENERAL STABILITY CLASSIFICATION:	This product is stable and non-reactive.
INCOMPATIBLE MATERIALS/ CONDITIONS TO AVOID:	Prevent contact with strong acids and bases, as with water.
HAZARDOUS DECOMPOSITION:	None

Section 11: TOXICOLOGICAL INFORMATION

TOXICITY: Under normal use of this product (per label instructions) there is low toxicity potential associated with this product.

COMPONENT	PERCENTAGE (W/V)	TOXICOLOGICAL DATA
Isopropyl alcohol	12	LCLo 16,000 ppm/4 hours
Dipropylene glycol methyl ether	2	LD_{50}(dog) 7500 mg/kg

Section 12: ECOLOGICAL INFORMATION

Ecological effects have not been determined at this time.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of in accordance with all applicable Federal, State, and local environmental regulations. This product does not meet the definition of hazardous waste per 40 CFR, Part 261.11

Section 14: TRANSPORT INFORMATION

There is no unreasonable risk (health, safety or property) that this product would pose when transported in commerce. Hazard class definitions (49 CFR, Part 173) are not applicable to this product.

Section 15: REGULATORY INFORMATION

TSCA: NA

CERCLA: NA

SARA TITLE III:

- SECTION 302 (Extremely Hazardous Substances): NA
- SECTION 311/312 (Hazard Categories): NA
- SECTION 313 (Toxic Chemicals): NA

TSCA = Toxic Substance Control Act
CERCLA = Comprehensive Response Compensation, and Liability Act
Sara Title III = Superfund Amendment and Reauthorization Act

SECTION 16: OTHER INFORMATION

The information contained herein is provided upon request without warranty of any kind. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Users should make independent determinations of the suitability and completeness of information from other sources to assure proper use and disposal of these materials and the safety and health of employees and customers. Bausch and Lomb Incorporated recommends that use of this product is in accordance with product labeling and appropriate safety practices and handling procedures.

MATERIAL SAFETY DATA SHEET

BAUSCH & LOMB, INCORPORATED
PERSONAL PRODUCTS DIVISION

Effective Date: August 30,1995 Supersedes: NA

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: SIGHT SAVERS brand ANTI-FOG LIQUID WITHOUT SILICONE
Product Code: 68GM, 69GM, 8565GM, 8569GM, 8570GM, 143060GM
Chemical Family: NA

For Information: 1-800-553-5340
For Emergency: 1-800-553-5340

Manufacturer: Bausch & Lomb, Inc.
Personal Products Division
P. O. Box 450
1400 N. Goodman St.
Rochester, New York 14692

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

COMPONENT:	CAS #	PERCENTAGE (W/V)	EXPOSURE STANDARDS/GUIDELINES*				
			OSHA		ACGIH		
			TWA	STEL	TWA	STEL	UNITS
Isopropyl alcohol	67-63-0	12	400	500	400	500	ppm
Dipropylene glycol methyl ether	34590-94-8	2	100	150	100	150	ppm

Other components considered as non-hazardous

NE = Not Established
STEL = Short Term Exposure Limit
OSHA - Occupational Safety & Health Administration

NA = Not Applicable
TWA = Time Weighted Average
ACGIH = American Conference of Governmental Industrial Hygienists

Section 3: HAZARDS IDENTIFICATION

PRECAUTIONS TO CONSIDER: This product is intended to be used to clean lenses in personal items such as eyeware, face shields, etc. This product is not intended to be ingested nor administered through any other routes of exposure. If you are sensitive to any ingredient in this product, do not use.

EYE CONTACT: This product is intended to be used per label instructions. Avoid eye contact. In the event of accidental eye contact flush with water for 15 minutes and obtain medical assistance.

SKIN CONTACT: This product is intended to be used per label instructions. Discontinue use if skin irritation develops.

INGESTION: In the event of ingestion of this product or any other untoward events, contact a Poison Control Center or other emergency service and obtain the appropriate medical attention. Accidental ingestion of Sight Savers Anti-fog Liquid may cause gastric and intestinal irritation. Ingestion of larger quantities may cause nausea, vomiting, headache, dizziness, abdominal pain or related gastrointestinal disturbance. Give fluids and seek medical care.

INHALATION: Normal use of this product will not present an inhalation hazard. An acute exposure to high concentrations, as from a spill, may result in upper respiratory tract irritation and central nervous system depression. Move to fresh air and seek medical care.

CARCINOGENICITY: None of the ingredients contained in this product are listed under IARC, NTP or 29 CFR 1910 subpart Z (as a suspect or known carcinogen).

Section 4: FIRST AID MEASURES

SKIN, INGESTION, INHALATION: Skin irritation is not expected. However, should irritation develop discontinue use. This product is not intended to be ingested or taken internally. In the event of ingestion of contents or any untoward events, contact a Poison Control Center or other emergency service and obtain the appropriate medical attention. Refer to the statements in sections 3 and 11.

Section 5: FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: This product is flammable.

FLASH POINT: 88° F Method: closed cup
FLAMMABLE LIMITS: Lower Flammable Limit: NA Upper Flammable Limit: NA
AUTO IGNITION TEMPERATURE: NA

HAZARDOUS DECOMPOSITION/ COMBUSTION PRODUCTS: Carbon dioxide and carbon monoxide.

Section 5: FIRE FIGHTING MEASURES - CONTINUED

FIRE FIGHTING INSTRUCTIONS:	As with all fires, evacuate personnel to safe area. Normal fire fighting procedures may be used.
EXTINGUISHING MEDIA:	Use foam, CO_2, dry chemical, or water fog.

Section 6: ACCIDENTAL RELEASE MEASURES

SPILL:	Remove sources of ignition and absorb with vermiculite or other absorbent. Use respiratory protection and gloves.
DISPOSAL:	Dispose of in accordance with all applicable Federal, State, and local environmental regulations. This product does not meet the definition of hazardous waster per 40 CFR, Part 261.11

Section 7: HANDLING AND STORAGE

HANDLING/STORAGE CONDITIONS:	This product is stable and non-reactive. Keep away from heat, sparks and flame.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

The following information assumes and pertains to situations where an event (such as warehouse storage or an industrial accident) occurs with large quantities of this product.

ENGINEERING CONTROLS: Not Applicable

RESPIRATORY PROTECTION:

Ventilation:	General room ventilation
Respirator:	A respirator with organic vapor cartridges should be used for spill cleanup.

SKIN AND EYE PROTECTION:	Eye protection should worn to protect against splash hazards and gloves should be used to prevent prolonged skin contact during spill cleanup.
ADDITIONAL PROTECTIVE CLOTHING & EQUIPMENT:	Not Applicable
HYGIENIC WORK PRACTICES:	No special work practices are required.

Section 9 PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT APPEARANCE:	Clear liquid. Refer to product labeling for description.
ODOR:	Slight odor of rubbing alcohol.
PHYSICAL STATE:	Liquid

CHEMICAL PROPERTIES:

BOILING POINT:	212 ° F	MELTING POINT:	NA
VAPOR PRESSURE:	30 mm @ 77 ° F	VAPOR DENSITY:	NA
SOLUBILITY IN WATER:	Soluble	SPECIFIC GRAVITY:	1.0
VISCOSITY:	Same as water	EVAPORATION RATE:	<1 (i.e. Butyl Acetate = 1)
pH:	7	% VOLATILE:	100%
MOLECULAR WEIGHT:	NA	FREEZING POINT:	0 ° C or 32 ° F

Section 10: STABILITY AND REACTIVITY

GENERAL STABILITY CLASSIFICATION:	This product is stable and non-reactive.
INCOMPATIBLE MATERIALS/ CONDITIONS TO AVOID:	Prevent contact with strong acids and bases, as with water.
HAZARDOUS DECOMPOSITION:	None

Section 11: TOXICOLOGICAL INFORMATION

TOXICITY: Under normal use of this product (per label instructions) there is low toxicity potential associated with this product.

COMPONENT	PERCENTAGE (W/V)	TOXICOLOGICAL DATA
Isopropyl alcohol	12	LCLo 16,000 ppm/4 hours
Dipropylene glycol methyl ether	2	LD ₅₀ (dog) 7500 mg/kg

Section 12: ECOLOGICAL INFORMATION

Ecological effects have not been determined at this time.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of in accordance with all applicable Federal, State, and local environmental regulations. This product does not meet the definition of hazardous waste per 40 CFR, Part 261.11

Section 14: TRANSPORT INFORMATION

There is no unreasonable risk (health, safety or property) that this product would pose when transported in commerce. Hazard class definitions (49 CFR, Part 173) are not applicable to this product.

Section 15: REGULATORY INFORMATION

TSCA: NA

CERCLA: NA

SARA TITLE III:

- SECTION 302 (Extremely Hazardous Substances): NA
- SECTION 311/312 (Hazard Categories): NA
- SECTION 313 (Toxic Chemicals): NA

TSCA = Toxic Substance Control Act
CERCLA = Comprehensive Response Compensation, and Liability Act
Sara Title III = Superfund Amendment and Reauthorization Act

SECTION 16: OTHER INFORMATION

The information contained herein is provided upon request without warranty of any kind. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Users should make independent determinations of the suitability and completeness of information from other sources to assure proper use and disposal of these materials and the safety and health of employees and customers. Bausch and Lomb Incorporated recommends that use of this product is in accordance with product labeling and appropriate safety practices and handling procedures.

The Clorox Company
7200 Johnson Drive
Pleasanton, California 94588
Tel. (510) 847-5100

Material Safety Data Sheet

I Product:	CLOROX BLEACH - FOR INSTITUTIONAL USE
Description:	CLEAR, LIGHT YELLOW LIQUID WITH CHLORINE ODOR

Other Designations	Manufacturer	Emergency Telephone No.
EPA Reg. No. 5813-1 Sodium hypochlorite soultion Liquid chlorine bleach Clorox Liquid Bleach Clorox Germicidal Bleach	The Clorox Company 1221 Broadway Oakland, CA 94612	For Medical Emergencies, call Rocky Mountain Poison Center: 1-800-446-1014 For Transportation Emergencies, call: Chemtrec: 1 800-424-9300

II Health Hazard Data

Causes substantial but temporary eye injury. May irritate skin. May cause nausea and vomiting if ingested. Exposure to vapor or mist may irritate nose, throat and lungs. The following medical conditions may be aggravated by exposure to high concentrations of vapor or mist; heart conditions or chronic respiratory problems such as asthma, chronic bronchitis or obstructive lung disease. Under normal consumer use conditions the likelihood of any adverse health effects are low.

FIRST AID: EYE CONTACT: Immediately flush eyes with plenty of water. If irritation persists, see a doctor. SKIN CONTACT: Remove contaminated clothing. Wash area with water. INGESTION: Drink a glassful of water and call a physician. INHALATION: If breathing problems develop remove to fresh air.

III Hazardous Ingredients

Ingredients	Concentration	Worker Exposure Limit
Sodium hypochlorite CAS # 7681-52-9	5.25%	not established

None of the ingredients in this product are on the IARC, NTP or OSHA carcinogen list. Occasional clinical reports suggest a low potential for sensitization upon exaggerated exposure to sodium hypochlorite if skin damage (e.g. irritation) occurs during exposure. Routine clinical tests conducted on intact skin with Clorox Liquid Bleach found no sensitization in the test subjects.

IV Special Protection and Precautions

Hygienic Practices: Wear safety glasses. With repeated or prolonged use, wear gloves.

Engineering Controls: Use general ventilation to minimize exposure to vapor or mist.

Work Practices: Avoid eye and skin contact and inhalation of vapor or mist.

Keep out of the reach of children.

V Transportation and Regulatory Data

U.S. DOT Hazard Class: Not restricted

U.S. DOT Proper Shipping Name: Hypochlorite solution with not more than 7% available chlorine. Not Restricted per 49CFR172.101(c)(12)(iv).

EPA CERCLA/SARA TITLE III Superfund Amendment and Reauthorization Act:

	CERLA/304		
	RQ (lbs)	311/312	313
Sodium hypochlorite	100	—	—
Sodium hydroxide	1000	Yes	—

VI Spill or Leak Procedures

Small Spills (<5 gallons)
1) Absorb, containerize, and landfill in accordance with local regulations. (2) Wash down residual to sanitary sewer.*

Large Spills (>5 gallons)
1) Absorb, containerize, and landfill in accordance with local regulations; wash down residual to sanitary sewer.* - OR - (2) Pump material to waste drum(s) and dispose in accordance with local regulations; wash down residual to sanitary sewer.*

VII Reactivity Data

Stable under normal use and storage conditions. Strong oxidizing agent. Reacts with other household chemicals such as toilet bowl cleaners, rust removers, vinegar, acids or ammonia containing products to produce hazardous gases, such as chlorine and other chlorinated species. Prolonged contact with metal may cause pitting or discoloration.

VIII Fire and Explosion Data

Not flammable or explosive. In a fire, cool containers to prevent rupture and release of sodium chlorate.

IX Physical Data

Boiling point ..... 212°F/100°C decomposes)
Specific Gravity (H_2O=1) 1.085
Solubility in Water ..... complete
pH 11.4

The Clorox Company
7200 Johnson Drive
Pleasanton, California 94588
Tel. (510) 847-6100

Material Safety Data Sheet

I Product: REGULAR CLOROX BLEACH

Description: CLEAR, LIGHT YELLOW LIQUID WITH CHLORINE ODOR

Other Designations	Manufacturer	Emergency Telephone No.
Sodium hypochlorite solution Liquid chlorine bleach Clorox Liquid Bleach	The Clorox Company 1221 Broadway Oakland, CA 94612	Notify your Supervisor Rocky Mountain Poison Center (800) 446-1014 For Transportation Emergencies Chemtrec (800) 424-9300

II Health Hazard Data

*Causes substantial but temporary eye injury. May irritate skin. May cause nausea and vomiting if ingested. Exposure to vapor or mist may irritate nose, throat and lungs. The following medical conditions may be aggravated by exposure to high concentrations of vapor or mist; heart conditions or chronic respiratory problems such as asthma, chronic bronchitis or obstructive lung disease. Under normal consumer use conditions the likelihood of any adverse health effects are low.

FIRST AID: EYE CONTACT: Immediately flush eyes with plenty of water. If irritation persists, see a doctor. SKIN CONTACT: Remove contaminated clothing. Wash area with water. INGESTION: Drink a glassful of water and call a physician. INHALATION: If breathing problems develop remove to fresh air.

III Hazardous Ingredients

Ingredients	Concentration	Worker Exposure Limit
Sodium hypochlorite CAS # 7681-52-9	5.25%	not established

None of the ingredients in this product are on the IARC, NTP or OSHA carcinogen list. Occasional clinical reports suggest a low potential for sensitization upon exaggerated exposure to sodium hypochlorite if skin damage (e.g. irritation) occurs during exposure. Routine clinical tests conducted on intact skin with Clorox Liquid Bleach found no sensitization in the test subjects.

IV Special Protection and Precautions

Hygienic Practices: Wear safety glasses. With repeated or prolonged use, wear gloves.

Engineering Controls: Use general ventilation to minimize exposure to vapor or mist.

Work Practices: Avoid eye and skin contact and inhalation of vapor or mist.

Keep out of the reach of children.

V Transportation and Regulatory Data

U.S. DOT Hazard Class: Not restricted

U.S. DOT Proper Shipping Name: Hypochlorite solution with not more than 7% available chlorine. Not Restricted per 49CFR172.101(c)(12)(iv).

Section 313 (Title III Superfund Amendment and Reauthorization Act): As a consumer product, this product is exempt from supplier notification requirements under Section 313 Title III of the Superfund Amendment and Reauthorization Act of 1986 (reference 40 CFR Part 372).

VI Spill or Leak Procedures

Small Spills (<5 gallons)
1) Absorb, containerize, and landfill in accordance with local regulations. (2) Wash down residual to sanitary sewer.*
Large Spills (>5 gallons)
1) Absorb, containerize, and landfill in accordance with local regulations; wash down residual to sanitary sewer.* - OR - (2) Pump material to waste drum(s) and dispose in accordance with local regulations; wash down residual to sanitary sewer.*

* Contact the sanitary treatment facility in advance to assure ability to process washed-down material.

VII Reactivity Data

Stable under normal use and storage conditions. Strong oxidizing agent. Reacts with other household chemicals such as toilet bowl cleaners, rust removers, vinegar, acids or ammonia containing products to produce hazardous gases, such as chlorine and other chlorinated species. Prolonged contact with metal may cause pitting or discoloration.

VIII Fire and Explosion Data

...flammable or explosive. In a fire, cool containers to prevent rupture ...release of sodium chlorate.

IX Physical Data

Boiling point	212°F/100°C decomposes
Specific Gravity (H_2O=1)	1.085
Solubility in Water	complete
pH	11.4

ACA Gas Inc.
6225 Oaktree Blvd.
P.O. Box 94737
Cleveland, Ohio 44101-4737

Telephone
(216) 642-6600

MATERIAL SAFETY DATA SHEET No. 12

PRODUCT NAME	CAS #
Compressed Air	N/A
TRADE NAME AND SYNONYMS Compressed Air; Air; Compressed Air, Breathing Quality	DOT ID No. UN 1002
CHEMICAL NAME AND SYNONYMS See last page.	DOT Hazard Class Nonflammable gas
	Formula See last page.
ISSUE DATE AND REVISIONS 25 November 1985	Chemical Family N/A

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT
None listed (ACGIH, 1985-86)

SYMPTOMS OF EXPOSURE Air is nontoxic and necessary to support life. Inhalation of air in a high pressure environment such as underwater diving, caissons or hyperbaric chambers can result in symptoms similar to overexposure to pure oxygen. These include tingling of fingers and toes, abnormal sensations, impaired coordination and confusion. Decompression sickness pains or "bends" are possible following rapid decompression.

TOXICOLOGICAL PROPERTIES
High pressure effects (greater than two atmospheres of oxygen) are on the central nervous system. Improper decompression results in the accumulation of nitrogen in the blood.

RECOMMENDED FIRST AID TREATMENT
Facilities or practices at which air is breathed in a high pressure environment should be prepared to deal with the illnesses associated with decompression (bends or caisson disease). Decompression equipment may be required.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

N/A

PHYSICAL DATA

BOILING POINT	LIQUID DENSITY AT BOILING POINT
-317.3°F (-194.3°C)	54.56 lb/ft^3 (874 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C): Above the critical temp. of -221.1°F (-140.6°C)	GAS DENSITY AT 70°F, 1 atm .0749 lb/ft^3 (1.200 kg/m^3)
SOLUBILITY IN WATER Very slightly	FREEZING POINT N/A
EVAPORATION RATE N/A	SPECIFIC GRAVITY (AIR=1) 1.0

APPEARANCE AND ODOR
Colorless, odorless gas

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	AUTO IGNITION TEMPERATURE	FLAMMABLE LIMITS - % BY VOLUME
N/A	N/A	LEL N/A UEL N/A

EXTINGUISHING MEDIA
Nonflammable gas

ELECTRICAL CLASSIFICATION
Nonhazardous

SPECIAL FIRE FIGHTING PROCEDURES

N/A

UNUSUAL FIRE AND EXPLOSION HAZARDS
Compressed air at high pressures will accelerate the burning of materials to a greater rate than they burn at atmospheric pressure.

REACTIVITY DATA

STABILITY		CONDITIONS TO AVOID
Unstable		
Stable	X	N/A

INCOMPATIBILITY (Materials to avoid)
None

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION		CONDITIONS TO AVOID
May Occur		
Will Not Occur	X	N/A

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
N/A

WASTE DISPOSAL METHOD
N/A

RESPIRATORY PROTECTION (Specify Type)
N/A

VENTILATION	LOCAL EXHAUST	SPECIAL
N/A	N/A	N/A
	MECHANICAL (General) N/A	OTHER N/A

PROTECTIVE GLOVES
Any material

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes

SPECIAL PRECAUTIONS

SPECIAL LABELING INFORMATION
DOT Shipping Name: Air, compressed DOT Hazard Class: Nonflammable gas
DOT Shipping Label: Nonflammable gas I.D. No.: UN 1002

SPECIAL HANDLING RECOMMENDATIONS
Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations, consult the Compressed Gas Association's Pamphlets P-1, G-7 and G-7.1.

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excesssive periods of time.

For additional storage recommendations, consult the Compressed Gas Association's Pamphlets P-1, G-7, and G-7.1.

SPECIAL PACKAGING RECOMMENDATIONS
Dry air is noncorrosive and may be used with all materials of construction. Moisture causes metal oxides which are formed with air to be hydrated so that they increase in volume and lose their protective role (rust formation). Concentrations of SO_2, Cl_2, salt, etc. in the moisture enhances the rusting of metals in air.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

CHEMICAL FORMULA: (Continued)

Atmospheric air which is compressed is composed of the following concentrations of gases:

Gas	Molar %
Nitrogen	78.09
Oxygen	20.94
Argon	0.93
Carbon Dioxide	0.033*
Neon	18.18×10^{-4}
Helium	5.239×10^{-4}
Krypton	1.139×10^{-4}
Hydrogen	0.5×10^{-4}
Xenon	0.086×10^{-4}
Radon	6×10^{-18}
Water vapor	Varying concentrations

*Concentrations may have slight variations.

Compressed air is also produced by reconstitution using only oxygen and nitrogen. This product contains 79 molar percent nitrogen and 21 molar percent oxygen plus trace amounts of other atmospheric gases which are present in the oxygen and nitrogen.

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 470
Diesel Fuel Oil No. 2-D

Issued: 10/81 Revision: A, 11/90

Section 1. Material Identification

33

Diesel Fuel Oil No. 2-D Description: Diesel fuel is obtained from the middle distillate in petroleum separation; a distillate oil of low sulfur content. It is composed chiefly of unbranched paraffins. Diesel fuel is available in various grades, one of which is synonymous with fuel oil No. 2-D. This diesel fuel oil requires a minimum Cetane No. (efficiency rating for diesel fuel comparable to octane number ratings for gasoline) of 40 (ASTM D613). Used as a fuel for trucks, ships, and other automotive engines; as mosquito control (coating on breeding waters); and for drilling muds.

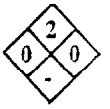
Other Designations: CAS No. 68334-30-5, diesel fuel.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(TM) for a suppliers list.

Cautions: Diesel fuel oil No. 2-D is a skin irritant and central nervous depressant with high mist concentrations. It is an environmental hazard and moderate fire risk.

R	1
I	-
S	2
K	2

NFPA



HMIS
H 0
F 2
R 0
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Diesel fuel oil No. 2-D*

1989 OSHA PEL	1990-91 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data‡
None established	Mineral Oil Mist TWA: 5 mg/m³† STEL: 10 mg/m³	None established	Rat, oral, LD_{50}: 9 g/kg produces gastrointestinal (hypermotility, diarrhea) effects

* Diesel fuel No. 2-D tends to be low in aromatics and high in paraffinics. This fuel oil is complex mixture of: 1) >95% paraffinic, olefinic, naphthenic, and aromatic hydrocarbons, 2) sulfur (<0.5%), and 3) benzene (<100 ppm). [A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)]. Although low in the fuel itself, benzene concentrations are likely to be much higher in processing areas.

† As sampled by nonvapor-collecting method.

‡ Monitor NIOSH, *RTECS* (HZ1800000), for future toxicity data.

Section 3. Physical Data

Boiling Point Range: 340 to 675 °F (171 to 358 °C)

Viscosity: 1.9 to 4.1 centistoke at 104 °F (40 °C)

Specific Gravity: <0.86

Water Solubility: Insoluble

Appearance and Odor: Brown, slightly viscous liquid.

Section 4. Fire and Explosion Data

Flash Point: 125 °F (52 °C) min. | **Autoignition Temperature:** >500 °F (932 °C) | **LEL:** 0.6% v/v | **UEL:** 7.5% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or foam to fight fire. Use a water spray to cool fire exposed containers. Do not use a forced water spray directly on burning oil since this will scatter the fire. Use a smothering technique for extinguishing fire.

Unusual Fire or Explosion Hazards: Diesel fuel oil No. 2-D is a OSHA Class II combustible liquid. Its volatility is similar to that of gas oil. Vapors may travel to a source of ignition and flash back.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. If feasible, remove containers from fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to pollution and fire or explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Diesel fuel oil No. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: It is incompatible with strong oxidizing agents; heating greatly increases the fire hazard.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of diesel fuel oil No. 2-D can produce various hydrocarbons and hydrocarbon derivatives, and other partial oxidation products such as carbon dioxide, carbon monoxide, and sulfur dioxide.

ction 6. Health Hazard Data

rcinogenicity: Although the IARC has not assigned an overall evaluation to diesel fuels as a group, it has evaluated occupational exposures in roleum refining as an IARC probable human carcinogen (Group 2A). It has evaluated distillate (light) diesel oils as not classifiable as human cin[illegible]s (Group 3).

mi[illegible]of Risks: Although diesel fuel's toxicologic effects should resemble kerosine's, they are somewhat more pronounced due to additives h as sulfurized esters. Excessive inhalation of aerosol or mist can cause respiratory tract irritation, headache, dizziness, nausea, vomiting, and s of coordination, depending on concentration and exposure time. When removed from exposure area, affected persons usually recover npletely. If vomiting occurs after ingestion and if oil is aspirated into the lungs, hemorrhaging and pulmonary edema, progressing to renal in- vement and chemical pneumonitis, may result. A comparative ratio of oral to aspirated lethal doses may be 1 pt vs. 5 ml. Aspiration may also ult in transient CNS depression or excitement. Secondary effects may include hypoxia (insufficient oxygen in body cells), infection, pneumato- e formation, and chronic lung dysfunction. Inhalation may result in euphoria, cardiac dysrhythmias, respiratory arrest, and CNS toxicity. longed or repeated skin contact may irritate hair follicles and block sebaceous glands, producing a rash of acne pimples and spots, usually on is and legs.

dical Conditions Aggravated by Long-Term Exposure: None reported.

rget Organs: Central nervous system, skin, and mucous membranes.

mary Entry Routes: Inhalation, ingestion.

ute Effects: Systemic effects from ingestion include gastrointestinal irritation, vomiting, diarrhea, and in severe cases central nervous system ression, progressing to coma or death. Inhalation of aerosols or mists may result in increased rate of respiration, tachycardia (excessively rapid rt beat), and cyanosis (dark purplish discoloration of the skin and mucous membranes caused by deficient blood oxygenation).

ronic Effects: Repeated contact with the skin causes dermatitis.

RST AID

s: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical lity. Consult a physician immediately.

n: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. If large areas of the body have been osed or if irritation persists, get medical help immediately. Wash affected area with soap and water.

alation: Remove exposed person to fresh air and support breathing as needed.

estion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. tact a physician immediately. Position to avoid aspiration.

er first aid, get appropriate in-plant, paramedic, or community medical support.

e to Physicians: Gastric lavage is contraindicated due to aspiration hazard. Preferred antidotes are charcoal and milk. In cases of severe ration pneumonitis, consider monitoring arterial blood gases to ensure adequate ventilation. Observe the patient for 6 hr. If vital signs become ormal or symptoms develop, obtain a chest x-ray.

ction 7. Spill, Leak, and Disposal Procedures

l/Leak: Notify safety personnel, evacuate area for large spills, remove all heat and ignition sources, and provide maximum explosion-proof tilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Clean up spills promptly to reduce fire or vapor hazards. a noncombustible absorbent material to pick up small spills or residues. For large spills, dike far ahead to contain. Pick up liquid for reclama- or disposal. Do not release to sewers or waterways due to health and fire and/or explosion hazard. Follow applicable OSHA regulations (29 R 1910.120). Diesel fuel oil No. 2-D spills may be environmental hazards. Report large spills.

po ontact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

A L nations

RA Hazardous Waste (40 CFR 261.21): Ignitable waste

RCLA Hazardous Substance (40 CFR 302.4): Not listed

RA Extremely Hazardous Substance (40 CFR 355): Not listed

RA Toxic Chemical (40 CFR 372.65): Not listed

HA Designations

Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

tion 8. Special Protection Data

gles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

pirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if neces- use a NIOSH-approved respirator with a mist filter and organic vapor cartridge. For emergency or nonroutine operations (cleaning spills, tor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

er: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

tilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and uctivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]

ty Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

taminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this rial from your shoes and equipment. Launder contaminated clothing before wearing.

ments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, ding, using the toilet, or applying cosmetics.

tion 9. Special Precautions and Comments

age Requirements: Use and storage conditions should be suitable for a OSHA Class II combustible liquid. Store in closed containers in a ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. To prevent static s, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Use nonsparking tools explosion-proof electrical equipment. No smoking in storage or use areas.

neering Controls: Avoid vapor or mist inhalation and prolonged skin contact. Wear protective rubber gloves and chemical safety glasses e contact with liquid or high mist concentration may occur. Additional suitable protective clothing may be required depending on working itions. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good nal hygiene and housekeeping procedures. Do not wear oil contaminated clothing. At least weekly laundering of work clothes is recom- ed. Do not put oily rags in pockets. When working with this material, wear gloves or use barrier cream.

sportation Data (49 CFR 172.101)

S ing Name: Fuel oil

l d Class: Combustible liquid

o.: NA1993

Label: None

Packaging Exceptions: 173.118a

Packaging Requirements: None

17-325; 17-325-2; 17-325-3 No. 1

ANSUL ANSUL FIRE PROTECTION MARINETTE, WI 54143-2542

MATERIAL SAFETY DATA SHEET

FORAY
QUICK IDENTIFIER (In Plant Common Name)

Manufacturer's Name:	ANSUL FIRE PROTECTION, NORMALO U.S., INC.	Emergency Telephone No.:	(715) 735-7411
Address:	One Stanton Street, Marinette, WI 54143-2542	Other Information Calls:	Same
Prepared By:	Safety and Health Department	Date Prepared:	June 1, 1989

SECTION 1 — IDENTITY

Common Name: (used on label) (Trade Name and Synonyms)	FORAY Dry Chemical Extinguishing Agent	CAS No.:	N/A
Chemical Name:	N/A This is a Mixture	Chemical Family:	Mixture
Formula:	N/A		

SECTION 2 — INGREDIENTS

PART A — HAZARDOUS INGREDIENTS

Principal Hazardous Component(s) (chemical and common name(s)):	%	CAS No.	ACGIH TLV	Acute Toxicity Data
Muscovite Talc	Less than 5	12001-26-2	20 mppcf*	NDA
Magnesium Aluminum Silicate	Less than 10	8031-18-3	10 mg/M3	NDA

*Million particles per cubic foot

PART B — OTHER INGREDIENTS

Other Component(s) (chemical and common name(s)):	%	CAS No.	Acute Toxicity Data
Monoammonium Phosphate	Greater than 75	7722-76-1	NDA
Ammonium Sulfate	Greater than 10	7783-20-2	NDA
Methyl Hydrogen Polysiloxane	Less than 1	63148-57-2	NDA
Yellow Pigment	Less than 0.1	5468-75-7	NDA

SECTION 3 — PHYSICAL AND CHEMICAL CHARACTERISTICS (Fire and Explosion Data)

Boiling Point:	N/A			Specific Gravity (H_2O = 1):	N/A	Vapor Pressure (mm Hg):	N/A
Percent Volatile by Volume (%):	N/A	Vapor Density (Air = 1):	N/A	Evaporation Rate (= 1):	N/A		
Solubility in Water:	Slight			Reactivity in Water:	Unreactive		
Appearance and Odor:	Yellow colored powder, no characteristic odor						
Flash Point:	None	Flammable Limits in Air % by Volume:	N/A	Extinguisher Media:	N/A	Auto-ignition Temperature:	N/A
Special Fire Fighting Procedures:	NONE – THIS IS AN EXTINGUISHING AGENT						
Unusual Fire and Explosion Hazards:	None						

SECTION 4 — PHYSICAL HAZARDS

Stability:	Unstable ☐ Stable ☒	Conditions to Avoid:	N/A
Incompatibility (Materials to Avoid):	Strong alkalis, Mg		
Hazardous Decomposition Products:	NH_3 and/or PO_x may be evolved		

SECTION 5 — HEALTH HAZARDS

Threshold Limit Value:	OSHA nuisance dust limit of 15 mg/M3 or ACGIH nuisance dust value of 10 mg/M3 for the eight hour time-weighted average.
Routes of Entry: Eye Contact:	Mildly irritating for a short period of time.
Skin Contact:	May be mildly irritating.
Inhalation:	Treat as a mineral dust irritant to the respiratory tract.
Ingestion:	Not an expected route of entry.
Signs and Symptoms: Acute Overexposure:	Transient cough, shortness of breath.
Chronic Overexposure:	Chronic fibrosis of the lung, pneumoconiosis.
Medical Conditions Generally Aggravated by Exposure:	Reactive airway
Chemical Listed as Carcinogen or Potential:	National Toxicology Program: Yes ☐ No ☒ I.A.R.C. Monographs: Yes ☐ No ☒ OSHA: Yes ☐ No ☒

SECTION 6 — EMERGENCY AND FIRST AID PROCEDURES

Eye Contact:	Flush with large amounts of water; if irritation persists, seek Medical attention.
Skin Contact:	Wash with soap and water; if irritation persists, seek Medical attention.
Inhalation:	Remove victim to fresh air. Seek Medical attention if discomfort continues.
Ingestion:	If patient is conscious, give large amounts of water and induce vomiting. Seek Medical help.

SECTION 7 — SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type):	Dust mask where dustiness is prevalent, or TLV exceeded. Mechanical filter respirator if exposure is prolonged.			
Ventilation:	Local Exhaust:	Discretionary	Mechanical (General):	Recommended
Protective Gloves:	N/A		Eye Protection:	Recommended as mechanical barrier for prolonged exposure.
Other Protective Clothing or Equipment:	If irritation occurs, long sleeves and impervious gloves should be worn.			

SECTION 8 — SPECIAL PRECAUTIONS AND SPILL/LEAK PROCEDURES

Precautions to be Taken in Handling and Storage:	Should be stored in original container or Ansul fire extinguisher.
Other Precautions:	Do not mix agents.
Steps to be Taken in Case Material is Released or Spilled:	Sweep up.
Waste Disposal Methods:	Dispose of in compliance with local, state, and federal regulations.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS

HAZARD INDEX:
4 Severe Hazard
3 Serious Hazard
2 Moderate Hazard
1 Slight Hazard
0 Minimal Hazard

1 HEALTH
0 FLAMMABILITY
0 REACTIVITY

N/A = Not Applicable NDA = No Data Available

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 467
Automotive Gasoline, Lead-free

Issued: 10/81 Revision: A, 9/91

Section 1. Material Identification

35

Automotive Gasoline, Lead-free, Description: A mixture of volatile hydrocarbons composed mainly of branched-chain paraffins, cycloparaffins, olefins, naphthenes, and aromatics. In general, gasoline is produced from petroleum, shale oil, Athabasca tar sands, and coal. Motor gasolines are made chiefly by cracking processes, which convert heavier petroleum fractions into more volatile fractions by thermal or catalytic decomposition. Widely used as fuel in internal combustion engines of the spark-ignited, reciprocating type. Automotive gasoline has an octane number of approximately 90. A high content of aromatic hydrocarbons and a consequent high toxicity are also associated with a high octane rating. Some gasolines sold in the US contain a minor proportion of tetraethyllead, which is added in concentrations not exceeding 3 ml per gallon to prevent engine "knock." However, methyl-tert-butyl ether (MTBE) has almost completely replaced tetraethyllead.

Other Designations: CAS No. 8006-61-9, benzin, gasoline, gasolene, motor spirits, natural gasoline, petrol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 2
S 2*
K 4
* Skin absorption

NFPA

HMIS
H 2
F 3
R 1
PPG†
† Sec. 8

Cautions: Inhalation of automotive gasoline vapors can cause intense burning in throat and lungs, central nervous system (CNS) depression, and possible fatal pulmonary edema. Gasoline is a dangerous fire and explosion hazard when exposed to heat and flames.

Section 2. Ingredients and Occupational Exposure Limits

Automotive gasoline, lead-free*

1990 OSHA PELs
8-hr TWA: 300 ppm, 900 mg/m³
15-min STEL: 500 ppm, 1500 mg/m³

1990-91 ACGIH TLVs
TWA: 300 ppm, 890 mg/m³
STEL: 500 ppm, 1480 mg/m³

1990 NIOSH REL
None established

1985-86 Toxicity Data*
Man, inhalation, TC_{Lo}: 900 ppm/1 hr; toxic effects include sense organs and special senses (conjunctiva irritation), behavioral (hallucinations, distorted perceptions), lungs, thorax, or respiration (cough)
Human, eye: 140 ppm/8 hr; toxic effects include mild irritation
Rat, inhalation, LC_{50}: 300 g/m³/5 min

* A typical modern gasoline composition is 80% paraffins, 14% aromatics, and 6% olefins. The mean benzene content is approximately 1%. Other additives include sulfur, phosphorus, and MTBE.
† See NIOSH, *RTECS* (LX3300000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: Initially, 102 °F (39 °C); after 10% distilled, 140 °F (60 °C); after 50% distilled, 230 °F (110 °C); after 90% distilled, 338 °F (170 °C); final boiling point, 399 °F (204 °C)

Vapor Density (air = 1): 3.0 to 4.0

Density/Specific Gravity: 0.72 to 0.76 at 60 °F (15.6 °C)

Water Solubility: Insoluble

Appearance and Odor: A clear (gasoline may be colored with dye), mobile liquid with a characteristic odor recognizable at about 10 ppm in air.

Section 4. Fire and Explosion Data

Flash Point: -45 °F (-43 °C)	Autoignition Temperature: 536 to 853 °F (280 to 456 °C)	LEL: 1.3% v/v	UEL: 6.0% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or alcohol foam as extinguishing media. Use of water may be ineffective to extinguish fire, but use water spray to knock down vapors and to cool fire-exposed drums and tanks to prevent pressure rupture. Do not use a solid stream of water since it may spread the fuel.

Unusual Fire or Explosion Hazards: Automobile gasoline is an OSHA Class IB flammable liquid and a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow to an ignition source and flash back. Automobile gasoline can also react violently with oxidizing agents.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode, and full protective clothing. When the fire is extinguished, use nonsparking tools for cleanup. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Automotive gasoline is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Automotive gasoline can react with oxidizing materials such as peroxides, nitric acid, and perchlorates.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of automotive gasoline can produce oxides of carbon and partially oxidized hydrocarbons.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC list gasoline as a possible human carcinogen (Group 2B). Although the IARC has assigned an overall evaluation to gasoline, it has not assigned an overall evaluation to specific substances within this group (inadequate human evidence).
Summary of Risks: Gasoline vapors are considered moderately poisonous. Vapor inhalation can cause central nervous system (CNS) depression and mucous membrane and respiratory tract irritation. Brief inhalations of high concentrations can cause a fatal pulmonary edema. Reported responses to gasoline vapor concentrations are: 160 to 270 ppm causes eye and throat irritation in several hours; 500 to 900 ppm causes eye, nose, and throat irritation and dizziness in 1 hr; and 2000 ppm produces mild anesthesia in 30 min. Higher concentrations are intoxicating in 4 to 10 minutes. If large areas of skin are exposed to gasoline, toxic amounts may be absorbed. Repeated or prolonged skin exposure causes dermatitis. Certain individuals may develop hypersensitivity. Ingestion can cause CNS depression. Pulmonary aspiration after ingestion can cause severe pneumonitis. In adults, ingestion of 20 to 50 g gasoline may produce severe symptoms of poisoning.
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Skin, eye, respiratory and central nervous systems.
Primary Entry Routes: Inhalation, ingestion, skin contact.
Acute Effects: Acute inhalation produces intense nose, throat, and lung irritation; headaches; blurred vision; conjunctivitis; flushing of the face; mental confusion; staggering gait; slurred speech; and unconsciousness, sometimes with convulsions. Ingestion causes inebriation (drunkenness), vomiting, dizziness, fever, drowsiness, confusion, and cyanosis (a blue to dark purplish coloration of skin and mucous membrane caused by lack of oxygen). Aspiration causes choking, cough, shortness of breath, increased rate of respiration, excessively rapid heartbeat, fever, bronchitis, and pneumonitis. Other symptoms following acute exposure include acute hemorrhage of the pancreas, fatty degeneration of the liver and kidneys, and passive congestion of spleen.
Chronic Effects: Chronic inhalation results in appetite loss, nausea, weight loss, insomnia, and unusual sensitivity (hyperesthesia) of the distal extremities followed by motor weakness, muscular degeneration, and diminished tendon reflexes and coordination. Repeated skin exposure can cause blistering, drying, and lesions.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Give conscious victim a mixture of 2 tablespoons of activated charcoal mixed in 8 oz of water to drink. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Use nonsparking tools. Take up small spills with sand or other noncombustible adsorbent. Dike storage areas to control leaks and spills. Follow applicable OSHA regulations (29 CFR 1910.120).
Aquatic Toxicity: Bluegill, freshwater, LC_{50}, 8 ppm/96 hr.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
RCRA Hazardous Waste (40 CFR 261.21): Characteristic of ignitability
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. There are no specific NIOSH recommendations. However, for vapor concentrations not immediately dangerous to life or health, use chemical cartridge respirator equipped with organic vapor cartridge(s), or a supplied-air respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Materials such as neoprene or polyvinyl alcohol provide excellent/good resistance for protective clothing. Note: Resistance of specific materials can vary from product to product.
Ventilation: Provide general and local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[103]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IB liquid. Outside or detached storage preferred.
Engineering Controls: Avoid vapor inhalation and skin or eye contact. Consider a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Indoor use of this material requires explosion-proof exhaust ventilation to remove vapors. Only use gasoline as a fuel source due to its volatility and flammable/explosive nature. Practice good personal hygiene and housekeeping procedures. Wear clean work clothing daily.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Gasoline (*including casing-head and natural*)
DOT Hazard Class: Flammable liquid
ID No.: UN1203
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

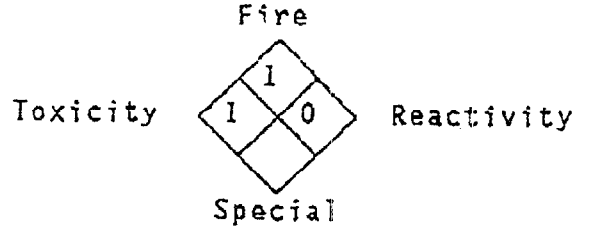
IMO Shipping Name: Gasoline
IMO Hazard Class: 3.1
ID No.: UN1203
IMO Label: Flammable liquid
IMDG Packaging Group: II

WITCO MATERIAL SAFETY DATA SHEET

Kendall C-915 Grease

Product Code: J63 7834

NFPA HAZARD RATING
4 - Extreme
3 - High
2 - Moderate
1 - Slight
0 - Insignificant



DIVISION AND LOCATION---SECTION I

Division: KENDALL REFINING COMPANY
Location: BRADFORD, PENNSYLVANIA
77 N. KENDALL AVE.,BRADFORD,PA,16701
Emergency Telephone Number: (814) 368-6111
Transportation Emergency: CHEMTREC 1-(800) 424-9300 (U.S. and Canada)

CHEMICAL AND PHYSICAL PROPERTIES---SECTION II

Chemical Name:
petroleum hydrocarbon and calcium stearate
Formula: not applicable
Hazardous Decomposition Products:
carbon monoxide and carbon dioxide from burning.
Incompatibility (Keep away from):
strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.
Toxic and Hazardous Ingredients:
none
Form: semi-solid Odor: mineral oil
Appearance: grease Color: black
Specific Gravity (water=1): .94
Boiling Point: greater than 260°C (500°F)
Melting Point: not applicable
Solubility in Water (by weight %): negligible
Volatile (by weight %): negligible
Evaporation Rate: negligible
Vapor Pressure (mm Hg at 20°C): negligible
Vapor Density (air=1): not applicable
pH (as is): not applicable
Stability: Product is stable under normal conditions
Viscosity SUS at 100°F: Greater than or = to 100

FIRE AND EXPLOSION DATA---SECTION III

Special Fire Fighting Procedures:
Do not use water except as fog.
Unusual Fire and Explosion Hazards:
none

(Continued on next page)

WITCO MATERIAL SAFETY DATA SHEET

Kendall C-915 Grease

Product Code: J63 7834

(Section III continued)

Flashpoint: (Method Used) ASTM D92 greater than 210°C (410°F)
Flammable limits %: not applicable
Extinguishing agents:
Drychemical or Waterfog or CO_2 or Foam or Sand/Earth
Water may cause frothing.
Closed containers exposed to fire may be cooled with water.

HEALTH HAZARD DATA---SECTION IV

Permissible concentrations (air):
not applicable
Chronic effects of overexposure:
Extended skin contact may cause dermatitis to some individuals.
Acute toxicological properties:
no data available
Emergency First Aid Procedures:
Eyes: Immediately flush with large quantities of water for at least 15 minutes and call a physician.
Skin Contact: Remove excess with cloth or paper. Wash thoroughly with soap and water.
Inhalation: Remove victim to fresh air. Call a physician.
If Swallowed: Contact a physician immediately.

SPECIAL PROTECTION INFORMATION---SECTION V

Ventilation Type Required (Local,mechanical,special):
none required
Respiratory Protection (Specify type):
none required
Protective Gloves:
rubber
Eye Protection:
chemical safety goggles
Other Protective Equipment:
none

HANDLING OF SPILLS OR LEAKS---SECTION VI

Procedures for Clean-Up:
Transfer bulk of mixture into another container. Absorb residue with an inert material such as earth, sand, or vermiculite. Sweep up and dispose as solid waste in accordance with local, state, and federal regulations.
Waste Disposal:
Dispose of in accordance with all applicable federal, state and local regulations.

(Continued on next page)

WITCO MATERIAL SAFETY DATA SHEET

Kendall C-915 Grease

Product Code: J63 7834

SPECIAL PRECAUTIONS---SECTION VII

Precautions to be taken in handling and storage:
Do not handle or store at temperatures over
Maximum Storage Temperature: 38°C (100°F)

TRANSPORTATION DATA---SECTION VIII

D.O.T.: Not Regulated
Reportable Quantity: not applicable
Freight Classification: Petroleum Lubricating Grease
Special Transportation Notes:

COMMENTS

* STATE REGULATORY INFORMATION:
Pennsylvania Worker And Community Right To Know Act: This product contains the following ingredient(s).
Hydrocarbon oils CAS. NO. 8020-83-5
Partial contents are withheld as trade secret information.

Prepared by: Robert Kellam
Title: Group Supervisor, Lubricants Testing, Maintenance, and Safety
Original Date: 06/18/82 Sent to: _____
Revision Date: 08/09/94 _____
Supersedes : 04/01/93 _____
Date Sent : _____

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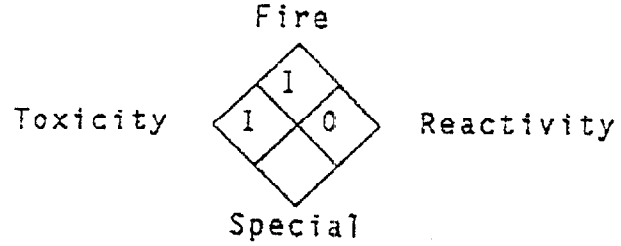
W I T C O M A T E R I A L S A F E T Y D A T A S H E E T

KENDALL FOUR SEASONS HYDRAULIC FLUID
AW-22,32,46,58,100 and 150

NFPA HAZARD RATING
4 - Extreme
3 - High
2 - Moderate
1 - Slight
0 - Insignificant



DIVISION AND LOCATION---SECTION I

Division: KENDALL REFINING COMPANY
Location: BRADFORD, PENNSYLVANIA
77 N. KENDALL AVE.,BRADFORD,PA,16701
Emergency Telephone Number: (814) 368-6111
Transportation Emergency: CHEMTREC 1-(800) 424-9300 (U.S. and Canada)

CHEMICAL AND PHYSICAL PROPERTIES---SECTION II

Chemical Name:
petroleum hydrocarbon
Formula: not applicable
Hazardous Decomposition Products:
carbon monoxide and carbon dioxide from burning.
oxides of phosphorous from burning
oxides of sulfur
Incompatibility (Keep away from):
strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.
Toxic and Hazardous Ingredients:
none
Form: liquid Odor: bland
Appearance: liquid Color: amber
Specific Gravity (water=1): .87 to .88
Boiling Point: greater than 330°C (625°F)
Melting Point: less than -18°C (0°F)
Solubility in Water-(by weight %): 0 at 20°C
Volatile (by weight %): 0
Evaporation Rate: 0
Vapor Pressure (mm Hg at 20°C): 0
Vapor Density (air=1): not volatile
pH (as is): not applicable
Stability: Product is stable under normal conditions
Viscosity SUS at 100°F: Greater than or = to 100

(Continued on next page)

WITCO MATERIAL SAFETY DATA SHEET

KENDALL FOUR SEASONS HYDRAULIC FLUID
AW-22,32,46,68,100 and 150

FIRE AND EXPLOSION DATA---SECTION III

Special Fire Fighting Procedures:
Do not use water except as fog.
Unusual Fire and Explosion Hazards:
none
Flashpoint: (Method Used) Cleveland open cup greater than 200°C (390°F)
Flammable limits %: not applicable
Extinguishing agents:
Drychemical or Waterfog or CO_2 or Foam
Closed containers exposed to fire may be cooled with water.

HEALTH HAZARD DATA---SECTION IV

Permissible concentrations (air):
see COMMENTS section
Chronic effects of overexposure:
no data available
Acute toxicological properties:
no data available
Emergency First Aid Procedures:
Eyes: Immediately flush with large quantities of water for at least 15 minutes and call a physician.
Skin Contact: Remove excess with cloth or paper. Wash thoroughly with soap and water.
Inhalation: Remove victim to fresh air. Call a physician.
If Swallowed: Contact a physician immediately.

SPECIAL PROTECTION INFORMATION---SECTION V

Ventilation Type Required (Local,mechanical,special):
see COMMENTS section
Respiratory Protection (Specify type):
Use NIOSH/MSHA certified respirator with dual organic vapor/mist and particulates cartridge if vapor concentration exceeds permissible exposure limit.
Protective Gloves:
neoprene type
Eye Protection:
chemical safety goggles
Other Protective Equipment:
none

(Continued on next page)

WITCO MATERIAL SAFETY DATA SHEET

HANDLING OF SPILLS OR LEAKS---SECTION VI

Procedures for Clean-Up:
Transfer bulk of mixture into another container. Absorb residue with an inert material such as earth, sand, or vermiculite. Sweep up and dispose as solid waste in accordance with local, state, and federal regulations.

Waste Disposal:
Dispose of in accordance with all applicable federal, state and local regulations.

SPECIAL PRECAUTIONS---SECTION VII

Precautions to be taken in handling and storage:
Do not handle or store at temperatures over
Maximum Storage Temperature: 38°C (100°F)

TRANSPORTATION DATA---SECTION VIII

D.O.T.: Not Regulated
Reportable Quantity: not applicable
Freight Classification: Petroleum Lubricating Oil
Special Transportation Notes:
none

ENVIRONMENTAL/SAFETY REGULATIONS---SECTION IX

Section 313 (Title III Superfund Amendment and Reauthorization Act):

This product does not contain any chemical in sufficient quantity to be subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

COMMENTS

If used in applications where a mist may be generated, observe a TWA/PEL of 5 mg/m3 for mineral oil mist (OSHA and ACGIH).

* STATE REGULATORY INFORMATION:

Pennsylvania Worker And Community Right To Know Act: This product contains the following ingredient(s).
Hydrocarbon oils CAS. NO. 8020-83-5
The additive mixtures in this product have been declared a trade secret by the additive manufacturers.

(Continued on next page)

WITCO MATERIAL SAFETY DATA SHEET

KENDALL FOUR SEASONS HYDRAULIC FLUID
AW-22,32,46,68,100 and 150

(COMMENTS continued)

Prepared by: Robert Kellam
Title: Group Supervisor, Lubricants Testing, Maintenance, and Safety
Original Date: 05/24/89 Sent to: _____
Revision Date: 08/09/94 _____
Supersedes : 04/01/93 _____
Date Sent : _____

We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind, express or implied, and we assume no responsibility for any loss, damage, or expense, direct or consequential, arising out of their use.

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ALPHAGAZ

Specialty Gas

Material Safety Data Sheet

	PRODUCT NAME: Isobutylene	
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
LIQUID AIR CORPORATION ALPHAGAZ DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	TRADE NAME AND SYNONYMS: Isobutylene	CAS NUMBER: 115-11-7
	CHEMICAL NAME AND SYNONYMS: Isobutene, Isobutylene, 2-Methylpropene	
ISSUE DATE AND REVISIONS: OCTOBER 1, 1985 CORPORATE SAFETY DEPT.	FORMULA: (iso) C_4H_8 MOLECULAR WEIGHT: 56.03	CHEMICAL FAMILY: Monolefin

See last page.

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Isobutylene is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg. (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Inhalation: Moderate concentrations so as to exclude an adequate supply of oxygen to the lungs causes dizziness, drowsiness and eventual unconsciousness. It also has a very mild anesthetic effect which might cause lack of co-ordination or lessened mental alertness.

Skin and Eye Contact: It is mildly irritating to mucous membranes. Due to its rapid rate of evaporation, it can cause tissue freezing or frostbite on dermal contact.

TOXICOLOGICAL PROPERTIES

It has a very mild anesthetic effect; however, the major property is the exclusion of an adequate supply of oxygen to the lungs.

Frostbite effects are a change in color of the skin to gray or white possibly followed by blistering.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	Yes ☐ No ☒	I.A.R.C. Monographs	Yes ☐ No ☒	OSHA	Yes ☐ No ☒		

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO ISOBUTYLENE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Medical assistance should be sought immediately.

Dermal Contact or Frostbite: Remove contaminated clothing and flush affected areas

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Isobutylene is flammable over a wide range in air.

PHYSICAL DATA

BOILING POINT 19.18°F (-7.12°C)	**LIQUID DENSITY AT BOILING POINT** 39.09 lb/ft^3 (626.2 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C) = 38.43 psia (265 kPa)	**GAS DENSITY AT 70°F 1 atm** .148 lb/ft^3 (2.37 kg/m^3)
SOLUBILITY IN WATER Insoluble	**FREEZING POINT** -220.63°F (-140.35°C)
APPEARANCE AND ODOR Colorless gas with an unpleasant odor similar to that which is emitted when burning anthracite coal. Specific gravity @70°F (Air = 1.0) is 1.98.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) -105°F (-76°C) Closed cup	**AUTO IGNITION TEMPERATURE** 869°F (465°C)	**FLAMMABLE LIMITS % BY VOLUME** LEL: 1.8 UEL: 9.6
EXTINGUISHING MEDIA Water, carbon dioxide, dry chemical		**ELECTRICAL CLASSIFICATION** Class 1, Group not specified

SPECIAL FIRE FIGHTING PROCEDURES

possible, stop the flow of isobutylene. Use water spray to cool surrounding containers.

UNUSUAL FIRE AND EXPLOSION HAZARDS Isobutylene is heavier than air and may travel a considerable distance to a source of ignition. Should flame be extinguished and flow of gas continue, increase ventilation to prevent flammable mixture formation in low areas or pockets.

REACTIVITY DATA

STABILITY Unstable		**CONDITIONS TO AVOID**
Stable	X	

INCOMPATIBILITY (Materials to avoid)
Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION May Occur		**CONDITIONS TO AVOID**
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD
Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air-line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
Hood with forced ventilation	To prevent accumulation above the LEL.	
	MECHANICAL (Gen.) In accordance with electrical codes.	OTHER

PROTECTIVE GLOVES
Plastic or rubber

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower, eyewash "fountain"

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Liquefied petroleum gas DOT Hazard Class: Flammable gas
DOT Shipping Label: Flammable gas I.D. No.: UN 1075

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<250 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and emptry cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS
Isobutylene is noncorrosive and may be used with any common structural material.

THER RECOMMENDATIONS OR PRECAUTIONS
Earth-ground and bond all lines and equipment associated with the isobutylene system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ADDITIONAL DATA

RECOMMENDED FIRST AID TREATMENT: (Continued)

with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

TIME WEIGHTED AVERAGE EXPOSURE LIMIT (Continued)

TWA (OSHA, 1985) for LPG (Liquefied Petroleum Gas) is 1,000 molar PPM.

No. 14

Genium Publishing Corp.
One Genium Plaza
Schenectady, NY 12304-4690
(518) 377-8854

Material Safety Data Sheets Collection

Isopropyl Alcohol MSDS No. 324
**Note: 2 pages
Date of Preparation: 9/85 Revision: A, 10/93

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Isopropyl Alcohol
Chemical Formula: $(CH_3)_2CHOH$
CAS No.: 67-63-0
Synonyms: Dimethyl carbinol, 2-hydroxypropane, IPA, Isohol, Lutosol, Isopropanol, Petrohol, 2-propanol, *sec*-propyl alcohol, rubbing alcohol, Spectar.
Derivation: Treating propylene with sulfuric acid and then hydrolyzing or direct hydration of propylene using superheated steam. Most commonly available as rubbing alcohol (70% IPA).
General Use: As a solvent for gums, shellac, and essential oils, chemical intermediate, dehydrating agent, vehicle for germicidal compounds, de-icing agent for liquid fuels; for denaturing ethyl alcohol, preserving pathological specimens; in extraction of alkaloids, quick-drying inks and oils, and an ingredient of skin lotions, cosmetics, window cleaner, liquid soaps, and pharmaceuticals.
Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Isopropyl alcohol, 100% vol. Most commonly sold as 70% isopropyl alcohol (rubbing alcohol).

OSHA PELs
8-hr TWA: 400 ppm (980 mg/m^3)
STEL: 500 ppm (1225 mg/m^3) *

ACGIH TLVs
TWA: 400 ppm (983 mg/m^3)
STEL: 500 ppm (1230 mg/m^3)

NIOSH REL
10-hr TWA: 400 ppm (980 mg/m^3)
STEL: 500 ppm (1225 mg/m^3)

IDLH Level
12,000 ppm

DFG (Germany) MAK
TWA: 400 ppm (980 mg/m^3)
Category II: Substances with systemic effects
Half-life: < 2 hr

Peak Exposure Limit: 800 ppm, 30 min. average value, 4/shift

* Vacated 1989 Final Rule Limits

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Isopropyl alcohol is a highly flammable, volatile liquid. It is considered more toxic than ethyl alcohol, but less toxic than methyl alcohol. Inhalation can cause irritation of the eyes and respiratory tract and central nervous system depression at high concentrations. Repeated skin contact may cause dermatitis. Systemic toxicity appears to occur mostly in cases of heavy ingestion or inhalation. There is recent evidence that skin absorption may be more likely to cause systemic effects than previously thought.

Wilson Risk Scale
R 1
I 2
S 2*
K 3
*Skin absorption

HMIS
H 1
F 3
R 0

PPE*
*See 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin contact/absorption.
Target Organs: Eyes, skin, respiratory system.
Acute Effects
Inhalation: Vapor inhalation is irritating to the respiratory tract and can cause central nervous system depression at high concentrations. Volunteers exposed to 400 ppm for 3 to 5 min experienced mild eye and respiratory irritation. At 800 ppm, irritation was not severe, but most people found the air uncomfortable to breathe.
Eye: Exposure to the vapor or direct contact with the liquid causes irritation and possible corneal burns.
Skin: Some irritation may occur after prolonged exposure.
Ingestion: Accidental ingestions have provided the most information on isopropyl alcohol toxicity. Symptoms include nausea and vomiting, headache, facial flushing, dizziness, lowered blood pressure, mental depression, hallucinations and distorted perceptions, difficulty breathing, respiratory depression, stupor, unconsciousness, and coma. Kidney insufficiency including oliguria (reduced urine excretion), anuria (absent urine excretion), nitrogen retention, and edema (fluid build-up in tissues) may occur. One post-mortem examination in a case of heavy ingestion showed extensive hemorrhagic tracheobronchitis, bronchopneumonia, and hemorrhagic pulmonary edema. Death can occur in 24 to 36 h post-ingestion due to respiratory paralysis.
Carcinogenicity: NTP and OSHA do not list isopropyl alcohol as a carcinogen. The IARC has studied IPA and has classified it as Class-3 (unclassifiable, inadequate human and animal evidence). There appears to be an association between the *manufacture* (strong acid process, rather than the alcohol itself) of isopropanol and parasinus cancer, but this may be due to the diisopropyl sulfate or isopropyl oil by-products.
Medical Conditions Aggravated by Long-Term Exposure: Dermatitis or respiratory or kidney disorders.
Chronic Effects: Repeated skin contact can cause drying of skin and delayed hypersensitivity reactions in some individuals.

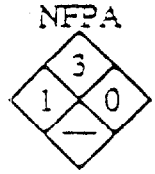
Other: Isopropyl alcohol is oxidized in the body to acetone where it is excreted by the lungs or kidneys. Some acetone may be further metabolized to acetate, formate, and finally carbon dioxide. Probable oral lethal dose is 240 mL.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Vomiting may be contraindicated because of the rapid onset of central nervous system depression. Gastric lavage is preferred.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Diagnostic test: acetone in urine.

Section 5 - Fire Fighting Measures

NFPA



Flash Point: 53 °F (12 °C)
Flash Point Method: CC
Burning Rate: 2.3 mm/min.
Autoignition Temperature: 750°F (399°C)
LEL: 2 % v/v
UEL: 12.7 % v/v at 200 °F
Flammability Classification: Class 1B Flammable Liquid
Extinguishing Media: Carbon dioxide, dry chemical, water *spray* (solid streams can spread fire), alcohol-resistant foam, or fog.
Unusual Fire or Explosion Hazards: Container may explode in heat of fire. Vapors may travel to an ignition source and flash back. Isopropyl alcohol poses an explosion hazard indoors, outdoors, and in sewers.
Hazardous Combustion Products: Carbon oxides and acrid smoke.
Fire-Fighting Instructions: If possible without risk, move container from fire area. Apply cooling water to container side until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw and let fire burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. *Do not* release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides only limited protection.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against vapor inhalation and skin/eye contact. Water spray may reduce vapor, but may not prevent ignition in closed spaces.
Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers.
Large Spills
Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use non-sparking tools to open containers.
Storage Requirements: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec 10). Install electrical equipment of Class 1, Group D.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around IPA.
Ventilation: Provide general or local exhaust ventilation systems to maintain airborne levels below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin, kidneys, and respiratory system. Be extra cautious when using IPA concurrently with carbon tetrachloride because animal studies have shown it enhances carbon tetrachloride's toxicity.
Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Nitrile rubber (breakthrough time > 8 hr), Neoprene and Teflon (breakthrough time > 4 hr) are suitable materials for PPE. Do not use PVA, PVC or natural rubber (breakthrough time < 1 hr). Wear protective eyeglasses or chemical safety goggles (see OSHA eye and face protection regulations (29 CFR 1910.133)). Emergency eyewash stations and safety showers should be available in areas where IPA is used.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use any powered, air purifying respirator with organic vapor cartridges or any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s). For < 10,000 ppm, use any supplied-air respirator (SAR) operated in continuous-flow mode. For < 12,000 ppm, use any air-purifying, full facepiece respirator (gas mask) with a chin-style, front-or back-mounted organic vapor canister or any SCBA or SAR with a full facepiece. For emergency or entrance into unknown concentrations, use any SCBA or SAR (with auxiliary SCBA) with a full facepiece and operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove isopropyl alcohol from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using isopropyl alcohol, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance and Odor: Colorless with a slight odor and bitter taste.
Odor Threshold: 22 ppm*
Vapor Pressure: 44 mm Hg at 25 °F (77 °C)
Saturated Vapor Density(Air = 1.2 kg/m^3, 0.075 lb/ft^3): 1.274 kg/m^3 or 0.080 lb/ft^3
Formula Weight: 60.09
Density (H_2O=1, at 4 °C): 0.78505 at 68°F (20 °C)
Water Solubility : > 10 %
Ionization Potential: 10.10 eV

Other Solubilities: Soluble in alcohol, ether, chloroform, and benzene. Insoluble in salt solutions.
Boiling Point: 180.5 °F (82.5 °C)
Freezing Point: -129.1 °F (-89.5 °C)
Viscosity: 2.1 cP at 77 °F (25 °C)
Refraction Index: 1.375 at 68 °F (20 °C)
Surface Tension: 20.8 dyne/cm at 77 °F (25 °C)
Critical Temperature: 455 °F (235 °C)
Critical Pressure: 47 atm
Octanol/Water Partition Coefficient: log Kow = 0.05

* References range from 1 to as high as 610 ppm.

Section 10 - Stability and Reactivity

Stability: Isopropyl alcohol is stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization does not occur.
Chemical Incompatibilities: Include acetaldehyde, chlorine, ethylene oxide, acids and isocyanates, hydrogen + palladium, nitroform, oleum, phosgene, potassium *t*-butoxide, oxygen (forms unstable peroxides), trinitromethane, barium perchlorate, tetrafluoroborate, chromium trioxide, sodium dichromate + sulfuric acid, aluminum, aluminum triisopropoxide, and oxidizers. Will attack some forms of plastic, rubber, and coatings.
Conditions to Avoid: Exposure to heat, ignition sources, and incompatibles.
Hazardous Decomposition Products: Thermal oxidative decomposition of isopropyl alcohol can produce carbon oxides and acrid smoke.

Section 11- Toxicological Information

Toxicity Data:*

Eye Effects:
Rabbit, eye: 100 mg caused severe irritation.

Skin Effects:
Rabbit, skin: 500 mg caused mild irritation.

Reproductive:
Rat, inhalation: 3500 ppm/7 hr given from 1 to 19 days of pregnancy caused fetotoxicity.

Acute Oral Effects:
Human, oral, TD_{Lo}: 223 mg/kg caused hallucinations, distorted perceptions, lowered blood pressure, and a change in pulse rate.
Human, oral, LD_{Lo}: 3570 mg/kg caused coma, respiratory depression, nausea, and vomiting.
Rat, oral, LD_{50}: 5045 mg/kg caused a change in righting reflex, and somnolence (general depressed activity).

* See NIOSH, *RTECS* (NT8050000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity Data: Fathead minnow: LC_{50} = 9,640 ppm; Fathead minnow: Bluegill: LC_{50} = 11,830

Environmental Degradation: On soil, IPA will volatilize or leach into groundwater. Biodegradation is possible but rates are not found in available literature. It will volatilize (est. half-life = 5.4 days) or biodegrade in water. It is not expected to bioconcentrate in fish. In the air, it reacts with photochemically produced hydroxyl radicals with a half-life of one to several days. Because it is soluble, removal by rain, snow or other precipitation is possible.

Section 13 - Disposal Considerations

Disposal: Microbial degradation is possible by oxidizing isopropyl alcohol to acetone by members of the genus *Desulfovibrio*. Spray waste into incinerator (permit-approved facilities only) equipped with an afterburner and scrubber. Isopropyl alcohol can be settled out of water spills by salting with sodium chloride. Note: Salt may harm aquatic life, so weigh the benefits against possible harm before application. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
Container Cleaning and Disposal: Triple rinse containers.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Isopropanol or isopropyl alcohol
Shipping Symbols: –
Hazard Class: 3
ID No.: UN1219
Packing Group: II
Label: Flammable Liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 5 L
b) Cargo Aircraft Only: 60 L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: –

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste Number (40 CFR 261.21)
RCRA Hazardous Waste Classification (40 CFR 261.21): Characteristic of Ignitability
Listed (Unlisted Hazardous Waste, Characteristic of Ignitability) as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA, Sec. 3001
CERCLA Reportable Quantity (RQ), 100 lb (45.4 kg)
SARA 311/312 Codes: 1, 2, 3
Listed as a SARA Toxic Chemical (40 CFR 372.65); *only persons who manufacture by the strong acid process are subject; no supplier notification.*
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 73, 103, 124, 126, 127, 132, 136, 139, 148, 153, 159, 164, 167, 168, 176, 187

Prepared By ..... M Gannon, BA
Industrial Hygiene Review ..... PA Roy, MPH, CIH
Medical Review ..... T Thoburn, MD, MPH

MATERIAL SAFETY DATA SHEET

NOTE: This Material Safety Data Sheet (MSDS) is prepared for industrial/commercial use situations. The preparation of this MSDS may be required by law but this is not an assertion that this product presents a risk in the normal consumer use situation.

1. PRODUCT IDENTIFICATION

PRODUCT (AS LABELED):	Dove® Dishwashing Liquid
GENERAL USE:	A consumer hand dishwashing liquid
MANUFACTURER'S NAME:	LEVER BROTHERS COMPANY
ADDRESS:	390 Park Avenue New York, NY 1 ^22
BUSINESS PHONE:	212-688-6000
DATE OF PREPARATION	8/01/95
MSDS#:	C024, Replaces version dated 2/2/95

2. COMPOSITION and INFORMATION ON INGREDIENTS

INGREDIENTS: The cleaning agents in Dove are biodegradable. Dove contains no phosphorous.

EXPOSURE LIMITS IN AIR*

		ACGIH		OSHA	
CHEMICAL NAME:	CAS#	TLV mg/m³	STEL mg/m³	PEL mg/m³	STEL mg/m³
Ammonium alkyl benzene sulfonate	1331-61-9	NA	NA	NA	NA
Ammonium alcohol ethoxysulfate	NA	NA	NA	NA	NA
Lauric-Myristic monoethanolamide	NA	NA	NA	NA	NA
Sodium aryl sulfonate	NA	NA	NA	NA	NA
Ethanol	64-17-5	1000ppm	NA	1000ppm	3300ppm

NA = Not Applicable
*See Section 12. for DEFINITION OF TERMS

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: **EMERGENCY OVERVIEW:** This product is a liquid detergent with a perfumed odor. It presents a low risk other than a possible slip hazard in the event of a spill.

POTENTIAL HEALTH EFFECTS:

CONTACT WITH SKIN: No irritation with brief contact. Possible irritation from prolonged or repeated industrial contact.
CONTACT WITH EYES: May cause mild irritation and discomfort.
INGESTION: May cause gastrointestinal irritation with nausea, vomiting, and delayed diarrhea.
INHALATION: While inhalation of a product mist is unlikely, such exposure may cause transient upper respiratory irritation.
CHRONIC HEALTH EFFECTS: None expected.
CONSUMER PRODUCT PRECAUTIONARY STATEMENT: Not for use in automatic dishwashers. Do not mix with chlorine bleach or other household cleaning products.KEEP OUT OF REACH OF CHILDREN.

4. FIRST-AID MEASURES

SKIN EXPOSURE: Rinse with water.
EYE EXPOSURE: Flush with water for 15 minutes.
INGESTION: Do not induce vomiting. Drink a glass of milk or water.
INHALATION: Move individual to fresh air.
Note: If symptoms persist, seek medical attention.

5. FIRE-FIGHTING MEASURES

FLASH POINT: No flash to 200 F..
AUTOIGNITION TEMPERATURE: Not applicable.
FLAMMABLE LIMITS(in air by volume,%): Not applicable.
FIRE EXTINGUISHING MATERIALS: Not applicable.

Water Spray: Yes	Carbon Dioxide: Yes	Foam: Yes
Dry Chemical: Yes	Halon: Yes	

UNUSUAL FIRE AND EXPLOSION HAZARDS: Product is not combustible. Use appropriate fire extinguishing agent for the packaging material.

SPECIAL FIRE FIGHTING PROCEDURES; None.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Disposal is to be performed in compliance with applicable laws. Small or household quantities may be disposed of in refuse or sewer. Product contains biodegradable ingredients. Contains no phosphorous. For large (industrial) releases, prevent spill from entering a waterway. Absorbent materials may be used.

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: Use personal protective equipment appropriate for the task.
STORING AND HANDLING PRACTICES: None required with normal use.
PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Use personal protective equipment when contact is likely.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINFERING CONTROLS: Use with adequate ventilation. Mechanical ventilation not normally required during normal operation.
EYE PROTECTION: Wear safety glasses.
HAND PROTECTION: Wear rubber gloves for prolonged contact.

BODY PROTECTION: None required.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: Not applicable.
SPECIFIC GRAVITY:1.032 - 1.048
SOLUBILITY IN WATER: soluble.
VAPOR PRESSURE,mm H_g @ 20 C:(approximately) 18
EVAPORATION RATE(water = 1): 1
MELTING POINT OR RANGE: < 0 C
BOILING POINT: > 100 C
pH(1% solution): 6.0 - 6.9 (as is)
APPEARANCE AND COLOR: This liquid is a pleasant smelling, slippery, opaque white solution.

10. STABILITY and REACTIVITY

STABILITY: Stable.
DECOMPOSITION PRODUCTS: None.
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Do not mix with chlorine bleach.
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Do not use in automatic dishwasher.

11. TRANSPORTATION INFORMATION

THIS MATERIAL IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Not applicable.
HAZARD CLASS NUMBER and DESCRIPTION: Not applicable.
UN IDENTIFICATION NUMBER: Not applicable.
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Not applicable.
EMERGENCY RESPONSE GUIDE NUMBER: Not applicable.
MARINE POLLUTANT: Not applicable.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS NOT CLASSIFIED AS "DANGEROUS GOODS".

12. OTHER INFORMATION

PREPARED BY: LEVER BROTHERS COMPANY
NEW YORK, NY 10022

The information contained in this MSDS is based on data which is believed to be accurate. While Lever Brothers Company believes that the data contained herein comply with 29 CFR 1910.1200, they are not to be taken as a warranty or representation for which Lever Brothers Company assumes legal responsibility. They are offered solely for your consideration and verification. This MSDS is not prepared for consumer use situations.

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

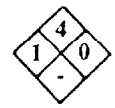
Sheet No. 440
Methane

Issued: 7/80 Revision: A, 8/89

Section 1. Material Identification

Methane Description: Widely distributed in nature, methane comprises 0.00022% by volume of the earth's atmosphere. American natural gas is mostly methane (85%). At temperatures greater than 2012 °F (1100 °C), pure carbon combines with pure hydrogen to form methane. Above 2732 °F (1500 °C), the amount of methane produced increases with temperature. Obtained from sodium acetate and sodium hydroxide or from aluminum carbide and water. Commercially prepared from natural gas or by fermentation of cellulose and sewage sludge. Constituent of illuminating and cooking gas. Used in the manufacture of hydrogen, hydrogen cyanide, ammonia, acetylene, formaldehyde, and many other organics.
Other Designations: Fire damp; marsh gas; methyl hydride; CH_4; CAS No. 0074-82-8.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R 1
I -
S -
K 4



NFPA

HMIS
H 1
F 4
R 0
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Methane, ca 100%*

OSHA PEL	ACGIH TLV, 1988-89	NIOSH REL	Toxicity Data†
None established	None established	None established	Not listed

* Check with your supplier to determine the exact composition of the purchased methane. Possible contaminants are ethane (C_2H_6), propane (C_3H_8), butane (C_4H_{10}), higher molecular weight alkanes, carbon dioxide (CO_2), nitrogen (N_2), and oxygen(O_2).
† Monitor NIOSH, *RTECS* (PA1490000), for future toxicity data.

Section 3. Physical Data

Boiling Point: -259 °F (161.6 °C)
Vapor Density (Air = 1): 0.544 at 32 °F (0 °C)
Molecular Weight: 16 g/mol
Water Solubility: Slight*
Melting Point: -296.5 °F (-182.5 °C)

Appearance and Odor: A colorless, odorless, tasteless, extremely flammable gas. Commercial methane's trace amounts of a suitable mercaptan compound give it natural gas's familiar rotten egg smell.

*Soluble in alcohol and ether.

Section 4. Fire and Explosion Data

Flash Point: -213 °F (-136.11 °C)	Autoignition Temperature: 999 °F (537 °C)	LEL: 5% v/v*	UEL: 15% v/v*

Extinguishing Media: Methane's extreme flammability, extensive explosibility range, and very low flash point represent dangerous fire and explosion risks. *Treat any fire situation involving rapidly escaping and burning methane gas as an emergency.* Extinguish methane fires by shutting off the source of the gas. Use water sprays to cool fire-exposed containers and to protect the personnel attempting to seal the source of the escaping gas.
Unusual Fire or Explosion Hazards: Methane gas is very flammable with an extensive explosibility range. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipelines. Never extinguish the burning gas without first locating and sealing its source. Otherwise, the still leaking gas could explosively re-ignite without warning and cause more damage than if it burned itself out.
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* The loudest methane-air explosions occur when 1 volume of methane is mixed with 10 volumes of air (or 2 volumes of oxygen). **Warning:** Air with more than 14% by volume methane burns *noiselessly*. Methane burns with a pale, faintly luminous, not always easily detected flame.

Section 5. Reactivity Data

Stability/Polymerization: Methane is stable at room temperature in closed, pressurized containers during routine operations. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Genium reference 84 reports that methane can react violently with bromine pentafluoride, chlorine, chlorine dioxide, nitrogen trifluoride, liquid oxygen, and oxygen difluoride.
Conditions to Avoid: Never expose methane to ignition sources such as open flame, lighted cigarettes or pipes, uninsulated heating elements, or electrical or mechanical sparks. Prevent any accidental or uncontrollably rapid release of methane gas from high-pressure cylinders, tank cars, or pipelines.
Hazardous Products of Decomposition: Thermal oxidative degradation of methane can produce carbon dioxide and toxic carbon monoxide (CO).

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists methane as a carcinogen. **Summary of Risks:** As a simple asphyxiant, methane does not cause significant physiological responses, but it can displace the minimum required atmospheric oxygen level. Significant displacement results in an oxygen-deficient atmosphere with no adequate warning properties. Asphyxiation can occur especially in confined, poorly ventilated, undisturbed spaces infrequently entered by workers. Frostbite (cryogenic damage) can result from contact with liquid methane's extremely low temperature. **Medical Conditions Aggravated by Long-Term Exposure:** *None reported.* **Target Organs:** *None reported.* **Primary Entry:** Inhalation. **Acute Effects:** The initial symptoms of simple asphyxiant gases's effects are rapid respiration and air hunger, diminished mental alertness, and impaired muscular coordination. Continuing lack of oxygen causes faulty judgement, depression of all sensations, rapid fatique, emotional instability, nausea, vomiting, prostration, unconsciousness, and finally, convulsions, coma, and death. **Chronic Effects:** None reported.

FIRST AID

Skin: (Liquid methane): *Promptly flush the affected area with lots of tepid/lukewarm water to reduce freezing of tissues. Never apply direct heat to frostbitten areas. Loosely apply dry, bulky dressings to protect the area from further injury. Get treatment from qualified medical personnel.* **Inhalation:** Rescuers must consider their own safety when entering confined, poorly ventilated, oxygen-deficient areas. Self-contained breathing equipment must be readily available. Rescuers must use nonsparking tools and equipment; e.g., floodlights lowered into any incident area must be electrically grounded and bonded, shatter-resistant, and sparkproof. **After first aid, get appropriate in-plant, paramedic, or community medical attention and support for inhalation exposures in oxygen-deficient atmospheres.** Seek prompt medical assistance for further observation and treatment.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a methane spill control and countermeasure plan (SCCP).* When a leak occurs, notify safety personnel, eliminate heat and ignition sources, evacuate unnecessary personnel, provide maximum explosion proof ventilation, and implement the SCCP. Use only nonsparking tools and equipment. Locate and seal the source of the leaking gas. Use water sprays to protect the personnel attempting this shutoff. Large methane releases can result in spectacular explosions. If attempts to shut off the leaking gas are unsuccessful, evacuate the likely explosion area. **Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Remove leaking or defective cylinders to a safe, outside, posted, discharge location. Let the methane gas discharge at a moderate rate. When it is empty, return the cylinder to the supplier after it is properly tagged, labelled, or stenciled MT (empty) or defective.

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). **Gloves:** To prevent skin contact, workers handling liquid methane should wear appropriate insulating gloves, safety glasses, and splash aprons, as required by *the particular work conditions.* **Respirator:** *Wear a NIOSH-approved respirator if necessary. Follow OSHA respirator regulations* (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres; use self-contained breathing equipment there. **Ventilation:** Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the 5% v/v LEL (Sec. 4). Local exhaust ventilation is preferred since it prevents methane dispersion into the work area by eliminating it at its source (Genium ref. 103). Give special attention to proper ventilation of enclosed areas. **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, washing facilities, fire extinguishers, and oxygen bottles for emergency first-aid. **Contaminated Equipment:** Never wear contact lenses in the work area: *soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from* your shoes and equipment. **Other:** If appropriate, consider installing automatic sensing equipment that warns workers of oxygen-deficient atmospheres or of potentially explosive air-gas mixtures. All engineering systems in any methane gas storage, handling, or processing area must be explosion-proof so they have no spark potential or hot spots. Pressurized systems must use only approved valves, manifolds, flanges, and flame arrestors. **Comments:** Methane gas presents dangerous fire, explosion, and reactivity risks. Regularly inspect and service all the piping systems which transport methane gas in production and storage areas. Before use, thoroughly test methane lines with nitrogen gas for leaking, especially in enclosed areas.

Section 9. Special Precautions and Comments

Storage Requirements: Store methane in closed, pressurized cylinders, tank cars, pipelines, or other containers in a cool, dry, well ventilated, fireproof area away from heat and ignition sources and incompatible chemicals (Sec. 5). Protect these containers from physical damage and heat. Shield them from direct sunlight. **Special Handling/Storage:** Electrically ground and bond all containers, tanks, cylinders, tank cars and pipelines used in methane shipping, receiving, or transferring operations. Never smoke in any work area where the possibility of exposure to methane gas (fire hazard) exits. Recommended storage containers include steel.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Methane
DOT Hazard Class: Flammable gas
DOT ID No.: UN1971
DOT Label: Flammable gas
DOT Packaging Requirements: 49 CFR 173.302
DOT Packaging Exceptions: 49 CFR 173.306

IMO Shipping Name: Methane, compressed
IMO Hazard Class: 2.1
IMO Label: Flammable gas

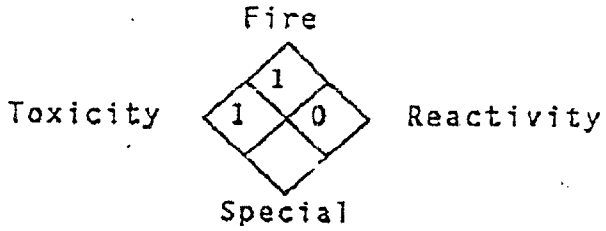
MSDS Collection References: 1, 6, 7, 84-94, 100, 116, 117, 119, 120, 122

Prepared by [illegible]; Industrial Hygiene Review: [illegible]; CHP Medical Review: [illegible], MD

WITCO MATERIAL SAFETY DATA SHEET

KENDALL NON-DETERGENT MOTOR OIL, ALL SAE GRADES

NFPA HAZARD RATING
4 - Extreme
3 - High
2 - Moderate
1 - Slight
0 - Insignificant



DIVISION AND LOCATION---SECTION I

Division: KENDALL REFINING COMPANY
Location: BRADFORD, PENNSYLVANIA
77 N. KENDALL AVE.,BRADFORD,PA,16701
Emergency Telephone Number: (814) 368-6111
Transportation Emergency: CHEMTREC 1-(800) 424-9300 (U.S. and Canada)

CHEMICAL AND PHYSICAL PROPERTIES---SECTION II

Chemical Name:
petroleum hydrocarbon plus additives
Formula: not applicable
Hazardous Decomposition Products:
carbon monoxide and carbon dioxide from burning.
oxides of phosphorous from burning
oxides of sulfur
ncompatibility (Keep away from):
strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.
Toxic and Hazardous Ingredients:
none
Form: liquid Odor: motor oil
Appearance: liquid Color: dark green-brown
Specific Gravity (water=1): .86 to .89
Boiling Point: greater than 330°C (625°F)
Melting Point: less than -12°C (10°F)
Solubility in Water (by weight %): 0 at 20°C
Volatile (by weight %): 0
Evaporation Rate: 0
Vapor Pressure (mm Hg at 20°C): 0
Vapor Density (air=1): not volatile
pH (as is): not applicable
Stability: Product is stable under normal conditions
Viscosity SUS at 100°F: Greater than or = to 100

(Continued on next page)

WITCO MATERIAL SAFETY DATA SHEET

FIRE AND EXPLOSION DATA---SECTION III

Special Fire Fighting Procedures:
Do not use water except as fog.
Unusual Fire and Explosion Hazards:
none
Flashpoint: (Method Used) Cleveland open cup greater than 190°C (380°F)
Flammable limits %: not applicable
Extinguishing agents:
Drychemical or Waterfog or CO_2 or Foam
Closed containers exposed to fire may be cooled with water.

HEALTH HAZARD DATA---SECTION IV

Permissible concentrations (air):
If used in applications where a mist may be generated, observe a TWA/PEL of 5 mg/m^3 for mineral oil mist (OSHA and ACGIH).
Chronic effects of overexposure:
Prolonged or repeated skin contact may cause dermatitis (skin irritation)
Acute toxicological properties:
no data available
Emergency First Aid Procedures:
Eyes: Immediately flush with large quantities of water for at least 15 minutes and call a physician.
Skin Contact: Remove excess with cloth or paper. Wash thoroughly with soap and water.
Inhalation: Remove victim to fresh air. Call a physician.
If Swallowed: Contact a physician immediately.

SPECIAL PROTECTION INFORMATION---SECTION V

Ventilation Type Required (Local,mechanical,special):
Local if necessary to maintain allowable PEL(permissible exposure limit) or TLV(threshhold limit value)
Respiratory Protection (Specify type):
Use NIOSH/MSHA certified respirator with dual organic vapor/mist and particulates cartridge if vapor concentration exceeds permissible exposure limit.
Protective Gloves:
neoprene type
Eye Protection:
chemical safety goggles
Other Protective Equipment:
none

(Continued on next page)

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.		
VENTILATION Hood with forced ventilation	**LOCAL EXHAUST** To prevent accumulation above the TWA.	**SPECIAL** N/A
	MECHANICAL (Gen.) In accordance with electrical codes	**OTHER** N/A
PROTECTIVE GLOVES Plastic or rubber		
EYE PROTECTION Safety goggles or glasses		
OTHER PROTECTIVE EQUIPMENT Safety shoes, safety shower, eyewash "fountain"		

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Pentane
DOT Hazard Class: Flammable liquid
DOT Shipping Label: Flammable liquid
DOT I.D. No.: UN 1265

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<50 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder. Do not tamper with (valve) safety device. Close valve after each use and when empty.

For additional handling recommendations consult L'Air Liquide's *Encyclopedia de Gaz* or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no source of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS

Pentane is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Earth-ground and bond all lines and equipment associated with the Pentane system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

Always secure cylinders in an upright position before transporting them. NEVER transport cylinders in trunks of vehicles, (Continued on last page)

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ADDITIONAL DATA

OTHER RECOMMENDATIONS OR PRECAUTIONS: (Continued) enclosed vans, truck cabs or in passenger compartments. Transport cylinders secured in open flatbed or in open pick-up type vehicles.

WITCO MATERIAL SAFETY DATA SHEET

HANDLING OF SPILLS OR LEAKS---SECTION VI

Procedures for Clean-Up:
Transfer bulk of mixture into another container. Absorb residue with an inert material such as earth, sand, or vermiculite. Sweep up and dispose as solid waste in accordance with local, state, and federal regulations.

Waste Disposal:
Dispose of in accordance with all applicable federal, state and local regulations.

SPECIAL PRECAUTIONS---SECTION VII

Precautions to be taken in handling and storage:
Do not handle or store at temperatures over
Maximum Storage Temperature: 38°C (100°F)

TRANSPORTATION DATA---SECTION VIII

D.O.T.: Not Regulated
Reportable Quantity: not applicable
Freight Classification: Petroleum Lubricating Oil
Special Transportation Notes:
none

ENVIRONMENTAL/SAFETY REGULATIONS---SECTION IX

Section 313 (Title III Superfund Amendment and Reauthorization Act):

This product does not contain any chemical in sufficient quantity to be subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

COMMENTS

* STATE REGULATORY INFORMATION:
Pennsylvania Worker And Community Right To Know Act: This product contains the following ingredient(s).
Hydrocarbon oils CAS. NO. 8020-83-5
The additive mixtures in this product have been declared a trade secret by the additive manufacturers.

(Continued on next page)

WITCO MATERIAL SAFETY DATA SHEET

(COMMENTS continued)

Prepared by: Robert Kellam
Title: Group Supervisor, Lubricants Testing, Maintenance, and Safety
Original Date: 05/18/81 Sent to: _____
Revision Date: 08/09/94 _____
Supersedes : 04/01/93 _____
Date Sent : _____

We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind, express or implied, and we assume no responsibility for any loss, damage, or expense, direct or consequential, arising out of their use.

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ALPHAGAZ

Specialty Gas

Material Safety Data Sheet

	PRODUCT NAME Pentane	
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
LIQUID AIR CORPORATION ALPHAGAZ DIVISION California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	TRADE NAME AND SYNONYMS Pentane; n-Pentane	CAS NUMBER 109-66-0
	CHEMICAL NAME AND SYNONYMS Pentane; n-Pentane	NFPA 704 NUMBER (HFR) 0 4 0
ISSUE DATE AUGUST 1, 1987 AND REVISIONS CORPORATE SAFETY DEPT.	FORMULA C_5H_{12} MOLECULAR WEIGHT 72.15	CHEMICAL FAMILY Alkane

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT
600 Molar PPM; STEL = 750 Molar PPM (ACGIH 1986-87). OSHA (1985)TWA = 1,000 Molar PPM.

SYMPTOMS OF EXPOSURE Vapors may cause mild irritation of the eyes, skin or lungs.

Inhalation: High concentrations of pentane so as to exclude an adequate supply of oxygen to the lungs causes dizziness, deeper breathing due to air hunger, possible nausea and eventual unconsciousness.

Contact with rapidly evaporating liquid can cause cryogenic "burns" or frostbite.

TOXICOLOGICAL PROPERTIES

Pentane is inactive biologically and essentially nontoxic; therefore, the major property is the exclusion of an adequate supply of oxygen to the lungs.

Frostbite effects are a change in color of the skin to gray or white, possibly followed by blistering.

Pentane is not listed in the IARC, NTP or by OSHA as a carcinogen or a potential carcinogen.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program		I.A.R.C. Monographs		OSHA	
		Yes ☐		Yes ☐		Yes ☐
		No ☒		No ☒		No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO PENTANE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

Dermal contact or frostbite: Remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physician should see the patient promptly if the cryogenic "burn" has resulted in blistering of the dermal surface or deep tissue freezing.

FIRST BRANDS

Material Safety Data Sheet
PRESTONE® Engine Starting Fluid

III. HAZARDOUS INGREDIENTS

(includes IARC, NTP, OSHA and ACGIH listed carcinogens greater than 0.1%)

MATERIAL	%	CAS #	EXPOSURE LIMIT	SOURCE
Ethyl ether	40-70	60-29-7	400 ppm TWA	(3)
			500 ppm STEL	(3)
n-heptane	25-60	142-82-5	400 ppm TWA	(3)
			500 ppm STEL	(3)
Methylcyclohexane	25-60	108-87-2	400 ppm TWA	(3)
Carbon dioxide	5-10	124-38-9	10000 ppm TWA	(1)
			5000 ppm TWA	(2)
			30000 ppm STEL	(3)

NON-HAZARDOUS INGREDIENTS > 1%
None

None of the other ingredients is listed as a carcinogen or potential carcinogen by OSHA, NTP or IARC.

The source for exposure limits listed above are:
(1) OSHA Permissible Exposure Limit (effective 9/89)
(2) ACGIH Threshold Limit Value (1988-89 Edition)
(3) Both the OSHA PEL and ACGIH TLV
(4) Recommended by the Manufacturer

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT
Tag Open Cup: Not determined
Pensky-Martens Closed Cup: -49°F

AEROSOL FLAME EXTENSION
Greater than 18 inches

FLASHBACK
Yes

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Pentane is flammable in air.

PHYSICAL DATA

BOILING POINT 97°F (36°C)	**LIQUID DENSITY AT BOILING POINT** @ 60°F (15.5°C) = 39.3 lb/ft^3 (629.4 kg/m^3)
VAPOR PRESSURE @ 100°F (37.8°C) = 15 psia (103 kPa)	**GAS DENSITY AT 70°F 1 atm** @ 60°F (15.5°C) = .2015 lb/ft^3 (3.228 kg/m^3)
SOLUBILITY IN WATER Negligible	**FREEZING POINT** -201.5°F (-129.7°C)
APPEARANCE AND ODOR Colorless liquid and vapor with mild paraffinic odor. Specific gravity (air=1) = 2.48	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) <-40° F & C (C.C.)	**AUTO IGNITION TEMPERATURE** Unknown	**FLAMMABLE LIMITS % BY VOLUME** LEL = 1.4 UEL = 8.3
EXTINGUISHING MEDIA Water (foam), dry chemical, carbon dioxide		**ELECTRICAL CLASSIFICATION** Class 1, Group not specified

SPECIAL FIRE FIGHTING PROCEDURES

If possible, stop flow of pentane. Use water spray to cool surrounding containers.

UNUSUAL FIRE AND EXPLOSION HAZARDS

None

REACTIVITY DATA

STABILITY		**CONDITIONS TO AVOID**
Unstable		
Stable	X	N/A

INCOMPATIBILITY (Materials to avoid)
Oxygen, other oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS
None

HAZARDOUS POLYMERIZATION		**CONDITIONS TO AVOID**
May Occur		
Will Not Occur	X	N/A

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact your closest Liquid Air location or call the emergency telephone number listed herein.

WASTE DISPOSAL METHOD Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to your supplier. For emergency disposal assistance, contact your closest Liquid Air location or call the emergency telephone number listed herein.

EMERGENCY RESPONSE INFORMATION

IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366

FIRST BRANDS

Material Safety Data Sheet
PRESTONE® Engine Starting Fluid

AEROSOL FIRE PROTECTION LEVEL
Level 3 Aerosol (NFPA 30B)

FLAMMABLE LIMITS IN AIR, % BY VOLUME
LOWER: 1.85
UPPER: 36.5

AUTOIGNITION TEMPERATURE
180°C

EXTINGUISHING MEDIA
Foam, alcohol foam, carbon dioxide, and dry chemical. Water may be unsuitable except as cooling medium.

SPECIAL FIRE FIGHTING PROCEDURES
Use self-contained breathing apparatus. Toxic fumes may be emitted.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Extremely flammable contents, pressurized containers. Vapors are heavier than air and may travel or be moved by air currents and be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharges or other ignition sources at locations distant from product handling point.

V. HEALTH HAZARD DATA

EFFECTS OF SINGLE OVEREXPOSURE

SWALLOWING	May cause signs and symptoms of systemic intoxication, with incoordination, blurred vision, headache, analgesia, unconsciousness and respiratory failure due to depression of the central nervous system. Due to high volatility, may rapidly distend the stomach, causing discomfort and may make breathing difficult. May also cause pneumonitis if aspirated.
SKIN ABSORPTION	Significant absorption not expected.
INHALATION	Acts as a narcotic or general anesthetic. May cause irritation of the respiratory tract with cough and also signs and symptoms of intoxication, with incoordination, blurred vision, headache, analgesia, unconsciousness, cardiac irregularities, and respiratory failure due to depression of the central nervous system. Breathing high vapor concentrations may cause heart rate irregularities, possibly fatal, particularly in persons with heart disease.
SKIN CONTACT	May cause mild irritation, experienced as local redness.

EYE CONTACT — Exposure to liquid or high concentrations of vapor may cause irritation, experienced as redness, excess tearing, and possible swelling of the conjunctiva.

EFFECTS OF REPEATED OVEREXPOSURE

Repeated skin exposure can cause cracking and drying. Repeated inhalation may cause loss of appetite, exhaustion, headaches, drowsiness, dizziness, cardiac arrhythmia, central nervous system excitability, and psychic disturbances.

OTHER EFFECTS OF OVEREXPOSURE

May cause albuminuria and polycythemia.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE

Because of its irritating and defatting properties, this material may aggravate an existing dermatitis. Existing cardiac conditions may be aggravated if inhaled in high concentrations and may be fatal as a result of serious arrhythmia and cardiac decompensation.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARDS

None currently known.

EMERGENCY AND FIRST AID PROCEDURES

SWALLOWING — Give at least 2 glasses of milk or water if the patient is conscious. Do not induce vomiting. Call a physician immediately.

SKIN — Wash with soap and water.

INHALATION — Remove to fresh air. Give artificial respiration if not breathing. CPR may be required if cardiac arrest occurs. Oxygen may be given if necessary. Call a physician.

EYES — Immediately flush eyes with plenty of water for least 15 minutes. Seek medical attention, preferably an ophthalmologist.

NOTES TO PHYSICIAN — May produce arrhythmia, especially in a person with an irritable myocardium. Because of possible arrhythmogenic effects, sympathomimetics should be used with caution. Avoid the use of epinephrine.

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition. Artificial ventilation may be required if coma is deep and breathing shallow.

VI. REACTIVITY DATA

STABILITY Stable.

HAZARDOUS POLYMERIZATION
Will not occur.

CONDITIONS TO AVOID Heat, sparks and open flames.

INCOMPATIBILITY (Materials to Avoid)
Strong oxidizing agents.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
Extremely flammable. Will burn to form carbon dioxide, carbon monoxide. May form oxides of nitrogen.

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Wear appropriate personal protective equipment and remove all sources of ignition. Contain spill using absorbent material and collect material for disposal in a container suitable for flammable waste. See Section IV, "Unusual Fire and Explosion Hazards."

WASTE DISPOSAL METHOD
Waste material is a RCRA hazardous waste due to ignitability if discarded in its purchased form. Incineration, treatment or landfilling should be carried out in accordance with applicable RCRA Federal, State, and Local regulations.

VIII. SPECIAL PROTECTION INFORMATION

(for manufacturing and bulk spill cleanup)

RESPIRATORY PROTECTION
Use NIOSH/MSHA approved chemical cartridge respirator for operations which may result in employee exposure above the Permissible Exposure Limit (PEL).

VENTILATION Use local exhaust ventilation for operations which may result in employee exposure above the PEL.

PROTECTIVE GLOVES None required under normal use. PVA (polyvinyl alcohol) gloves are recommended for operations which may result in repeated skin contact.

EYE PROTECTION Safety glasses are considered adequate for normal use.

OTHER PROTECTIVE EQUIPMENT
None required

IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

- DANGER: Extremely flammable. Do not store near heat, sparks or open flame.
- Do not inhale vapors; use in well ventilated area.
- Avoid eye and prolonged skin contact.
- Do not drink or swallow contents.
- Contents under pressure; do not store at temperatures above 120°F.

OTHER PRECAUTIONS

Observe all requirements of plant, company or government regulations.

KEEP OUT OF REACH OF CHILDREN.

No. 13

FIRST BRANDS

Material Safety Data Sheet
PRESTONE® Engine Starting Fluid

X. DEPARTMENT OF TRANSPORTATION

HAZARDOUS MATERIALS	Engine Starting Fluid
HAZARD CLASSIFICATION	Flammable Gas
IDENTIFICATION NUMBER	UN1960
LABEL(S) REQUIRED	Flammable Gas

XI. ENVIRONMENTAL DATA

EMERGENCY PLANNING AND COMMUNITY RIGHT TO KNOW INFORMATION

This product contains the following chemicals subject to SARA TITLE III, Section 313 reporting:

Chemical Name	CAS#	Weight %
None		

This MSDS is directed to professional users and bulk handlers of the product. Consumer products are labeled in accordance with Federal Hazardous Substances Act regulations.

While First Brands Corporation believes that the data contained herein are factual and the opinions expressed are those of qualified experts regarding the results of the tests conducted, the data are not to be taken as a warranty or representation for which First Brands Corporation assumes legal responsibility. They are offered solely for your consideration, investigation and verification. Any use of these data and information must be determined by the user to be in accordance with applicable federal, state and local laws and regulations.

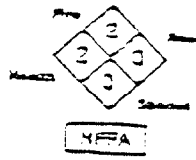
If more information is needed, please contact:

R. L. Lewis
First Brands Corporation
88 Long Hill Street
East Hartford, CT 06108
(203)728-6181

No. 19

WD-40®

MATERIAL SAFETY DATA SHEET



I. PRODUCT IDENTIFICATION

Manufacturer:	WD-40 Company	Telephone:	
Address:	1061 Cudahy Place (92110) P.O. Box 80607 San Diego, California 92138-9021	Emergency Only:	1 (800) 424-9300 (CHEMTREC)
		Information:	(619) 275-1400
		Chemical Name:	Organic Mixture
		Trade Name:	WD-40 Bulk Liquid

II. HAZARDOUS INGREDIENTS

Chemical Name	CAS Number	%	Exposure Limit ACGIH/OSHA
Aliphatic Petroleum Distillates	8052-41-3	70	100 ppm (PEL)
Petroleum Base Oil	64742-65-0	> 20	5 mg/M³ (TWA)
Non-hazardous Ingredients		< 10	

III. PHYSICAL DATA

Boiling Point:	300°F (minimum)	Evaporation Rate:	Not determined
Vapor Density (air = 1):	Greater than 1	Vapor Pressure:	Not determined
Solubility in Water:	Insoluble	Appearance:	Cloudy light amber
Specific Gravity (H_2O = 1):	.800 @ 70°F	Odor:	Characteristic odor
Percent Volatile (volume):	74%	VOC:	576 grams per liter

IV. FIRE AND EXPLOSION

Flash Point:	Tag Open Cup 110°F (minimum)
Flammable Limits:	(solvent portion) [Lel] 1.0% [Uel] 6.0%
Extinguishing Media:	CO_2, Dry Chemical, Foam
Special Fire Fighting Procedures:	None
Unusual Fire and Explosion Hazards:	None

V. HEALTH HAZARD / ROUTE(S) OF ENTRY

Threshold Limit Value

Aliphatic Petroleum Distillates (Stoddard solvent) lowest TLV (ACGIH 100 ppm.)

Symptoms of Overexposure

Inhalation (Breathing): May cause anesthesia, headache, dizziness, nausea and upper respiratory irritation.
Skin Contact: May cause drying of skin and or irritation.
Eye Contact: May cause irritation, tearing and redness.
Ingestion (Swallowed): May cause irritation, nausea, vomiting and diarrhea.

First Aid Emergency Procedures

Ingestion (Swallowed): Do not induce vomiting, seek medical attention.
Eye Contact: Immediately flush eyes with large amounts of water for 15 minutes.
Skin Contact: Wash with soap and water.
Inhalation (Breathing): Remove to fresh air. Give artificial respiration if necessary. If breathing is difficult, give oxygen.

DANGER!

Aspiration Hazard: If swallowed can enter lungs and may cause chemical pneumonitis. Do not induce vomiting. Call Physician immediately.

Suspected Cancer Agent

Yes _____ No X The components in this mixture have been found to be noncarcinogenic by NTP, IARC and OSHA.

<2.35 BULK No. 1

VI. REACTIVITY DATA

Stability:	Stable X	Unstable
Conditions to avoid:	NA	
Incompatability:	Strong oxidizing materials	
Hazardous decomposition products:	Thermal decomposition may yield carbon monoxide and/or carbon dioxide.	
Hazardous polymerization:	May occur	Will not occur X

VII. SPILL OR LEAK PROCEDURES

Spill Response Procedures
Absorb small quantities with sand, earth, sawdust. Large quantities pump into tank.
Waste Disposal Method
Incinerate liquid, bury saturated absorbent in land fill. Dispose of in accordance with local, state and federal regulations.

VIII. SPECIAL HANDLING INFORMATION

Ventilation:	Sufficient to keep solvent vapor less than TLV.
Respiratory Protection:	Advised when concentrations exceed TLV.
Protective Gloves:	Advised to prevent possible skin irritation.
Eye Protection:	Approved eye protection to safeguard against potential eye contact, irritation or injury.
Other Protective Equipment:	None required.

IX. SPECIAL PRECAUTIONS

Keep from open flame, do not take internally. Avoid excessive inhalation of spray particles. Keep from children.

X. TRANSPORTATION DATA

Domestic Surface	
Description:	Petroleum Distillate Mixture
Hazard Class:	Combustible Liquid
ID No.:	UN 1268
Label Required:	NONE, for containers less than 100 Gallons
Domestic Air	
Description:	Petroleum Distillate Mixture
Hazard Class:	Combustible Liquid
Label Required:	NONE, for containers less than 110 Gallons

SIGNATURE: R. Miles R Miles TITLE: Technical Director

REVISION DATE: March 1990 SUPERSEDES: April 1988

NA = Not applicable NCA = No data available < = Less than > = More than

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ALPHAGAZ

Specialty Gas

Material Safety Data Sheet

PRODUCT NAME
Hydrogen Cyanide

TELEPHONE (415) 977-6500
EMERGENCY RESPONSE INFORMATION ON PAGE 2

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION
One California Plaza, Suite 350
2121 N. California Blvd.
Walnut Creek, California 94596

ISSUE DATE AND REVISIONS: OCTOBER 1, 1985 CORPORATE SAFETY DEPT.

TRADE NAME AND SYNONYMS: Hydrogen Cyanide, Hydrocyanic acid

CAS Number: 74-90-8

CHEMICAL NAME AND SYNONYMS: Hydrogen Cyanide, Formonitrile

FORMULA: HCN

MOLECULAR WEIGHT: 27.018

CHEMICAL FAMILY: Cyanide compound

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT: Pure hydrogen cyanide is a liquid, is unstable, and must be stabilized with the addition of sulfuric or phosphoric acid. Liquid Air Corporation
(Continued on last page.)

SYMPTOMS OF EXPOSURE

Inhalation: At approximately 1 molar PPM concentration, the detection of its odor of "bitter almonds" is possible.

At levels of 20-40 molar PPM, slight symptoms of digestive irritation, mental confusion, and slowing of the breathing rate are evident after several hours of exposure. Cyanosis also appears even though the circulatory function is only slightly impaired.
(Continued on last page.)

TOXICOLOGICAL PROPERTIES

It is one of the quickest acting poisons. It hinders the vital oxydation-reduction reactions in the body resulting in anoxia affecting the central nervous system resulting in respiratory paralysis.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	Yes ☐ No ☒	I.A.R.C. Monographs	Yes ☐ No ☒	OSHA	Yes ☐ No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT RENDERING OF FIRST AID IS IMPERATIVE.

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO HYDROGEN CYANIDE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

Treatment is based on forming methemaglobin in the blood which complexes with the cyanide ion rendering it incapable of acting as a poison. It is reported that up to 20% of the hemoglobin can be converted to methemaglobin without danger of anoxia. The formation of methemoglobin is accomplished by injecting intravenously 10 ml of a sterile 3% solution of sodium nitrate followed immediately by 50 ml of a 25% sterile solution of
(Continued on last page.)

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Hydrogen cyanide is slowly polymerized to ammonia. In the presence of moisture, cyanides, potassium and bases, this exothermic, autocatalytic reaction is accelerated. Acids retard this reaction.

PHYSICAL DATA

BOILING POINT 78.3°F (25.7°C)	**LIQUID DENSITY AT BOILING POINT** 41.7 lb/ft^3 (668 kg/m^3)
VAPOR PRESSURE @ 70°F (21.1°C) 12.3 psia (85 kPa)	**GAS DENSITY AT 70°F 1 atm** .071 lb/ft^3 (1.14 kg/m^3)
SOLUBILITY IN WATER @ 68°F (20°C) Bunsen coefficient = 224	**FREEZING POINT** 8.1°F (-13.3°C)
APPEARANCE AND ODOR Colorless liquid with a bitter almond odor. Specific gravity @70°F (Air = 1.0) is .95.	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) -0.4°F (-18°C) Closed cup	**AUTO IGNITION TEMPERATURE** 1000°F (538°C)	**FLAMMABLE LIMITS % BY VOLUME** LEL = 5.6 UEL = 40
EXTINGUISHING MEDIA Water, carbon dioxide		**ELECTRICAL CLASSIFICATION** Class 1, Group not specified
SPECIAL FIRE FIGHTING PROCEDURES		
UNUSUAL FIRE AND EXPLOSION HAZARDS		

REACTIVITY DATA

STABILITY Unstable	X	**CONDITIONS TO AVOID** See Hazardous Polymerization below
Stable		
INCOMPATIBILITY (Materials to avoid) Moisture, cyanides, potassium or bases		
HAZARDOUS DECOMPOSITION PRODUCTS Ammonia		
HAZARDOUS POLYMERIZATION May Occur	X	**CONDITIONS TO AVOID** Pure HCN slowly polymerizes to ammonia. With incompatible materials this reaction is accelerated. Acids are added to pure HCN to retard this exothermic polymerization.
Will Not Occur		

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of residual or unused quantities. Return in the shipping container properly labled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
Hood with forced ventilation.	To prevent accumulation above the TWA.	
	MECHANICAL (Gen.)	OTHER

PROTECTIVE GLOVES
Rubber

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Hydrocyanic acid, liquefied (RQ 10/4.54) I.D. No.: NA 1051
DOT Shipping Label: Poison gas and flammable gas DOT Hazard Class: Poison A

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area. It may also be advisible to post signs indicating that a poison is stored in this area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS
Most common structural materials are compatible with hydrogen cyanide. Equipment for containing HCN must be kept scrupulously dry and leak-tight.

OTHER RECOMMENDATIONS OR PRECAUTIONS Because of hydrogen cyanide's extreme toxicity, it is recommended that a continuous monitoring system with alarm be installed to monitor the atmosphere wherever hydrogen cyanide is being handled or used. The system should have sensitivity and accuracy to a level at least one half of the TWA. Earth-ground and bond all lines and equipment associated with the hydrogen cyanide system. Electrical equipment should be non-sparking or explosion proof. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal law (49CFR).

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ADDITIONAL DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT: (Continued)

only offers HCN for sale as low concentrations of vapor diluted in other gases. The Ceiling Limit for hydrogen cyanide is 10 molar PPM. (ACGIH, 1984-85) TWA (skin) 10 molar PPM (OSHA, 1985).

SYMPTOMS OF EXPOSURE: (Continued)

135 Molar PPM - death within 30 minutes of exposure.

180 Molar PPM - death within 10 minutes of exposure.

270 Molar PPM - death within 5 minutes of exposure.

RECOMMENDED FIRST AID TREATMENT: (Continued)

sodium thiosulfate - both solutions injected at a rate of 2.5-5.0 ml per minute.

If the victim is unconscious, assisted respiration should be started immediately on clearing the contaminated area.

For further information refer to L'Air Liquide's Encyclopedie des Gaz.

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ALPHAGAZ

Specialty Gas

Material Safety Data Sheet

	PRODUCT NAME: Hydrogen Sulfide	
	TELEPHONE (415) 977-6500 EMERGENCY RESPONSE INFORMATION ON PAGE 2	
LIQUID AIR CORPORATION ALPHAGAZ DIVISION One California Plaza, Suite 350 2121 N. California Blvd. Walnut Creek, California 94596	TRADE NAME AND SYNONYMS: Hydrogen Sulfide	CAS NUMBER: 7783-06-04
	CHEMICAL NAME AND SYNONYMS: Hydrogen Sulfide	
ISSUE DATE AND REVISIONS: OCTOBER 1, 1985 CORPORATE SAFETY DEPT.	FORMULA: H_2S MOLECULAR WEIGHT: 34.06	CHEMICAL FAMILY: Nonmetal hydride

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT

10 molar PPM; STEL = 15 molar PPM (ACGIH, 1984-85)

SYMPTOMS OF EXPOSURE

Continuous exposure to low (15-50 PPM) concentrations will generally cause irritation to mucous membranes and conjunctivae of the eyes. It may also cause headache, dizziness or nausea. Higher concentrations (200-300 PPM) can result in respiratory arrest leading to coma or unconsciousness. Exposures for more than 30 minutes at concentrations of greater than 700 PPM have been fatal. Continuous inhalation of low concentrations may cause olfactory fatigue or paralysis rendering the detection of its presence by odor ineffective.

TOXICOLOGICAL PROPERTIES

Inhalation of hydrogen sulfide is highly toxic. It is also an irritant to mucous tissue, membranes and the conjunctivae of the eyes. Continued exposure renders the olfactory sensors inoperative. Toxicologically its reaction with enzymes in the blood stream inhibit cell respiration resulting in pulmonary paralysis, sudden collapse and death. This overshadows its irritant effect on mucous membranes and tissues which at worst will cause pulmonary edema or conjunctival lesions.

Listed as Carcinogen or Potential Carcinogen	National Toxicology Program	I.A.R.C. Monographs	OSHA
	Yes ☐ No ☒	Yes ☐ No ☒	Yes ☐ No ☒

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO HYDROGEN SULFIDE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. RESCUE PERSONNEL SHOULD RECOGNIZE THE HAZARDS OF OVEREXPOSURE DUE TO OLFACTORY FATIGUE.

Inhalation: Extreme fire hazard when rescuing semi-conscious or unconscious persons due to flammability of hydrogen sulfide. Avoid use of rescue equipment which might contain ignition sources or cause static discharge. Move affected person to an uncontaminated area. If breathing has stopped, give assisted respiration. Oxygen or a mixture of 5% carbon dioxide in oxygen should be administered by a qualified person. Keep victim warm and calm. Seek immediate medical assistance. (Continued on last page.)

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

Hydrogen sulfide will explode or burn over a wide range of mixtures in air. It becomes dangerously reactive when mixed with concentrated nitric acid or other strong oxidizers such as sulfuric acid. Vapors will combust spontaneously when mixed with vapors of chlorine, oxygen difluoride or nitrogen trifluoride.

PHYSICAL DATA

BOILING POINT -76.4°F (-60.2°C)	**LIQUID DENSITY AT BOILING POINT** 57.11 lb/ft^3 (914.9 kg/m^3)
VAPOR PRESSURE 266.9 psia (1840 kPa)	**GAS DENSITY AT 70°F, 1 atm** .091 lbs/ft^3 (1.45 kg/m^3)
SOLUBILITY IN WATER Soluble	**FREEZING POINT** -122.3°F (-85.7°C)
APPEARANCE AND ODOR Shipped and stored as a liquid under its own vapor pressure. Vapor is colorless with a characteristic "rotten egg" odor. Specific gravity (Air=1.0) is 1.21	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (METHOD USED) Gas	**AUTO IGNITION TEMPERATURE** 554°F (290°C)	**FLAMMABLE LIMITS % BY VOLUME** LEL: 4.0 UEL: 44.0
EXTINGUISHING MEDIA Carbon dioxide, dry chemical or water spray		**ELECTRICAL CLASSIFICATION** NEC Class I

SPECIAL FIRE FIGHTING PROCEDURES

Shut off flow of gas. Cool surrounding fire-exposed containers with water spray. Fire fighters should use self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Hydrogen sulfide is slightly heavier than air so may accumulate in low spots and may "travel" a considerable distance to a flame or other source of ignition.

REACTIVITY DATA

STABILITY Unstable		**CONDITIONS TO AVOID**
Stable	X	Avoid heat, flame or other sources of ignition.

INCOMPATIBILITY (Materials to avoid) Concentrated nitric acid, chlorine, nitrogen trifluoride, oxygen difluoride or other strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Oxides of sulfur

HAZARDOUS POLYMERIZATION May Occur		**CONDITIONS TO AVOID**
Will Not Occur	X	

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the closest Liquid Air Corporation location.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Liquid Air Corporation for proper disposal. For emergency disposal, contact the closest Liquid Air Corporation location.

EMERGENCY RESPONSE INFORMATION
IN CASE OF EMERGENCY INVOLVING THIS MATERIAL, CALL DAY OR NIGHT (800) 231-1366
OR CALL CHEMTREC AT (800) 424-9300

SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
Hood with forced ventilation.	To prevent accumulation above the TWA for H_2S	
	MECHANICAL (Gen.)	OTHER

PROTECTIVE GLOVES
Neoprene or butyl rubber, PVC, polyethylene

EYE PROTECTION
Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT
Safety shoes, safety shower, eyewash "fountains"

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION
DOT Shipping Name: Hydrogen sulfide (RQ-100/45.4) I.D. No.: UN 1053
DOT Hazard Class: Flammable gas DOT Shipping Label: Flammable gas, Poison

SPECIAL HANDLING RECOMMENDATIONS
Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<750 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations consult L'Air Liquide's Encyclopedie de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL STORAGE RECOMMENDATIONS
Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "No Smoking or Open Flames" signs in the storage or use area. There should be no sources of ignition in the storage or use area.

For additional storage recommendations consult L'Air Liquide's Encyclopedia de Gaz or Compressed Gas Association Pamphlet P-1.

SPECIAL PACKAGING RECOMMENDATIONS
Many metals corrode rapidly with wet hydrogen sulfide. Anhydrous (water content <-40F or C) hydrogen sulfide can be handled in carbon steel, aluminum, Inconel®, Stellite® and 304 and 316 stainless steels. Avoid hard steels which are highly stressed since they may be susceptible to hydrogen embrittlement from hydrogen sulfide.

OTHER RECOMMENDATIONS OR PRECAUTIONS
Earth-ground and bond all lines and equipment associated with the hydrogen sulfide system. All electrical equipment should be non-sparking or explosion proof. Do not rely on the olfactory sense to detect the presence of hydrogen sulfide. Analytical devices and instrumentation are readily available for this purpose. Perform frequent analytical tests to be certain that the TWA is not being exceeded.

Compressed gas cylinders should not be refilled except by qualified producers of

(Continued on last page.)

*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

LIQUID AIR CORPORATION
ALPHAGAZ DIVISION

ADDITIONAL DATA

Recommended First Aid Treatment: (Continued)

Eye Contact: PERSONS WITH POTENTIAL EXPOSURE TO HYDROGEN SULFIDE SHOULD NOT WEAR CONTACT LENSES.

Flush contaminated eye(s) with copious quantities of water. Part eyelids with fingers to assure complete flushing. Continue for at least 15 minutes.

Other Recommendations or Precautions: (Continued)

compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

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Material Safety Data Sheets Collection:

Sheet No. 312
Trichloroethylene

Issued: 7/79 Revision: F, 9/92

Section 1. Material Identification

Trichloroethylene (C_2HCl_3) Description: Derived by treating tetrachloroethane with lime or other alkali in the presence of water, or by thermal decomposition of tetrachloroethane followed by steam distillation. Stabilizers such as epichlorohydrin, isobutanol, carbon tetrachloride, chloroform, benzene, or pentanol-2-triethanolamine are then added. Used as a degreasing solvent in electronics and dry cleaning, a chemical intermediate, a refrigerant and heat-exchange liquid, and a diluent in paint and adhesives; in oil, fat, and wax extraction and in aerospace operations (flushing liquid oxygen). Formerly used as a fumigant (food) and anesthetic (replaced due to its hazardous decomposition in closed-circuit apparatus).

Other Designations: CAS No. 79-01-6; acetylene trichloride; Algylen; Anamenth; Benzinol; Cecolene; Chlorylen; Dow-Tri; ethylene trichloride; Germalgene; Narcogen; Triasol; trichloroethene; TCE; 1,1,3-trichloroethylene.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 2
S 2*
K 3
* Skin absorption

NFPA
2
2 0
-

HMIS
H 2†
F 2
R 0
PPE‡
† Chronic Effects
‡ Sec. 8

Cautions: TCE is irritating and toxic to the central nervous system (CNS). Inhalation of high concentrations have lead to death due to ventricular fibrillation. Chronic exposure may lead to heart, liver, and kidney damage. The liquid is absorbed through the skin. Although it has a relatively low flash point, TCE burns with difficulty.

Section 2. Ingredients and Occupational Exposure Limits

Trichloroethylene, < 100% [contains stabilizers (Sec. 1)].

1991 OSHA PELs
8-hr TWA: 50 ppm (270 mg/m³)
15-min STEL: 200 ppm (1080 mg/m³)

1990 IDLH Level
1000 ppm

1990 NIOSH REL
10-hr TWA: 25 ppm (~135 mg/m³)

1992-93 ACGIH TLVs
TWA: 50 ppm (269 mg/m³)
STEL: 200 ppm (1070 mg/m³)

1990 DFG (Germany) MAK
Ceiling: 50 ppm (270 mg/m³)
Category II: Substances with systemic effects
Half-life: 2 hr to shift length
Peak Exposure Limit: 250 ppm, 30 min average value; 2 peaks/shift

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 160 ppm/83 min caused hallucinations and distorted perceptions.
Human, lymphocyte: 5 mL/L caused DNA inhibition.
Rabbit, skin: 500 mg/24 hr caused severe irritation.
Rabbit, eye: 20 mg/24 hr caused moderate irritation.
Mouse, oral, TD_{Lo}: 455 mg/kg administered intermittently for 78 weeks produced liver tumors.

* See NIOSH, *RTECS* (KX4550000), for additional irritation, mutation, reproductive, tumorigenic and toxicity data.

Section 3. Physical Data

Boiling Point: 189 °F (87 °C)
Freezing Point: -121 °F (-85 °C)
Viscosity: 0.0055 Poise at 77 °F (25 °C)
Molecular Weight: 131.38
Density: 1.4649 at 20/4 °C
Refraction Index: 1.477 at 68 °F (20 °C/D)
Odor Threshold: 82 to 108 ppm (*not an effective warning*)

Vapor Pressure: 58 mm Hg at 68 °F (20 °C); 100 mm Hg at 32 °F (0 °C)
Saturated Vapor Density (Air = 0.075 lbs/ft³; 1.2 kg/m³): 0.0956 lbs/ft³; 1.53 kg/m³
Water Solubility: Very slightly soluble; 0.1% at 77 °F (25 °C)
Other Solubilities: Highly soluble in organic solvents (alcohol, acetone, ether, carbon tetrachloride, & chloroform) and lipids.
Surface Tension: 29.3 dyne/cm

Appearance and Odor: Clear, colorless (sometimes dyed blue), mobile liquid with a sweet chloroform odor.

Section 4. Fire and Explosion Data

Flash Point: 90 °F (32 °C) CC | **Autoignition Temperature:** 788 °F (420 °C) | **LEL:** 8% (25 °C); 12.5% (100 °C) | **UEL:** 10% (25 °C); 90% (100 °C)

Extinguishing Media: A Class 1C Flammable Liquid. Although it has a flash point of 90 °F, TCE burns with difficulty. For small fires, use dry chemical, carbon dioxide, water spray, or regular foam. For large fires, use water spray, fog, or regular foam. **Unusual Fire or Explosion Hazards:** Vapor/air mixtures may explode when ignited. Container may explode in heat of fire. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides only limited protection against TCE. Apply cooling water to sides of container until well after fire is out. Stay away from ends of tanks. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: TCE slowly decomposes in the presence of light and moisture to form corrosive hydrochloric acid. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Include alkalis (sodium hydroxide), chemically active metals (aluminum, beryllium, lithium, magnesium, sodium, potassium, and titanium), epoxides, and oxidants (nitrogen tetraoxide, perchloric acid). Contact with 1-chloro-2,3-epoxy propane or the mono and di 2,3-epoxypropyl ethers of 1,4-butanediol + 2,2-bis-4(2',3'-epoxypropoxy)-phenylpropane can, in the presence of catalytic quantities of halide ions, cause dehydrochlorination of TCE to explosive dichloroacetylene. **Conditions to Avoid:** Exposure to light, moisture, ignition sources, and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of TCE (above 300 °C) or exposure to ultraviolet light can produce carbon dioxide (CO_2) and toxic dichloro acetylene (explosive), chlorine, hydrogen chloride, and phosgene gas.

Section 6. Health Hazard Data

Carcinogenicity: The following agencies have rated TCE's carcinogenicity: IARC (Class 3, limited animal evidence & insufficient human data), Germany MAK (Class B, justifiably suspected of having carcinogenic potential), & NIOSH (Class X, carcinogen defined with no further categorization). **Summary of Risks:** TCE vapor is irritating to the eyes, nose, and respiratory tract and inhalation of high concentrations can lead to severe CNS effects such as unconsciousness, ventricular arrythmias, and death due to cardiac arrest. Mild liver dysfunction was also seen at levels high enough to produce CNS effects. Contact with the liquid is irritating to the skin and can lead to dermatitis by defatting the skin. Chronic toxicity is observed in the victims increasing intolerance to alcohol characterized by 'degreasers flush', a transient redness of the face, trunk, and arms. The

Section 6. Health Hazard Data, *Continued*

TCE crosses the placental barrier and thus exposes the fetus (any effects are yet unknown). There are increased reports of menstrual disorders in women workers and decreased libido in males at exposures high enough to cause CNS effects. TCE is eliminated unchanged in expired air and as metabolites (trichloroacetic acid & trichloroethanol) in blood and urine. **Medical Conditions Aggravated by Long-Term Exposure:** Disorders of the nervous system, skin, heart, liver, and kidney. **Target Organs:** Respiratory, central & peripheral nervous, and cardiovascular (heart) systems, liver, kidney, and skin. **Primary Entry Routes:** Inhalation, skin and eye contact, and ingestion (rarely). **Acute Effects:** Vapor inhalation can cause eye, nose, and throat irritation, nausea, blurred vision, overexcitement, headache, drunkenness, memory loss, irregular heartbeat (resulting in sudden death), unconsciousness, and death due to cardiac failure. Skin contact with the liquid can cause dryness and cracking and prolonged exposure (generally if the victim is unconscious) can cause blistering. Eye contact can cause irritation and watering, with corneal epithelium injury in some cases. Ingestion of the liquid can cause lip, mouth, and gastrointestinal irritation, irregular heartbeat, nausea and vomiting, diarrhea (possibly blood-stained), drowsiness, and risk of pulmonary edema (fluid in lungs). **Chronic Effects:** Effects may persist for several weeks or months after repeated exposure. Symptoms include giddiness, irritability, headache, digestive disturbances, mental confusion, intolerance to alcohol (degreasers flush), altered color perception, loss or impairment of sense of smell, double vision, and peripheral nervous system function impairment including persistent neuritis, temporary loss of sense of touch, and paralysis of the fingers from direct contact with TCE liquid.
FIRST AID Eyes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting. Do not give milk, as its fat content (TCE is lipid soluble) may inhance gastrointestinal absorption of TCE. **Note to Physicians:** TCE elimination seems to be triphasic with half lives at 20 min, 3 hr, and 30 hr. Some success is seen in treating patients with propranolol, atropine, and disulfiram. Monitor urine and blood (lethal level = 3 to 110 µg/mL) metabolites. BEI = 100 mg/g creatinine (trichloroacetic acid) in urine, *sample at end of workweek.* BEI = 4 mg/L (trichloroethanol) in blood, *sample at end of shift at end of the workweek.* These tests are not 100% accurate indicators of exposure; monitor TCE in expired air as a confirmatory test.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container for later disposal. For large spills, flush to containment area where density stratification will form a bottom TCE layer which can be pumped and containerized. Report any release in excess of 1000 lbs. Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Bluegill sunfish, LC_{50} = 44,700 µg/L/96 hr; fathead minnow (*Pimephales promelas*), LC_{50} = 40.7 mg/L/96 hr. **Environmental Degradation:** In air, TCE is photooxidized with a half-life of 5 days and reported to form phosgene, dichloroacetyl chloride, and formyl chloride. In water it evaporates rapidly in minutes to hours. TCE rapidly evaporates and may leach since it does not absorb to sediment. **Soil Absorption/Mobility:** TCE has a Log K_{oc} of 2, indicating high soil mobility. **Disposal:** Waste TCE can be poured on dry sand and allowed to vaporize in isolated location, purified by distillation, or returned to supplier. A potential candidate for rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C) with an acid scrubber to remove halo acids. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a RCRA Hazardous Waste (40 CFR 261.33 & 261.31): No. U228 & F002 (*spent solvent*)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 100 lb (45.4 kg) [* per RCRA, Sec. 3001, CWA Sec. 311 (b)(4), & CWA Sec. 307 (a)]

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear chemical safety goggles (cup-type or rubber framed, equipped with impact-resistant glass), per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. At any detectable concentration, wear a SCBA with a full facepiece operated in pressure demand or other positive pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made from Viton or Neoprene to prevent skin contact. *Do not* use natural rubber or polyvinyl chloride (PVC). **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean personal protective equipment. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in steel drums, in a cool, dry, well-ventilated area away from sunlight, heat, ignition sources, and incompatibles (Sec. 5). Store large quantities in galvanized iron, black iron, or steel containers; small amounts in dark (amber) colored glass bottles. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Design processes so that the operator is not directly exposed to the solvent or its vapor. Do not use open electric heaters, high-temperature processes, arc-welding or open flames in TCE atmospheres. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers with emphasis on skin, respiratory, cardiac, central and peripheral nervous systems, and liver and kidney function. Employ air and biological monitoring (BEIs). Instruct employees on safe handling of TCE.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Trichloroethylene
DOT Hazard Class: 6.1
ID No.: UN1710
DOT Packing Group: III
DOT Label: Keep Away From Food
DOT Special Provisions (172.102): N36, T1

Packaging Authorizations
a) **Exceptions:** 173.153
b) **Non-bulk Packaging:** 173.203
c) **Bulk Packaging:** 173.241

Quantity Limitations
a) **Passenger Aircraft or Railcar:** 60L
b) **Cargo Aircraft Only:** 220L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: 40

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Material Safety Data Sheets Collection:

Sheet No. 703
1,2-Dichloroethylene

Issued: 4/90

Section 1. Material Identification

1,2-Dichloroethylene Description: An industrial solvent composed of 60% cis- and 40% trans-isomers. Both isomers, cis and trans, are made by partial chlorination of acetylene. Used as a general solvent for organic materials, lacquers, dye extraction, thermoplastics, organic synthesis, and perfumes. The trans-isomer is more widely used in industry than either the cis-isomer or the mixture. Toxicity also varies between the two isomers.

Other Designations: CAS No. 0540-59-0; $C_2H_2Cl_2$; acetylene dichloride; *cis*-1,2-dichloroethylene; *sym*-dichloroethylene; *trans*-1,2-dichloroethylene, dioform.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R 1
I 2
S 2
K 1

NFPA

HMIS
H 2
F 3
R 1
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

1,2-Dichloroethylene, ca 100%

OSHA PEL
8-hr TWA: 790 mg/m³, 200 ppm

ACGIH TLV, 1989-90
TLV-TWA: 790 mg/m³, 200 ppm

NIOSH REL, 1987
790 mg/m³, 200 ppm

Toxicity Data*
Rat, oral, LD_{50}: 770 mg/kg; toxic effects not yet reviewed
Frog, inhalation, TC_{Lo}: 117 mg/m³ inhaled for 1 hr affects the peripheral nerve and sensation (flaccid paralysis without anesthesia); behavior (excitement); lungs, thorax, or respiration (respiratory depression)

* See NIOSH, *RTECS* (KV9360000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: 119 °F/48 °C
Melting Point: -56 to -115 °F/-49 to -82 °C/
Vapor Pressure: 180 to 264 torr at 68 °F/20 °C
Vapor Density (Air = 1): 3.4

Molecular Weight: 96.95 g/mol
Specific Gravity (H_2O = 1 at 39 °F/4 °C): 1.27 at 77 °F/25 °C
Water Solubility: Insoluble

Appearance and Odor: A colorless, low-boiling liquid with a pleasant odor.

Section 4. Fire and Explosion Data

Flash Point: 37 °F/2.8 °C, CC	Autoignition Temperature: 860 °F/460 °C	LEL: 5.6% v/v	UEL: 12.8% v/v

Extinguishing Media: Use dry chemical, CO_2, halon, water spray, or standard foam. Water may be ineffective unless used to blanket the fire.

Unusual Fire or Explosion Hazards: This material's vapors are a dangerous fire hazard and moderate explosion hazard when exposed to any heat or ignition source or oxidizer.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and a fully encapsulating suit. Vapors may travel to heat or ignition sources and flash back. Stay upwind and out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: This material is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: This material is incompatible with alkalies, nitrogen tetraoxide, difluoromethylene, strong oxidizers, and dihypofluorite. When in contact with copper or copper alloys or by reaction with potassium hydroxide, explosive chloroacetylene may be released.

Conditions to Avoid: Addition of hot liquid to cold 1,2-dichloroethylene may cause sudden emission of vapor that could flash back to an ignition source.

Hazardous Products of Decomposition: Thermal oxidative decomposition of 1,2-dichloroethylene can produce highly toxic fumes of chlorine (Cl).

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists 1,2-dichloroethylene as a carcinogen.

Summary of Risks: 1,2-Dichloroethylene's most important effect is its irritation of the central nervous system (CNS) and narcosis. This material is toxic by inhalation, ingestion, and skin contact. It is also irritating to the eyes. The trans-isomer at 2200 ppm causes nausea, vertigo, and burning of the eyes. The trans-isomer is twice as potent as the cis-isomer. If renal effects occur, they are transient.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Central nervous system, eyes, respiratory system.

Primary Entry Routes: Inhalation, ingestion, skin and eye contact.

Acute Effects: Inhalation of 1,2-dichloroethylene causes narcosis, respiratory tract irritation, nausea, vomiting, tremor, weakness, central nervous depression, and epigastric (the abdomen's upper midregion) cramps. Contact with the liquid causes eye and skin (on prolonged contact) irritation. Ingestion causes slight depression to deep narcosis.

Chronic Effects: None reported.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: *Quickly* remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed. Have trained personnel administer 100% oxygen, preferably with humidification.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a *conscious* person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Intravenous injections of calcium gluconate may relieve cramps and vomiting. Treat central nervous system effects symptomatically.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a 1,2-dichloroethylene spill control and countermeasure plan (SCCP).* Notify safety personnel, remove all heat and ignition sources, evacuate hazard area, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation and skin or eye contact. Absorb small spills on paper towels. After evaporating the 1,2-dichloroethylene from these paper towels in a fume hood, burn the paper in a suitable location away from combustible material. Collect and atomize large quantities in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per RCRA, Sec. 3001, per Clean Water Act, Sec. 307(a)]†

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)

† Listed as 1,2-*trans*-dichloroethylene.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. 1,2-dichloroethylene attacks some forms of plastics, rubber, and coatings.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[107]

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and oxidizing materials. Outside or detached storage is preferred. If stored inside, place containers in a standard flammable liquids storage cabinet or room. Protect containers from physical damage.

Engineering Controls: Avoid vapor inhalation and skin and eye contact. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. 1,2-dichloroethylene is a dangerous fire hazard. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement questionnaires which emphasize detecting a history of chronic respiratory disease.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 7, 26, 33, 73, 84, 85, 87, 88, 100, 101, 103, 109, 126, 127, 136, 137.

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Material Safety Data Sheets Collection:
Sheet No. 382
Vinyl Chloride
Issued: 7/78 Revision: C, 9/92

Section 1. Material Identification

Vinyl Chloride (C_2H_3Cl) Description: Derived from ethylene dichloride and alcoholic potassium, by reaction of acetylene and hydrogen chloride (as gas or liquids), or by oxychlorination where ethylene reacts with hydrochloric acid and oxygen. Inhibitors such as butyl catechol, hydroquinone, or phenol are added to prevent polymerization. Used in the plastics industry for the production of polyvinyl chloride resins, in organic synthesis and formerly as a refrigerant, extraction solvent, and propellant (banned in 1974 because of its carcinogenic activity).

Other Designations: CAS No. 75-01-4, chloroethylene, chloroethene, ethylene monochloride, Trovidur, VC, VCM.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Vinyl chloride is a confirmed human carcinogen. Vapor inhalation leads to central nervous system (CNS) depression. The liquid can cause frostbite. It is a flammable gas at room temperature and polymerizes on exposure to air or sunlight. Avoid exposure to VC through engineering controls and wearing PPE.

NFPA
R 2
I 4
S 4
K 4

HMIS
H 3*
F 4
R 2
PPE - Sec. 8
* Chronic effects

Section 2. Ingredients and Occupational Exposure Limits

Vinyl Chloride, ca 98 to 99%. Impurities include water, acetaldehyde, hydrogen chloride, hydrogen peroxide, methyl chloride, butane, 1,3-butadiene, chlorophene, diacetylene, vinyl acetylene, and propine.

1991 OSHA PELs
8-hr TWA: 1 ppm
Ceiling: 5 ppm; OSHA-X

1990 NIOSH REL
NIOSH-X

1992-93 ACGIH TLV
TWA: 5 ppm (13 mg/m^3)
TLV-A1

1990 DFG (Germany) TRK*
Existing Installations: 3 ppm
MAK-A1

1985-86 Toxicity Data†
Man, inhalation, TC_{Lo}: Intermittent exposure to 200 ppm for 14 yr caused liver tumors.
Man, inhalation, TC_{Lo}: 30 mg/m^3/5 yr caused spermatogenesis.
Human, inhalation, TC: Continuous exposure to 300 mg/m^3 for an undetermined number of weeks caused blood tumors.
Rat, oral, LD_{50}: 500 mg/kg; toxic effects not yet reviewed

* TRK (technical exposure limit) is used in place of MAK when a material is a carcinogen. Unlike an MAK below which no adverse effects are expected, the TRK is a limit set below which adverse effects may still occur. This is based on the theory that 1 molecule of a carcinogenic substance may still produce a tumor. The TRK is set to allow for an acceptable risk (for example, 1 tumor in 1 million persons may be an acceptable risk).
† See NIOSH, *RTECS* (KU9625000), for additional mutation, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 7 °F (-13.9 °C)
Freezing Point: -245 °F (-159.7 °C)
Molecular Weight: 62.5
Specific Gravity: 0.9106 at 68 °F (20 °C)
Ionization Potential: 9.99 eV
Refraction Index: 1.370 at 20 °C/D
Surface Tension: 23.1 dyne/cm at -4 °F (-20 °C)
Odor Threshold: 2000 to 5000 ppm*
Vapor Density (Air = 1): 2.155

Water Solubility: Slightly soluble, 0.1% at 77 °F (25 °C)
Other Solubilities: alcohol, benzene, carbon tetrachloride, ether, hydrocarbon and oils.
Vapor Pressure: 2500 mm Hg at 68 °F (20 °C), 400 mm Hg at -18.4 °F (-28 °C)
Critical Temperature: 304.7 °F (151.5 °C)
Critical Pressure: 56.8 atm
Viscosity: 0.01072 cP at 68 °F (20 °C), *gas*; 0.28 cP at -4 °F (-20 °C), *liquid*
Appearance and Odor: A gas at room temperature. Usually found as a compressed/cooled liquid. The colorless liquid forms a vapor with a pleasant ethereal odor.

*The actual vapor concentration that can be detected by humans has not been adequately determined and varies from one individual to another, from impurities, and probably from exposure duration. The odor threshold is not an accurate warning of exposure.

Section 4. Fire and Explosion Data

Flash Point: -108.4 °F (-78 °C) OC	Autoignition Temperature: 882 °F (472 °C)	LEL: 3.6% v/v	UEL: 33% v/v

Extinguishing Media: For small fires, use dry chemical or carbon dioxide. For large fires, use water spray, fog, or regular foam. **Unusual Fire or Explosion Hazards:** Large fires can be practically inextinguishable. Vapors may travel to an ignition source and flash back. VC may polymerize in cylinders or tank cars and explode in heat of fire. Vapors pose an explosion hazard indoors, outdoors, and in sewers. VC decomposes in fire to hydrogen chloride, carbon monoxide, carbon dioxide, and phosgene. Burning rate = 4.3 mm/min. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Stop gas leak if possible. Let tank, tank car, or tank truck burn unless leak can be stopped. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if this is impossible, withdraw from area and let fire burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. *Do not* release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Long term exposure to air may result in formation of peroxides which initiates explosive polymerization of the chloride. VC can polymerize on exposure to light or in presence of a catalyst. **Chemical Incompatibilities:** VC can explode on contact with oxide of nitrogen, may liberate hydrogen chloride on exposure to strong alkalies, and is incompatible with copper, oxidizers, aluminum, and peroxides. In the presence of moisture, VC attacks iron and steel. **Conditions to Avoid:** Exposure to sunlight, air, heat, and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of vinyl chloride can produce carbon oxides, and chloride gas.

Section 6. Health Hazard Data

Carcinogenicity: Vinyl chloride is listed as a carcinogen by the IARC (Class 1, *sufficient human evidence*),(164) NTP (Class 1, *sufficient human* evidence),(169) NIOSH (Class X, *carcinogen defined without further categorization*),(163) ACGIH (TLV-A1, *confirmed human carcinogen*),(163) DFG (MAK-A1, *capable of inducing malignant tumors in humans*),(163) and OSHA (Class X, *carcinogen defined without further categorization*).(164) Liver tumors (angiosarcomas) are confirmed from VC exposure. Other tumors of the CNS, respiratory system, blood, and lymphatic system have occurred from exposure to the polyvinyl chloride manufacture process but VC itself may not be the causative agent. Summary of Risks: Vapor inhalation causes varying degrees of CNS depression with noticeable anesthetic effects at levels of 1% (10,000 ppm). Similar

Section 6. Health Hazard Data, *continued*

It appears that metabolism is necessary before many of VC's toxic effects occur. Some vinyl chloride is exhaled unchanged but most is metabolized to chloroacetaldehyde. Skin absorption may occur if liquid is confined on skin but absorbed amount would be small. It is possible that the phenol inhibitor may be absorbed as well. The compressed liquid can cause frostbite. Vapors are severely irritating to the eyes. Chronic exposure can cause cancer and a triad of syndromes known as *vinyl chloride disease*. **Medical Conditions Aggravated by Long-Term Exposure:** Liver, cardiac, pulmonary, and connective tissue disorders. **Target Organs:** Liver, CNS, respiratory and lymphatic systems, bone, and connective tissue of the skin. **Primary Entry Routes:** Inhalation, skin/eye contact. **Acute Effects:** CNS effects include fatigue, headache, vertigo, ataxia, euphoria, visual disturbances, dulling of auditory cues, numbness and tingling in the extremities, narcosis, unconsciousness, and death due to respiratory failure. Respiratory problems include dyspnea, asthma, and pneumonoconiosis. **Chronic Effects:** Repeated exposure has lead to liver cancer; confirmed because of the otherwise rarity of its type (angiosarcoma). Tumors in other organs have occurred in the polyvinyl chloride industry but agents other than VC may be responsible; authorities are still debating this issue. A triad of other effects are associated with VC exposure. Acro-osteolysis is associated with hand cleaning of polymerization vessels and characterized by dissolution of bone in the hands, especially when associated with resorption. Raynaud's Phenomenon is a vascular disorder marked by recurrent spasm of the capillaries and especially those of the fingers and toes on exposure to cold. This is usually accompanied by pain and in severe cases may progress to local gangrene. Sclerodermatous skin changes (affecting the dorsal hands and distal forearms) are seen and described as a slowly progressive disease marked by deposition of fibrous connective tissue in the skin. The skin becomes thickened and raised nodules appear. Arthralgias (pain in one or more joints) and blood changes with decreased platelet number and capillary abnormalities may also occur.
FIRST AID Eyes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. For frostbite, immerse affected area in 107.6 °F (42 °C) water until completely rewarmed. *Do not* use dry heat. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Unlikely! VC is a gas above 7 °F (-14°C). **Note to Physicians:** Endotracheal intubation may be required if significant CNS or respiratory depression occur. Diagnostic test: thiodiglycolic acid in urine (normally < 2 mg/g creatinine).

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. If possible without risk, stop gas flow. Shut off ignition sources. Report any release > 1 lb. Follow applicable OSHA regulations (29 CFR 1910.120) **Environmental Transport:** VC reacts with hydroxyl radicals in the trophosphere with a half-life of 1.2 days. The half-life = a few hr in photochemical smog. Reaction products in the air include chloroacetaldehyde, hydrogen chloride, chloroethylene, epoxide, formaldehyde, formyl chloride, formic acid, and carbon monoxide. In soil, VC rapidly volatilizes. What does not evaporate will be highly mobile and may leach into groundwater. In water, VC is not expected to hydrolyze, bioconcentrate, or absorb to sediment. It will rapidly volatilize with an estimated half-life of 0.805 hr for evaporation from a river 1 meter deep with a current of 3 meter/sec and a wind velocity of 3 meter/sec. In waters containing photosensitizers such as humic acid, photodegradation will be rapid. **Soil Absorption/Mobility:** From an estimated solubility of 2,700 ppm, a Koc of 56 is established for VC which indicates high soil mobility and potential to leach into groundwater. **Disposal:** Dilute any waste compressed liquid to a 1% solution and remove phenol inhibitor as sodium. Pour onto vermiculite, sodium bicarbonate, or a sand & soda ash mixture (90/10). Add slaked lime if fluoride is present. Mix in paper boxes, place in incinerator, cover with scrap wood and paper, and ignite with excelsior train. Another method is to dissolve waste in a flammable solvent and spray in incinerator firebox equipped with an afterburner and alkali scrubber. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U043
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1 lb (0.454 kg) [* per CWA, Sec. 307 (a); CAA, Sec. 112, & RCRA, Sec. 3001]

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. According to NIOSH[148], for any detectable concentration use a SCBA or supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode. See 29 CFR 1910.1017 for detailed OSHA respirator recommendations. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made of Viton or chlorinated polyethylene to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL's (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate work clothes from street clothes, launder before reuse and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in a cool, dry, well-ventilated area in clearly labeled containers. Outside or detached storage is preferred. Large amounts should be stored in steel containers under pressure. Keep separate from incompatibles (Sec. 5). Venting, under pressure should be safety relief. At atm, venting should be pressure vacuum. Regularly monitor inhibitor levels. To avoid static sparks, electrically ground and bond all equipment used with VC. Avoid open flames, spark formation and electric discharges around VC. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Install Class 1, Group D electrical equipment. **Administrative Controls:** Inform VC exposed personnel of hazards associated with its use. Preplacement and periodic medical exams of workers exposed above the action level is mandatory under OSHA 29 CFR (1910.1017). Monitor for liver cancer, scleroderma, pneumonitis, clotting abnormalities, and acro-osteolysis.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Vinyl Chloride
DOT Hazard Class: 2.1
ID No.: UN1086
DOT Packing Group: --
DOT Label: Flammable Gas
Special Provisions (172.102): B44

Packaging Authorizations
a) **Exceptions:** 173.306
b) **Non-bulk Packaging:** 173.304
c) **Bulk Packaging:** 173.314 & 173.315

Quantity Limitations
a) **Passenger Aircraft or Railcar:** Forbidden
b) **Cargo Aircraft Only:** 150 kg

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: 40

APPENDIX D

SPECIFIC OHM HEALTH AND SAFETY PROCEDURES

SOP No. 2-1 Vehicle Safety
SOP No. 2-3 Personal Lifting Safety
SOP No. 2-4 Slip, Trip, Fall Prevention
SOP No. 2-5 Electrical Safety
SOP No. 2-7 Equipment Inspection
SOP No. 2-9 Fall Protection
SOP No. 3-4 Heat Stress Prevention
SOP No. 4-2 Respiratory Protection
SOP No. 5-4 Decontamination
SOP No. 6-1 Confined Space Entry
SOP No. 6-4 Lockout/Tagout/Try
SOP No. 6-5 Excavation
SOP No. 7-1 High Pressure Washers
SOP No. 7-14 Equipment Operator Qualification
Regional SOP - Buried Utility Location and Associated Subsurface Field Activities

1.0 OBJECTIVE

OHM Remediation Services Corp. (OHM) is greatly concerned about safe operation of motor vehicles. Motor vehicle usage presents the most significant work risk to employees. United States Department of Labor statistics indicate that motor vehicle deaths and injuries continue to be the number one cause of work-related death and serious injury. Accordingly, it is essential that OHM have an effective vehicle safety program.

2.0 PURPOSE

This section establishes requirements for safe operation of vehicles and equipment. This procedure is an overview of the guidelines in the proposed OSHA Motor Vehicle Safety Standard 29 CFR 1910.140.

3.0 RESPONSIBILITIES

3.1 Driver's License. Operation of a vehicle without a valid operator's license is prohibited. Personnel operating vehicles regulated by the United States Department of Transportation (DOT) shall have a current commercial drivers license (CDL). Employees must notify Human Resources if they lose their driver's license for any reason.

3.2 The driver of a Company owned, rented or leased vehicle is responsible for:

- Operating the vehicle in a safe and legal manner.
- The safety of passengers.
- Reporting immediately any motor vehicle that is found to be defective or not operating properly.

3.3 The supervisor is responsible for the following:

- Ensuring that all vehicle accident reports are processed and the required number of copies submitted in accordance with OHM accident investigation procedures to local, state, and federal agencies, to the resource manager and to the insurance carrier.

- Assuring that appropriate individuals, including the corporate vice president of health and safety, are notified by telephone of accidents that involve fatalities or multiple serious injuries.

- Assuring that all accidents are documented and investigated. The investigation should be of sufficient depth to determine the cause and action required to prevent recurrence. Copies of all motor vehicle investigations shall be forwarded to the regional health and safety director and the regional resource manager.

4.0 SEAT BELTS

OSHA has determined that the use of seat belts in motor vehicles can significantly reduce the number and seriousness of occupational motor vehicle accidents, including crashes, by requiring employers to ensure that each employee uses occupant safety belts. Accordingly, all OHM employees driving motor vehicles on company business (including rental cars, pick-up trucks, personal vehicles which are used for company compensated business travel, etc.) shall ensure that all occupants use seat belts at all times.

5.0 STATE AND LOCAL LAWS

5.1 All drivers shall drive OHM vehicles in accordance with the law.

5.2 Drivers shall not operate OHM vehicles which are known to be defective or not in compliance with the law.

5.3 Drivers of OHM vehicles are personally liable and responsible for the consequences of state and community violations.

5.4 The use of devices designed to identify active police speed detection systems (i.e. radar detectors) is prohibited in all OHM owned, leased and rented vehicles and in personal vehicles used for company compensated business travel.

6.0 SAFE DRIVING PRACTICES

6.1 Personnel shall operate vehicles in a defensive manner, i.e., being always on the alert and trying to anticipate what might occur under the existing conditions and driving in such a manner as to avoid hazards.

6.2 Personnel operating vehicles shall be considerate of, and courteous to, the traveling public and/or pedestrians and should yield the right-of-way to avoid accidents.

6.3 Personnel shall drive at speeds consistent with posted speed limits and prevailing conditions, such as weather, traffic and road conditions.

6.4 Personnel shall drive at all times with sufficient space around the vehicle to provide time to see conflicts arising, to react quickly, and to stop.

7.0 GENERAL SAFETY RULES

7.1 Blind Curves. Slow down and sound horn when approaching a blind curve.

7.2 School Buses. Obey school bus la Slow down and prepare to stop when approaching school buses, children on foot or on bicycles.

7.3 Emergency Vehicles. Give ambulances, fire fighting equipment and other vehicles the right-of-way during emergencies and lend assistance if required.

7.4 Gasoline. Gasoline and other flammable/combustible liquids shall not be carried in or on vehicles other than in permanent gas tanks or in approved safety cans. Approved safety containers must be properly secured when being carried in the back of pick-up trucks.

7.5 Laws and Regulations. Learn and obey all local, state, and federal laws.

7.6 Parking. Equipment and vehicles shall be parked off roads and highways whenever possible. When it is not possible, the vehicle shall be marked by red lights or flares at night and red flags during the day. Wheels should be blocked or chocked.

7.7 Passing. Do not pass when visibility is restricted for any reason.

7.8 Pedestrians. Be constantly alert for pedestrians. Remember they have the right-of-way.

7.9 Slow Down. Slow down and use caution at blind intersections and crossings when visibility is limited or when passing work crews.

7.10 Speeding. Speeding is strictly prohibited.

7.11 Visibility. Make sure all windshields, side and rear windows, mirrors and lights are clean before moving vehicles.

7.12 Warning Signs and Traffic Signals. Be alert for and strictly obey all directional and warning signs and signals.

7.13 Seat Belts. If unit is equipped with seat belts, operator and passengers must keep seat belts fastened at all times during operations.

8.0 DOT REGULATED VEHICLES

8.1 All OHM personnel operating a DOT regulated vehicle must hold a valid CDL from their state of residence.

8.2 Air Hose and Couplings. Periodically check air hoses and couplings and compressor hoses for worn or damaged parts. Do not crimp air hose to disconnect couplings; shut off air at the valve.

8.3 Backing Up. Never start or back up equipment or vehicles until you are sure the way is clear. If necessary, have another person guide you safely. Back up alarms, when required, must be working and audible over the surrounding noise.

8.4 Fueling and Repair. No fueling or repair shall be made to equipment while it is in operation.

8.5 Housekeeping. Operators should keep deckplates, steps, rung and hand rails on equipment free of grease, oil, ice, and mud. The inside of the cabs shall also be kept clean and free of flammable items.

8.6 Inspections. Equipment and vehicles shall not be used until known defects or discrepancies are corrected. Inspections shall be made at the start of each shift and defects or discrepancies shall be reported to the supervisor immediately.

8.7 Jumping. Jumping on or off equipment is prohibited. When climbing on or off equipment or vehicles, face the unit and use secure hand and foot holds to prevent slips and falls. Always look where you are stepping.

8.8 Know your Equipment or Vehicle. It is your responsibility to be thoroughly familiar with all features and manuals and if you are in doubt as to correct operating techniques or safety features, ask your supervisor at once.

8.9 Overloading. Avoid overloading vehicle beds. Excessive material can damage the unit and falling material can cause serious injury.

8.10 Power Lines. When operating trucks, cranes, shovels or other units, always use caution around power lines and maintain a minimum safe clearance of 10 feet or more depending upon the voltage.

8.11 Riders. Only authorized persons will be permitted to ride in equipment or vehicles.

8.12 Securing Loads. The operator of the vehicle is responsible for ensuring that their load is secure and will not shift during transport. All equipment must be secured by at least two (2) tie-down devices.

8.13 Long Hauls. On long hauls, tie-down chairs and binders should be checked periodically (at least during each rest or service stop) to make sure they are still secure and tight.

8.14 Overhanging and Oversize Loads. When it is necessary to transport overhanging or oversize loads, the OHM resource manager must obtain the appropriate permits and make sure the appropriate signs and red flags and red lights will be used.

8.15 Safety Chains. Safety chains of sufficient size and strength shall be installed on all trailers being towed.

8.16 Safety Hooks. Use safety hooks with latches on all trailer safety chains.

8.17 Side Roads and Railroad Tracks. Stop and look both ways before crossing railroad tracks or before driving onto a highway from a side road.

8.18 Stopping. Do not stop vehicles in the middle of the road to talk to occupants in another vehicle. Always pull to the side or off the road to maintain a clear, safe road.

8.19 Turn signals. Always use turn signals, emergency and other signals as appropriate when turning, stopping, passing, or performing other vehicle operations.

8.20 Vehicle Maintenance. It is the driver's responsibility to see that his vehicle is in good mechanical condition before and during operation. Special emphasis should be placed on ensuring the brakes, lights, horn, windshield wiper, tires and steering assembly are in good order. Defects must be reported and corrected immediately.

1.0 OBJECTIVE

All OHM Remediation Services Corp. (OHM) employees will use the proper lifting techniques and will utilize mechanical means when an objects' weight or bulk cannot be safely lifted by manual means. Generally, employees will not be expected to lift more than 60 pounds.

2.0 PURPOSE

This procedure provides the general guidelines to be used by OHM employees. By utilizing proper technique, OHM employees can avoid debilitating lower back injuries.

3.0 REQUIREMENTS

3.1 Use mechanical material handling equipment whenever practical; however, mechanical lifting equipment shall be used only by qualified personnel.

3.2 If the material must be lifted manually, the following procedures apply:

3.2.1 Make certain that the load lifted can be safely handled. Consider the size, weight, and shape of the load. If necessary, get help.

3.2.2 Warm up for the lift by bending, stretching, and turning.

3.2.3 Do not attempt to lift more than 60 pounds.

3.2.4 Ensure proper lifting technique as follows.

- Place feet about shoulder width apart.
- Place one foot alongside the object being lifted and the other foot in front of the object.
- Bend at the knees to grasp the load.
- Maintain slight arch in the back when positioning over load.

- Draw the load close to the body, keeping the arms and elbows tucked into the side of the body.
- Take a firm hold on the load with the palms of the hands, not just the fingers.
- Maintain same slight arch in the back.
- Lift gradually, using your leg muscles. Make sure you draw the load close to your body.
- Do not twist the body when lifting. If you have to change direction, turn with your feet, not your trunk.
- Carry the object close to the body and watch where you are going. Do not carry objects in a manner that obstructs your vision.
- Avoid throwing or dropping objects. When lowering, maintain a firm grip. Watch out for pinching of the fingers. Use your leg muscles to lower the object by bending at the knees and keeping your back straight.

4.0 BACK BELT POLICY

This section addresses the Company's position in regards to the use of industrial type back belts.

The routine issuance for general use of industrial-type back belts (i.e., those designed for use in the workplace, as compared to medical or therapeutic orthosis) is not sanctioned by OHM. This position is based upon the May 1994 issue of NIOSH Workplace Use of Back Belts, Review and Recommendations, which concludes there is insufficient data to indicate that typical industrial-type back belts significantly reduce the biomechanical loading of the trunk during manual lifting.

It is recommended that intervention strategies other than back belts be used to reduce biomechanical loading on the spine during manual material handling.

This does not prohibit the use of medical or therapeutic devices prescribed by a physician as part of a comprehensive rehabilitation program. Individuals may purchase back belts for their personal use. However, they are strongly encouraged to consult with their personal medical physician on the selection and use of back belts prior to purchasing these devices.

The use of back belts does not excuse the individual from complying with the requirements set forth in this procedure.

1.0 OBJECTIVE

All OHM Remediation Services Corp. (OHM) will prevent injuries or "near misses" which could occur from slip, trip, or fall hazards by identification and control for these hazards.

2.0 PURPOSE

This procedure describes work practices that will reduce or eliminate slips, trips, and falls and thereby reduce or prevent the injuries associated with these types of accidents. The intent is to prevent injuries and maintain an efficient and healthy workforce.

3.0 REQUIREMENTS

The following requirements detail a number of rules and methods to prevent slips, trips, and falls.

3.1 General Housekeeping. Personnel shall keep the working area clean and orderly. Tools must not be left lying on the floor or decking where they present tripping hazards during a job or after a job is completed.

3.2 Debris. Small, loose items such as, disconnected joints of pipe, wood chips, other small objects and debris shall not be left lying around in any place, particularly in areas where personnel walk.

3.3 Walkways and Grating. Walkways and grating shall be kept free of obstacles. Openings in walkways and grating shall be repaired immediately if possible. If not immediately repaired, the section must be roped off or closed until repairs can be made.

3.4 Access Points. Access points or holes in gratings shall be covered or surrounded by an adequate guard rail.

3.5 Spills. Oil spills and spills of other materials slippery materials shall be cleaned up immediately.

3.6 Steel Decks. Personnel shall take extra precautions when walking on steel decking or catwalks during wet weather such as establishing firm hand holds, wearing

suitable footwear, and walking slowly.

3.7 Jumping. Personnel shall not jump from elevated places or the backs of trucks or equipment.

3.8 Tools. Personnel using hand and mechanical tools shall position themselves properly, consider leverage, and events if a tool is suddenly moved.

3.9 Climbing Surfaces. Personnel shall not walk or climb on piping, valves, fittings or any other equipment not designed as walking surfaces.

3.10 Stairways, Walkovers, and Ramps. Stairways, walkovers or ramps shall be installed where personnel must walk or step over equipment in the course of their normal duties.

3.11 Extension Cord. Electrical extension cords and electrical wiring must be kept clear of walking and working areas and/or covered, buried or otherwise secured.

3.12 Winter Conditions. Walking and working surfaces shall be properly maintained during inclement winter weather.

3.13 Running. Running is prohibited on job sites unless under emergency conditions.

4.0 FALL PROTECTION

Fall hazards of 4 feet or more must be evaluated by a competent person. Fall protection is required at heights of 6 feet or greater. Refer to SOP 2-9, Fall Protection, for further information.

1.0 OBJECTIVE

OHM Remediation Services Corp. (OHM) personnel performing work on electrical systems and equipment will control electrical hazards by following standards set by OSHA.

2 0 PURPOSE

This procedure specifies the requirements for electrical equipment and methods and is an overview of the requirements of 29 CFR 1910, Subpart S-Electrical. If work is to be performed on any electrical circuit, Lockout/Tagout/Try may be required. Refer to the Lockout/Tagout/Try procedure.

3.0 GENERAL REQUIREMENTS

3.1 Only approved electricians will be permitted to work on electrical equipment or permanent electrical wiring.

3.2 Use proper clearance and grounding procedures. All electrical circuits and equipment shall be de-energized and Lockout/Tagout/Try accomplished before maintenance or repair work is started.

3.3 Single-phase electric hand tools and other single-phase portable electrical equipment must be approved by a recognized testing agency, and all exposed non-current-carrying metal parts must be grounded, or be double insulated.

3.4 Before each use, portable electrical appliances are to be examined for obvious deficiencies in the appliance, cord, and plug. If any deficiency is noted, the appliance is not to be used.

4.0 PORTABLE ELECTRICAL EQUIPMENT

4.1 Double insulated portable industrial type electric tools meeting the requirements of the Underwriters Laboratory are authorized for use (ground wire not required). Where such a system is employed, the equipment must be distinctly marked.

4.2 All portable electrical appliances and equipment where the non-current carrying metal parts are exposed to contact by personnel shall be grounded by continuous

conductor of adequate capacity from the device to a grounded receptacle. The site safety officer shall resolve any question which arises as to whether or not a particular appliance should be grounded.

4.3 Grounding of receptacles shall be accomplished in one of two ways:

- A built-in ground wire of green color may be attached to the ground pole of the receptacle.
- The conduit system, if installed in an approved manner, may be relied upon for grounding of a receptacle serving single phase appliances with ratings up to 230 volts.

4.4 All single-phase 15 and 20 ampere receptacle outlets operating at 120 and 240 volts which are not a part of the permanent wiring of the building or structure must have GFCI for personnel protection. The GFCI should be located at the power source so that all extension cords and tools are protected by the GFCI. In situations where GFCI protection is not practical for 240 volt equipment, the supervisor must follow the procedures for assuring grounding conductors on all equipment.

The outlet box for portable extension cords for outdoor use shall be of weatherproof type maintained in good condition.

5.0 ELECTRICAL GUARDING

5.1 Suitable access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment.

5.2 The dimension of the working space in the direction of access to energized parts in switchboards, control panels, fused switches, circuit breakers, panel boards, motor controllers, and similar equipment which require examination, adjustment, servicing, or maintenance while energized, shall not be less that 36" in depth (30" for installations built prior to 1981) and the side being 30" or the width of the equipment, whichever is greater.

5.3 The working space shall not be used for storage purposes. The "keep clear" area may be identified with suitable floor markings and/or posting of signs or decals on the equipment.

5.4 Energized parts of electrical equipment operating at 50 volts or more shall be guarded against accidental contact by the use of approved cabinets or enclosures.

5.5 Entrance to rooms and other guarded location containing exposed energized parts shall be marked with a conspicuous warning sign forbidding unqualified persons to enter. Doors shall be kept locked.

5.6 Temporary covers, warning signs, and/or barricades are to be used when it is necessary to remove covers of electrical panels during construction, major refurbishment, or for the purpose of providing temporary power to an area.

5.7 All openings in boxes, enclosures, or fittings shall be effectively guarded or closed to afford protection substantially equivalent to that of the wall of the box, enclosure, or fitting.

5.8 All electrical components over 230 volts shall have signs stating "High Voltage" 240 volts (or whatever voltage is present).

6.0 EXTENSION CORD REQUIREMENTS

6.1 Extension cords are designed for and will be used for TEMPORARY USE ONLY! All other electrical connections will be made permanent by proper construction methods.

6.2 Extension cords are to be kept clean, dry, free of kinks, and protected from oil, hot or sharp surfaces, and chemicals. Extension cords used on construction and hazardous waste sites shall be Ground Fault Circuit Interrupter (GFCI) protected. All extension cords shall be free from damage and are not to be placed across aisles, through doors, through holes in a wall, or in areas where the cord may be damaged or become a tripping hazard. Extension cords must not be placed in walkways, or on stairs or steps where the cords may pose a tripping hazard.

6.3 If a cord is damaged through use or abuse, it must be de-energized, destroyed, and discarded. OHM will not repair extension cords.

6.4 Cords shall be protected against contact with oil, hot surfaces and chemicals.

6.5 Cords must not be hung over nails or other sharp edges or placed where vehicles may run over them.

7.0 ELECTRICAL FUSE REQUIREMENTS

7.1 Circuits must be de-energized by Lockout/Tagout/Try procedures before attempting to replace fuses.

7.2 Bridging of fuses or circumventing the normal operation of circuit breakers is prohibited.

7.3 Blown fuses shall not be replaced with fuses having a higher amperage or voltage rating. Fuses should be replaced in kind to maintain proper circuit protection.

7.4 Use a fuse puller to remove fuses.

8.0 ASSURED ELECTRICAL GROUNDING STATEMENT

In limited circumstances, and only with the approval of the Regional Health and Safety Director will Assured Equipment Grounding be used at OHM projects or facilities. If implemented, all requirements of the OSHA regulations will be required.

9.0 TEMPORARY LIGHTING

Exposed bulbs on temporary lights shall be guarded to prevent accidental contact, except where bulbs are deeply recessed in the reflector. Temporary lights shall not be suspended by their electric cords unless designed for this use. Explosion-proof bulb covers shall be used when contact with flammable vapors or gases is possible and shall meet Class 1, Division 1 requirements.

1.0 OBJECTIVE

OHM Remediation Services Corp. (OHM) will provide equipment for use that it is proper working order and free from all safety deficiencies. One component to accomplish this objective is routine equipment inspection.

2.0 PURPOSE

The procedure provides for the systematic inspection of mechanized equipment including heavy equipment and other diesel or gasoline powered equipment to ensure periodic maintenance is conducted, safety equipment is operable, and if necessary, the removal from service units which are found to be defective. OHM shall maintain a comprehensive equipment inspection plan that meets the requirements for heavy equipment as found in 29 CFR 1926, Subpart O.

3.0 INSPECTION REQUIREMENTS

3.1 Before any piece of heavy equipment or other diesel or gasoline powered equipment is used, it must be inspected by the equipment's operator and determined to be in a safe operating condition.

3.2 The equipment operator shall use the heavy equipment inspection form similar to the sample which is attached in Appendix A. Records of inspection shall be maintained at the project site and be available upon request of client representatives, regulatory agency officials, and OHM auditors. These records shall become part of the official project file.

3.3 All machinery and equipment shall be inspected daily (when in use) to ensure proper working order. A thorough weekly inspection will be performed and documented using the form in Appendix A. The equipment operator is designated as the competent person to conduct the daily inspections.

3.4 Any piece of equipment which have deficiencies found during the daily or weekly inspection which would create a hazardous condition for the operator or other personnel on the job must be removed from service and repaired before allowing it to operate. Examples of this type of deficiency would include brake problems; drifting hydraulics; broken, shut down, or dead man switches.

4.0 HEAVY EQUIPMENT REQUIREMENTS

The equipment operator is responsible to make daily inspections of their equipment and to note any deficiencies. These deficiencies, no matter how minor, should be reported immediately to the site supervisor. In this way, many potential breakdowns of the equipment or potential safety hazards can be avoided by corrective maintenance.

Test shall be made at the beginning of each shift during which the equipment is to be used to determine that the operating systems are in proper working condition and that all required safety devices are in place and functional.

4.1 Safety Checks:

- Check the engine oil level. If low, add enough to bring the level to the full mark.
- Check the coolant level. Add water coolant if level is low.
- Check fuel level. Refill if necessary.
- Check tires for proper inflation, worn spots, cuts or breaks and objects imbedded in or between the tires. Correct or report conditions when found.
- Check under the vehicle for signs of oil, water, fuel, or other leaks. If leaks are seen, report them to your supervisor.
- Check head, tail, and clearance lights. If any are burned out, damaged, or missing, report them at once.
- Check batteries at least once a week for proper electrolyte level, leaks, and loose connections.
- Report any change in steering play or vibration in the steering mechanisms.
- Check the horn. If inoperative, have it repaired.
- Check the condition of the windshield, rear view mirrors and other glass. Report broken, cracked or missing glass. Clean all dirty or wet glass. Adjust rear view mirrors.
- Check belts on air compressor, generator, water pump, and any other. If loose or torn, report to your supervisor.

- Check special equipment such as wrenches, jacks, fire extinguisher, etc. Report any that are missing or unserviceable.
- Check the tracks for any loose bolts, nuts, proper adjustment, unusual wear patterns, cracks etc.
- Check the boom and buckets for cracks, bent members, worn teeth and cutting edges.
- Check fluid level of the hydraulic system.
- Check for dirty or inoperative air cleaners and filters.
- Check for proper brake operation.
- Check to make sure the equipment is equipped with a back-up alarm and the alarm is working properly.
- Make a complete walk-around inspection of the unit. In this manner damage may be detected before the machine is put into operation.
- When walking up to or around the unit, observe its condition and notice if anyone or anything is on or under it. By checking now, you may prevent injury or damage when you start out.
- If applicable, drain water off of the lubricating oil sump daily.
- In cold weather, bleed the air tank and, if equipment is equipped, use the alcohol injector pump.
- All guards protecting rotating shafts, pulleys, and pinch points are in place.

4.2 Unsafe or Deficient Equipment Whenever any machinery or equipment is found to be unsafe, or whenever a deficiency which affects the safe operation of equipment is observed, the equipment shall be immediately taken out of service and its use prohibited until unsafe conditions have been corrected.

4.2.1 A tag indicating that the equipment shall not be operated, and that the tag shall not be removed, must be placed in a conspicuous location on the equipment. Where required, lockout procedures shall be used. On the back of the tag, the problem with the equipment, inspector's name, employee number and date should be written.

4.2.2 The tag must remain in its attached location until it is demonstrated that the equipment is safe to operate.

4.2.3 When corrections are complete, the machinery or equipment shall be retested and reinspected prior to being returned to service.

4.3 Equipment Requirements

4.3.1 Seats or equal protection must be provided for each person required to ride on equipment.

4.3.2 Equipment operated on the highway shall be equipped with headlights, taillights, brake lights, and backup lights and turn signals visible from the front and rear.

4.3.3 All equipment with windshields shall be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields shall be equipped with operable defogging or defrosting devices.

4.3.4 Mobile equipment, operating within an off-highway job site not open to public traffic, shall have a service brake system and a parking brake system capable of stopping and holding the equipment while fully loaded on the grade of operation.

4.3.5 All vehicles which will be parked or moving slower than normal traffic on haul roads shall have a yellow flashing light or four-way flashers visible from all directions.

4.3.6 No one shall be permitted in the truck cab during loading operations except the driver and then only if the truck has a cab protector.

4.3.7 Steering or spinner knobs shall not be attached to the steering wheel unless the steering mechanism prevents road reactions from causing the steering handwheel to spin: when permitted, the steering knob shall be mounted within the periphery of the wheel.

4.3.8 The controls of loaders, excavators, or similar equipment with folding booms or lift arms shall not be operated from a ground position unless so designed.

4.4 Parking

4.4.1 Whenever equipment is parked, the parking brake shall be set.

4.4.2 Equipment parked on an incline shall have the wheels chocked or track mechanism blocked and the parking brake set.

4.4.3 All equipment left unattended at night, adjacent to a highway in normal use or adjacent to construction areas where work is in progress, shall have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

4.5 Towing

4.5.1 In the event that a disabled piece of heavy equipment requires towing, towing devices used on any combination of equipment shall be structurally adequate for the weight drawn and securely mounted.

4.5.2 Persons shall not be permitted between a towing vehicle and the piece of towed equipment until both have been completely stopped with all brakes set and wheels chocked on both vehicle and equipment.

5.0 MAINTENANCE AND REPAIRS

5.1 Preventive Maintenance. Preventive maintenance procedures recommended by the manufacturer shall be followed.

5.2 Equipment Repairs. All machinery or equipment shall be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Equipment designed to be serviced while running are exempt from this requirement.

5.3 Repairs. All repairs on machinery or equipment shall be made at a location which will protect repair personnel from traffic.

5.4 Heavy machinery, equipment, or parts thereof which are suspended or held apart by slings, hoist, or jacks shall be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

5.5 Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment shall be either fully lowered or blocked when being repaired or when

not in use. All controls shall be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

5.6 Mechanized Equipment. Mechanized equipment shall be shut down prior to fueling operations.

5.7 No modifications or additions which affect the capacity or safe operation of machinery or equipment shall be made without the manufacturer's written approval.

5.7.1 If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.

5.7.2 In no case shall the original safety factor of the equipment be reduced.

6.0 GUARDING AND SAFETY DEVICES

6.1 Reverse Signal (Back-up) Alarm. All self-propelled construction and industrial equipment, whether moving alone or in combination, shall be equipped with a reverse signal alarm. Note: Equipment designed and operated so that the operator is always facing the direction of motion does not require a reverse signal alarm.

6.1.1 Reverse signal alarms shall be audible and sufficiently distinct to be heard under prevailing conditions.

6.1.2 Alarms shall operate automatically upon commencement of backward motion. Alarms may be continuous or intermittent (not to exceed 3-second intervals) and shall operate during the entire backward movement.

6.1.3 Reverse signal alarms shall be in addition to requirements for signal persons.

6.2 Warning Device. A warning device or signal person shall be provided where there is danger to persons from moving equipment, swinging loads, buckets, booms, etc.

6.3 Machinery Repair. No guard, safety appliance, or device shall be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and then only after the power has been shut off. All guards and devices shall be replaced immediately after completion of repairs and adjustments and before power is turned on.

6.4 Seatbelts and Anchorage. Seatbelts and anchorages meeting the requirements of 49 CFR 571 shall be installed and worn in all motor vehicles (installation and usage on buses is optional); two-piece seat belts and anchorages for construction equipment shall comply with applicable federal specifications or SAE J 386a.

6.5 Protection. Suitable protection against the elements, falling or flying objects, swinging loads, and similar hazards shall be provided for operators of all machinery or equipment; glass used in windshields or cabs shall be safety glass.

6.6 Guarding

6.6.1 All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

6.6.2 All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

6.6.3 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

6.6.4 Substantial overhead protection shall be provided for the operators of fork lifts and similar material handling equipment.

6.6.5 Fuel tanks shall be located in a manner which will not allow spills or overflows to run onto engine, exhaust, or electrical equipment.

6.6.6 Exhaust or discharges from equipment shall be so directed that they do not endanger persons or obstruct view of operator.

6.7 Falling Object Protective Structures (FOPs). All bulldozers, tractors, or similar equipment used in clearing operations shall be provided with guards, canopies, or grills to protect the operator from falling and flying objects as appropriate to the nature of the clearing operations.

6.7.1 FOPs for other construction, industrial, and grounds-keeping equipment will be furnished when the operator is exposed to falling object hazards.

6.7.2 FOPs will be certified by either the manufacturer or a licensed engineer.

6.8 Rollover Protective Structures (ROPS).

6.8.1 Seat belts and rollover protective structures (ROPS) shall be installed on:

- Crawler and rubber-tire tractors including dozers, push and pull tractors, winch tractors, and mowers;
- Off-the-highway self-propelled pneumatic-tire earth movers such as trucks, pans, scrapers, bottom dumps and end dumps;
- Motor grades;
- Water tank trucks having a tank height less than the cab; and
- Other self-propelled construction equipment such as front-end loaders, backhoes, rollers, and compactors.

6.8.2 ROPS are not required on:

- Trucks designed for hauling on public highways,
- Crane-mounted dragline backhoes,
- Sections of rollers and compactors of the tandem steel-wheeled and self-propelled pneumatic tired type that do not have an operator's station,
- Self-propelled rubber-tired lawn and garden tractors and side boom pipe laying tractors operated solely on flat terrain, not exposed to rollover hazards, and
- Cranes, drag lines, or equipment on which the operator's cab and boom rotate as a unit.

7.0 RENTAL AND LEASED HEAVY EQUIPMENT

All equipment either rented or leased for use on OHM project sites and facilities must comply with all of the requirements in this procedure. In addition, before any piece of equipment is accepted for use on an OHM project site or facility, a competent person must perform a thorough inspection using the form in Appendix A to ensure that the equipment will be safe to use and operate within the requirement for that type of equipment.

OHM Remediation Services Corp.
A Subsidiary of OHM Corporation

DAILY HEAVY EQUIPMENT SAFETY INSPECTION CHECKLIST

EQUIPMENT I.D. NO.: EQUIPMENT NAME: WEEK OF:

ITEM INSPECTED	MONDAY	TUESDAY	WED.	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Falling Object Protective Structure (FOP)							
Roll-Over Protective Structure (ROP)							
Seat Belts							
Operator Seat Bar(s)							
Side Shields, Screens or Cab							
Grab Handles							
Back-Up Alarm - Working							
Lights							
Guards							
Horn							
Anti-Skid Tread Steps Clear of Mud							
Safety Signs (i.e. counterbalance swing area)							
Fire Extinguisher							
Oil (full and no leaks)							
Clear Of Extra Materials							
Controls function properly							
Hydraulic System (full and no leaks)							
Parking brake							
Lift Arm and Bucket							
Tires/Tracks							
Steering							
Inspectors Name and Employee No.							

NSTRUCTIONS - Inspect all applicable items indicated, each shift. If an unsatisfactory condition is observed, suspend operation of the equipment and report the unsatisfactory condition to the site supervisor immediately.

1.0 OBJECTIVE

OHM Remediation Services Corp. (OHM) employees, subcontractors, and visitors will be protected from fall hazards, such as unprotected edges 6 feet or more above the next lower level, by learning to recognize fall hazards and implement controls including the appropriate selection, use, and maintenance of fall protection equipment. **Note: OSHA regulation requires fall protection at a height of 6 feet; however, a competent person (i.e. site supervisor, site safety officer) will evaluate fall hazards at OHM projects/facilities for work involving any potential fall of 4 feet or more, determine appropriate controls, document the hazard evaluation in the site safety log, and implement control measures. State OSHA programs may also impose more stringent fall protection requirements.**

2.0 PURPOSE

The purpose of this procedure is to address the elements of the Fall Protection Program and to conform to the requirements found in 29 CFR 1926.500 - .503 (Subpart M) - Fall Protection. In some cases this procedure incorporates specific OHM requirements, which are more stringent than the OSHA regulation.

3.0 DEFINITIONS

The following are common definitions used to describe fall protection systems.

3.1 Anchorage/Tie-Off Point. A secure point of attachment for lifelines, lanyards, or deceleration devices must have 5,000 pounds tensile strength per employee. Common examples of adequate anchor points include eye bolts, beams, confined space retrieval tripods, etc. Acceptable anchorage points should be selected under the advice of the site competent person. The site competent person may seek the advice of a structural engineer in any situation where the anchor point strength is in question.

3.2 Body Belt. A strap that can be both secured around the waist and attached to a lanyard, lifeline, or deceleration device. Body belts are intended to be used as a restraining device which in conjunction with a lanyard would keep an employee away from an unprotected edge or other fall hazard. Body belts must never be used in situations where personnel are actually exposed to a fall hazard situation.

3.3 Body Harness. Straps that can be secured around the employee to distribute the fall arrest forces over the thighs, pelvis, waist, chest, and shoulders with a dee-

ring in the middle of the back to attach it to other components of a personal fall arrest system.

3.4 Competent Person. A qualified individual (such as the site supervisor or site safety officer) will serve as the competent person to oversee all job activity involving fall hazards. The competent person will identify and evaluate fall hazards at work, and will select the appropriate fall protection system to eliminate or control the fall hazard.

3.5 Deceleration Device. Mechanism such as a rope grab, a self-retracting lifeline, or a shock absorbing lanyard that serves to dissipate a large amount of energy during a fall arrest.

3.6 Guardrail System. A fixed barrier erected in compliance with Section 5.1 of this procedure as an engineering control to prevent employees from falling to a lower level.

3.7 Lanyard. Flexible line of rope, wire rope, or synthetic web with a connector at each end to connect a body belt or harness to a deceleration device, lifeline, or anchorage. Lanyards must have double-locking snaphooks, 5,000 pounds of tensile strength, and are usually limited to 6 feet in length.

3.8 Leading Edge. Edge of a floor, roof, or framework that changes location as additional material is formed/constructed. The edge is considered an unprotected or leading side/edge when not actively and continuously under construction. The wall or bank of an excavation can be considered a leading edge during periods of non-activity. An acceptable anchorage point (5,000 pounds of tensile strength) is not required if personnel are not exposed to a fall hazard.

3.9 Low Sloped Roof. A roof having a slope less than or equal to 4:12 (vertical to horizontal).

3.10 Personal Fall Arrest System. A system used to arrest an employee in a fall from a working level. A complete system consists of an anchorage, connectors, body harness, and may include a lanyard, deceleration device, lifeline, or a combination of these. **OHM prohibits the use of body belts for a fall arrest system.**

3.11 Portable Anchorage Point/Cross Arm Strap. A synthetic web with metal Dee-rings which can be used in a choke hitch around a structural building member used to connect the lanyard to an anchorage member when there is no eye bolt or other means for direct attachment; must have 5,000 pound tensile strength per employee.

3.12 Positioning Device System. A body belt/positioning belt or harness used in combination with an anchorage and connectors to support an employee on an

elevated surface with both hands free and/or prevent an employee from approaching a leading edge. A positioning device system must limit employee free fall to 2 feet or less. A positioning device must not be used in a fall arrest system.

3.13 Roll Out. The accidental disengagement or opening of a snaphook, which occurs when there is an improper use of a snaphook with an attachment point. The force of the fall arrest rebounds through the lanyard, the hook is driven up and around the attachment, the gate is depressed, and the snaphook opens or rolls out. This disengagement can be prevented by using locking snaphooks.

3.14 Roof. The exterior surface on the top of a building; not including floors or framework serving as the temporary top surface while building construction is being completed.

3.15 Rope Grab. A deceleration device that travels on a lifeline and automatically engages the lifeline and locks to arrest the employee's fall. Operates by friction and employs the principle of inertial locking and/or cam/lever locking.

3.16 Safety Monitoring System. A fall protection system that employs a competent person, the "safety monitor", to monitor the safety of employees during leading edge work at elevated heights. This system is administered as part of a fall protection plan, to be implemented only when the use of conventional fall protection equipment would create a greater hazard for the existing situation. Only personnel covered under the fall protection plan are allowed in an area where a safety monitoring system is being used.

3.17 Swing Fall. A pendulum-type swing resulting from a fall. A large swing arc is produced from lateral movement away from the anchorage point, momentum builds and the victim usually strikes an obstruction or sharp object, which stops the swing fall. Swing fall hazards can be controlled by maintaining an anchorage point, which at a minimum is at or above the employee's shoulders.

3.18 Warning Line System. A barrier erected on a roof to warn employees that they are approaching an unprotected roof side or edge, and which designates an area where roofing work may take place without the use of a guardrail, safety net, or fall arrest system to protect employees in the area.

4.0 RECOGNIZING FALL HAZARDS

Fall hazards and falling object hazards may be encountered by OHM personnel in the following situations:

4.1 Working on levels 6 feet or more above the next lower level/ground with an open side. Common situations might include work on top of frac tanks, carbon cells,

pipe racks, open floors, excavations, wells, shafts, pits, tank trucks, rail cars, manlifts or other elevated platforms.

4.2 Falling object/overhead hazards such as those encountered during work in an excavation, during tank cleaning operations, working below scaffolds, or during demolition activities.

4.3 Trips, falls, or tangles in fall protection equipment.

5.0 GUARDRAIL SYSTEMS

Guardrail systems shall be used as an engineering control to eliminate hazards of unprotected edges or open holes, such as work near the edge of an excavation, well, shaft or pit. Note: OSHA prefers the use of engineering controls over personal protective equipment for controlling hazards at work.

5.1 System Specifications

- Height of the top rail edge must be 42 inches ± 3 inches above the working level.
- Midrails shall be installed midway between the top rail and working level.
- Guardrail system must be capable of withstanding 200 pounds of force applied outward or downward within 2 inches of the top edge of the guardrail at any point. (Midrails must have 150 pound capacity.)
- Guardrail system shall be constructed to prevent puncture or laceration to personnel or equipment, or snagging of clothing.
- Top rails and midrails shall be at least one-quarter of an inch-thick to prevent cuts/lacerations. If wire rope is used, it must be flagged every 6 inches. Metal strapping and rope are not acceptable for use.
- Toeboards shall be installed whenever personnel are working above other personnel to prevent tools or debris from being kicked out, falling, and striking the people below.

5.2 System Use

- Personnel shall not lean on guardrails or rest equipment against guardrails.
- Inspect guardrails regularly for defects, and replace/rebuild defective components immediately.

6.0 COVERS

Holes (including skylights) in walking/working surfaces that present a potential for employees to fall 6 feet or more must be protected using guardrails, personal fall arrest systems, or covers. Holes that could permit objects to fall and strike personnel below must also be protected with covers.

6.1 Covers shall be capable of supporting at least twice the maximum axle load of the largest vehicle expected to drive over the cover.

6.2 Covers shall be capable of supporting at least twice the weight of employees expected to walk over the cover.

6.3 Covers shall be secured to prevent displacement by wind, equipment, or employees.

6.4 Covers shall be marked with signs or other hazard warnings such as **"Do not remove - open hole."**

7.0 PERSONAL FALL ARREST SYSTEMS

These systems shall be used when engineering controls are not feasible to control a fall hazard of 6 feet. Improper selection and use of fall protection equipment, or failure to use fall protection equipment can lead to serious accidents or fatalities resulting from unprotected falls, swing falls, rollout, or failure of fall arrest system components.

7.1 System Specifications

- Components of a personal fall arrest system include a body system (harness), connecting device (rope or web lanyard, shock absorbing lanyard, self-retracting lifeline), and a tie-off or anchorage point (5,000 pounds per worker; eye bolt or beam).
- Only ANSI approved fall protection equipment shall be used.
- Use lanyards with locking snaphooks only. Non-locking snaphooks are not acceptable, since they may contribute to roll out.
- Dee-rings, snap hooks, and attachment straps must have 5,000 pound tensile strength.

7.2 System Use

- Use a portable anchorage point (cross arm strap) to connect the lanyard to the anchorage point when there is no eye bolt for direct attachment. Hitching the lanyard onto itself as a choker is never allowed.
- Attach connecting devices to the dee-ring in the middle of the back.
- Locate anchorage points at or above the dee-ring attachment point in the middle of the back.
- Do not work above the tie-off anchor point. If it is necessary to work above the tie-off point, reposition the tie-off anchor point to a point above the middle of the back.
- Choose an anchor point that is located well above the lower level. A 6 foot man, with a 6 foot lanyard, plus 3.5 foot maximum shock absorbing extension requires a minimum clearance of 15.5 feet from anchor point to ground to avoid striking the ground during a fall.
- When no overhead structures exist or qualify as acceptable anchorage, a crane or forklift may be used if it has sufficient capacity.
- Do not tie off around sharp edges, which may cut anchorage straps and lanyards.
- Destroy and discard all components of a fall arrest system (e.g. harness, lanyard) after a fall, and replace them with new fall arrest equipment. NOTE: Specific fall arrest components like retractable lifelines may be sent to the manufacturer for testing and returned to service with approval of the regional health and safety director.
- Maintain fall arrest systems that are free of debris, rust, and corrosion; protect them from crushing and sharp surfaces. Appropriately clean and dry components before storing them in a safe place.
- Dispose of chemically contaminated components properly at the conclusion of a project or when the chemical contamination could have an adverse effect on the device.
- System components shall be used only for employee fall protection and not to hoist equipment or materials.

7.3 Inspecting Components

Inspect systems using the following guidelines:

Harnesses and Dee-Rings

- Hold with two hands, bend, and look for broken fibers, cuts, and pulled stitches.
- Dee-rings shall pivot freely. Inspect for distortion, cracks, and breaks.
- Inspect for wear, frayed or cut fibers, or distortion of buckles. Rivets must be tight and immovable with the fingers. Bent rivets may fail under stress.
- Inspect for frayed or broken strands. Look for tufts on webbing surface.
- Inspect for wear of repeated buckling and unbuckling on the tongue or billet.
- Look for loose, distorted grommets. There shall be no additional punched holes.

Lanyards

- Inspect for frays by twisting the rope.
- Inspect for failing hook latches, absence of locking latches, or a change in shape of the metal eye on lanyards or hooks.
- Examine for rips or tears in shock absorbing lanyard sections.
- Self-retracting lifelines must be inspected annually by the manufacturer.

8.0 WARNING LINE SYSTEMS

Warning line systems are often combined with other fall protection systems to provide fall protection for work on low-sloped roofs. Personnel working on low-sloped roofs with unprotected sides 6 feet or more above the next lower level must implement fall protection to include one of the following:

- Warning line and guardrail system
- Warning line and safety net system
- Warning line and personal fall arrest system
- Warning line and safety monitoring system, or
- Guardrail, safety net, or personal fall arrest system

8.1 System Specifications

- Warning lines consist of ropes, wires or chains, and supporting stanchions.
- Flag warning lines every 6 feet with high visibility material.
- With the warning line erected, stanchions shall be capable of resisting at least 16 pounds applied horizontally, perpendicular to the warning line, without tipping over.
- The lowest point (sag) of the lines must be at least 34 inches from the work surface and no more than 39 inches from the work surface.
- The warning line shall have a minimum tensile strength of 500 pounds.

8.2 System Use

- Erect warning lines around all sides of the roof work area.
- Erect warning lines at least 6 feet from the roof edge when mechanical equipment is not being used.
- When mechanical equipment is in use, erect warning lines at least 6 feet from the edge parallel to equipment operation, and at least 10 feet from the edge that is perpendicular to equipment operations.
- No employee is allowed in an area between a roof edge and a warning line unless performing designated work tasks in that area.
- Mechanical equipment can be used and stored only in areas where employees are protected by warning lines, guardrails, or a personal fall arrest system.
- Access points, storage and hoist areas shall be connected to the work area by a path formed with two warning lines. When this path is not in use, it shall be barricaded with rope, wire, or chain, equivalent in strength and height to the warning line, to prevent employees from walking directly into the work area.

9.0 SAFETY MONITORING SYSTEM

This system may be used in combination with a warning line system to provide fall protection during work on low-slope roofs. It may be used alone as a fall protection system during work on low-sloped roofs 50 feet or less in width, or as otherwise specified in a fall protection plan. Use of this system requires approval of the Regional Health and Safety Director.

9.1 A competent person such as the site safety officer or the site supervisor shall be designated as the "safety monitor" to recognize fall hazards and warn employees of these hazards or unsafe acts.

9.2 The safety monitor shall be on the same walking/working surface and within visual distance of the employees being monitored.

9.3 The safety monitor shall be close enough to communicate orally with employees.

9.4 The safety monitor shall not have other job responsibilities that would distract the safety monitor's attention.

9.5 Mechanical equipment shall not be used or stored in areas where safety monitoring systems are used for roofing operations on low-sloped roofs.

9.6 No employees other than those performing roofing work covered under the fall protection plan shall be allowed in an area covered by the safety monitoring system.

10.0 OVERHEAD PROTECTION

Employees are required to wear hardhats in areas where falling object hazards exist, and to implement one of the following:

10.1 Erect toeboards, screens or a guardrail system to prevent objects from falling from the work surface.

10.2 Erect a canopy structure or a debris net, to catch objects if they do fall, and keep objects away from the edge of the work surface.

10.3 Barricade areas where objects could fall, keep employees out of barricaded areas and keep objects away from the edge of the work surface.

11.0 OTHER FALL PROTECTION SYSTEMS

11.1 Work on manlifts or other elevated platforms can expose personnel to fall hazards. Guardrails, midrails and possibly toeboards shall be installed on manlifts or other elevated platforms, and personnel shall tie off to the boom or basket during work activities. A personal fall arrest system shall be used when the above engineering controls cannot be implemented due to clearance restrictions.

11.2 A number of other fall protection systems can be used with approval of the Regional Health and Safety Director. These systems include safety nets, controlled access zones, a fall protection plan, or a combination of these. These systems are less likely to be used on OHM projects due to the nature of the work

and the selection of guardrails. covers, and personal fall arrest systems to better provide fall protection.

11.3 Other industry standards that involve fall hazards are 29 CFR 1926 Subpart L, the Scaffolding standard, Subpart X, Floor and Wall Openings and Stairways and Ladders.

11.4 If a fall hazard situation arises at an OHM project site or facility, and is not addressed by this procedure, then it will be the responsibility of the site supervisor to contact the regional health and safety director to determine what method will be used to control the fall hazard.

12.0 TRAINING

The following statements describe the requirements of the OHM fall protection training program.

12.1 Training must be provided to all employees who may be exposed to fall hazards during the course of their work. Training will teach employees to recognize fall hazards and falling object hazards at work and to implement procedures to control these hazards.

12.2 The program shall address procedures for erecting, maintaining, disassembling, inspecting and storing fall protection equipment, as outlined in sections 5 through 11 of this procedure.

12.4 Retraining shall be conducted for situations where an employee is believed to lack the skill and understanding to recognize and control fall hazards at work, which may include changes in the workplace or changes in the types of fall protection systems or equipment to be used.

1.0 OBJECTIVE

In work situations where heat stress may be a factor, OHM Remediation Services Corp. (OHM) will attempt to prevent heat related illness by use of work-rest schedules, physiological monitoring and/or personal cooling devices.

2.0 PURPOSE

This procedure describes the causes, symptoms, treatment, and prevention of heat-related illness.

3.0 GENERAL INFORMATION

3.1 Heat-related illnesses are caused by the body's inability to dissipate metabolic heat in conjunction with excessive environmental heat and wearing PPE.

3.2 A period of adjustment or acclimatization is necessary before maximum tolerance to heat is acquired. Most workers require 7 to 10 working days of gradually increasing workload to become fully acclimatized.

4.0 HEAT-RELATED ILLNESSES

4.1 **Heat rash** can be caused by continuous exposure to hot and humid air and skin abrasion from sweat soaked clothing.

Signs and Symptoms: The condition is characterized by a localized red skin rash and reduced sweating. Aside from being a nuisance, the ability to tolerate heat is reduced.

Treatment: Keep skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.

4.2 **Heat cramps** are caused by profuse perspiration with inadequate fluid intake and salt replacement. This often robs the larger muscle groups (stomach and quadriceps) of blood which can make them cramp.

Signs and Symptoms: Muscle spasm and pain in the extremities and abdomen.

Treatment: Remove affected person to a cool place and give sips of clear water or an electrolytic drink (for example, Gatorade). Manual pressure may also be applied to the cramped muscles.

4.3 **Heat exhaustion** is a mild form of shock caused by sustained physical activity in heat and profuse perspiration without adequate fluid and salt replacement.

Signs and Symptoms: Weak pulse; shallow breathing; pale, cool, moist (clammy) skin; profuse sweating; dizziness; fatigue

Treatment: Remove affected person to a cool place and remove as much clothing as possible. Give sips of water or electrolytic solution and fan the person continually to remove heat by convection. CAUTION: Do not allow the affected person to become chilled -- treat for shock if necessary.

4.4 **Heat stroke** is the most severe form of heat stress; the body must be cooled immediately to prevent severe injury and/or death. **THIS IS A MEDICAL EMERGENCY!!**

Signs and Symptoms: Red, hot, dry skin; body temperature of 105 degrees Fahrenheit or higher; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma

Treatment: Heat stroke is a true medical emergency. Transportation of the victim to a medical facility must not be delayed. Prior to transport, remove as much clothing as possible and wrap the victim in a sheet soaked with water. Fan vigorously while transporting to help reduce body temperature. Apply cold packs, if available; place under the arms, around the neck, or any other place where they can cool large surface blood vessels. If transportation to a medical facility is delayed, reduce body temperature by immersing victim in an ice/water bath (however, be careful not to over chill the victim once body temperature is reduced below 102 degrees Fahrenheit). If this is not possible, keep victim wrapped in a sheet and continuously douse with water and fan.

5.0 SPECIFIC REQUIREMENTS

5.1 The environmental hazards section of site health and safety plans will address heat stress if the ambient temperature is expected to exceed 65 degrees Fahrenheit. Guidance for heat stress prevention can be found in the American Council of Governmental Industrial Hygienists' (ACGIH) current year edition of the TLV (Threshold Limit Values).

5.2 The site health and safety plan will discuss work-rest cycles and provisions for monitoring the level of heat stress (i.e., pulse rate).

5.3 Workers are to be advised not to drink caffeinated or alcoholic beverages because they increase the rate of body water loss.

5.4 Increased dietary salt or lightly salted (0.2 percent) water is adequate to replace lost salt. Salt tablets are not to be used.

5.5 If juice or electrolyte drinks are used, they should be diluted prior to drinking.

5.6 Thirst is not an adequate indicator of body water loss. Workers are to drink at least small amounts of water on each break.

5.7 Workers are to rest when any of the symptoms described above are present. The buddy system is mandatory, as most often the potential victim will not be aware of any symptoms. Watch out for each other.

1.0 OBJECTIVE

No individual will enter an area where the use of respiratory protective equipment is required unless the person has been trained in the selection, use, care and limitations of the respirators, and the proper respirator has been selected for the task, and the individual is fit tested for that respirator.

2.0 PURPOSE

The purpose of this procedure is to provide information and guidelines for the selection, use, and care of respiratory protective equipment for all OHM Remediation Services Corp. (OHM) and contractor personnel. This procedure complies with the requirements of 29 CFR 1910.134 Respiratory Protection.

3.0 GENERAL

3.1 The use of engineering controls should be the primary method to limit employee exposure to respiratory hazards.

3.2 Respirators shall be worn when engineering controls are unsuccessful and:

- The established PEL (Permissible Exposure Limit) or TLV (Threshold Limit Value) for the particular material is approached or exceeded, as measured by direct reading and/or integrated air sampling applicable for the suspected contaminant.
- As deemed appropriate by the regional health and safety director or designee.

3.3 Respirators can only be issued and worn by individuals who have been properly trained and fit tested.

3.4 The respirator program coordinator for each region will be the regional health and safety director.

3.5 The regional health and safety director will evaluate annually the effectiveness of the respirator program and denote deficiencies to the vice president of health and safety.

3.6 Only respirators approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA) which are appropriate for the potential hazard shall be worn when potential exposure involves a toxic material.

4.0 SELECTION OF RESPIRATORS

4.1 Engineering controls should always be the primary control method of employee exposure to airborne contaminants (i.e. elimination of contamination source, ventilation of area, barriers, remote handling methods, etc).

4.2 Once the need for respiratory protection has been established, the respirators shall be selected on the basis of the hazards to which the worker is exposed.

4.2.1 Selection criteria should include:

- Identity of airborne hazard
- Physical form of contaminant
- The current concentration of the contaminant
- Potential maximum concentration of the contaminant
- Whether the contaminant may be present in concentrations to be immediately dangerous to life or health (IDLH)
- The possibility of oxygen deficiency
- A suitable approved cartridge is available
- The useful life of the respirator cartridge
- The escape routes available
- Whether the respiratory devices are intended for emergency use, for periodic use, or for stand-by purposes

4.3 **Other relevant information based on site conditions may be considered to determine type of respirator to be used.**

4.4 **OHM does not routinely permit the use of one half face piece air purifying respirators and disposable dust masks. The regional health and safety director or designee must approve the use of either of these devices.**

5.0 MEDICAL SCREENING

5.1 Prior to assigning personnel to perform tasks requiring the use of respirators, the employee shall be medically qualified in compliance with requirements of 29 CFR 1910.134(a)(10) and 29 CFR 1910.120(f).

5.2 Employees not physically and psychologically capable of wearing respirators shall not be assigned to work requiring the use of respirators.

5.3 The medical status of each employee is to be periodically evaluated as outlined in SOP 3-1, Occupational Health Examination Program. Additional evaluations may be deemed necessary if the physical/medical status of the employee changes.

6.0 FIT TESTING

6.1 Fit testing will be performed in accordance with accepted fit test procedures by the regional health and safety director or their designated employee who has been trained and qualified to do so. Fit testing will take place at least annually or as required by other specific OSHA standards (i.e. 29 CFR 1926.62). Additionally, fit testing will be performed whenever a new respirator has been issued; there is a change in facial features, for example, weight loss/gain, accident or dental changes; or difficultly in achieving a satisfactory positive/negative fit test. Site specific fit tests will take place when requested by the client. A copy of the Respirator Fit Test Record follows this procedure.

6.2 Records of fit testing shall be maintained by the employee's division office and/or the corporate health and safety department. These records will include the manufacturer, model, and size of respirator the employee used in the fit test and the procedures used to perform the fit test.

7.0 RESPIRATOR USE INSTRUCTIONS

7.1 Respirators must be used only by those employees who have been properly trained and qualified on the specific type of respirator to be worn.

7.2 All employees whose job assignment requires the use of respirators shall be given respirator training and be fit tested prior to being initially assigned to a field project or job requiring respirator usage. A review of operation and maintenance will be performed annually, typically during the HAZWOPER refresher, on each type of respirator worn by the individual. Documentation of this training will be maintained in the Corporate Health and Safety Office.

7.3 Only respirators and/or cartridges approved by NIOSH/MSHA and appropriate for the hazardous atmosphere to be encountered will be used.

7.4 CAUTION: Air-purifying respirators are not to be used where an oxygen deficiency (less than 19.5 percent) exists. Only air-supplied full face respirators with an emergency escape cylinder or self-contained breathing apparatus will be worn when an oxygen deficiency exists. The regional health and safety director must approve any entry into an oxygen deficient atmosphere.

7.5 OHM personnel will not enter atmospheres recognized exceeding the IDLH concentration for a particular material without approval of the regional health and safety director. Only air-supplied full face respirators with an emergency escape cylinder or self-contained breathing apparatus will be worn in IDLH atmospheres. CAUTION: A respirator does not protect against excessive heat or against hazardous substance that can attack the body through the skin.

7.6 Contact lenses shall not be worn in contaminated atmospheres requiring the use of respiratory protection.

7.7 A person wearing a respirator must be clean-shaven in the area of the face piece seal. Long hair, sideburns, and skull caps that extend under the seal are not allowed. Glasses with temple pieces extending under the seal are not allowed. Persons with facial conditions that prevent a proper seal are not allowed to wear respiratory protection until the condition is corrected. Facial conditions which may cause a seal problem include missing dentures, scars, severe acne, etc.

7.8 A minimum of three (3) people must be assigned to each operation involving use of airline egress systems. That two (2) people operating in a buddy system and one (1) person as a cylinder watch. This person may have collateral duties as long as they are in the same general vicinity and the duties would not interfere with monitoring the egress system.

8.0 RESPIRATOR INSPECTION

8.1 Respirators shall be inspected by the user before and after each day's use. Respirators not used routinely (e.g. emergency use respirators) shall be inspected once a month.

8.2 Inspection procedure for air purifying respirators (full-face piece and one half-face piece cartridge/canister respirators)

8.2.1 Examine the face piece for:

- Excessive dirt.
- Cracks, tears, holes, or distortion from improper storage.
- Inflexibility.

- Cracked or badly scratched lenses.
- Incorrectly mounted lens or broken or missing mounting clips.
- Cracked or broken air purifying element holder, badly worn threads, or missing gaskets.

8.2.2 Examine the head straps or head harness for:

- Breaks or cracks.
- Broken or malfunctioning buckles. Excessively worn serrations on the head harness which may permit slippage.

8.2.3 Examine exhalation valve for the following after removing cover:

- Foreign material.
- Cracks, tears, or distortion in the valve material.
- Improper insertion of the valve body into the face piece.
- Cracks, breaks, or chips in the valve body, particularly in the sealing surface.
- Missing or defective valve cover.
- Improper installation of the valve into the valve body.

8.2.4 Examine the air purifying elements (cartridge or canister) for:

- Missing cartridge adapter gasket
- Incorrect cartridge/canister, or filter for the hazard.
- Incorrect installation, loose connections, missing or worn gaskets, or cross threading in the cartridge adapter.
- Cracks or dents in outside case or threads of filter or cartridge /canister.

8.2.5 If the device has a corrugated breathing tube, examine it for:

- Broken or missing end connections.

- Missing or loose hose clamps.
- Deterioration, determined by stretching the tube and looking for cracks.

8.3 Inspection procedure for air-supplied respirators (full face piece air line respirators and self contained breathing apparatus (SCBA)) should be as follows:

8.3.1 If the device has a tight-fitting face piece, follow the procedures outlined for air purifying respirators, except those pertaining to the air purifying elements.

8.3.2 The inspection of air-supplied respirators should include checks on the following items:

- Tightness of connections
- Condition of all rubber parts
- Air cylinder (SCBA & egress) must be fully charged and the hydrostatic test certification must be current(Fiberglass/ composite cylinders-3 years/steel cylinders-5 years).
- Regulators and warning devices function properly.
- Each unit (SCBA & egress units) must have a distinct identification number permanently affixed or engraved on the regulator. The manufacturers serial number may be used.

8.4 A record of respirator inspections including date and inspectors initials and employee number will be maintained for all respiratory protective equipment designated for emergency response. Ergress units and SCBAs shall be inspected on a monthly basis. The SCBA inspection form follows this procedure.

8.5 Inspection of hoop-wrapped air cylinders will follow the recommendations set forth in the Compressed Gas Association, Inc. publication CGA C-6.2-1988 "Guidelines for Visual Inspection & Requalification of Fiber Reinforced High Pressure Cylinders" and will be examined for the following five types of damage.

8.5.1 Abrasion is damage caused by wearing, grinding, or rubbing away by friction. Abrasions less than 0.005 inch (0.127 mm) deep are acceptable and should have no adverse effects on the safety of the cylinder. Abrasions with isolated groups of fibers exposed or flat spots with a depth greater than 0.005 inch (0.127 mm) but less than 0.0075 inch (0.191 mm) are acceptable if the damaged is repaired. Cylinders

abraded in excess of 0.0075 inch (0.191 mm) should be taken out of service until professionally inspected.

8.5.2 Cuts are damage inflicted by a sharp objects. Cuts or scratches less than 0.005 inch (0.127 mm) deep are acceptable regardless of length, number, or direction. For cuts greater than 0.005 inch (0.127 mm) deep and up to a depth of 0.015 inch (0.038 mm) with a maximum 1 or 2 inch (25.4 or 50.8 mm) length transverse to the fiber direction, the cylinder should be removed from service until repaired. Cylinders with cuts greater than 0.015 inch (0.038 mm) with a maximum greater than 2 inches (50.8 mm) length transverse to the fiber direction or with bare metal showing through must be condemned.

8.5.3 Impact damage is caused by a cylinder striking or being struck by another object. Impact damage is considered slight if a frosted area is noted in the impact area. These cylinders may be returned to service. Impact damage is severe if evidence of fiber cutting, delamination, and possible structural damage is apparent. Cylinders sustaining severe impact damage should be evaluated using the guidelines for cuts and structural damage.

8.5.4 Structural damage is damage which causes a visual change in original cylinder configuration. This change can include any evidence of bulges, a cocked end fitting, concave areas on the domes or on the cylinder section, or, if by visual inspection of the cylinder interior, there is evidence of damage involving deformation of the liner. Structurally damaged cylinders must be immediately removed form service and condemned.

8.5.5 Heat or fire damage to a cylinder is evident by discoloration, charring, or burning of the composite, labels, paint, or plastic components of the valve. Such damage would cause a cylinder to be removed from service and condemned. Note: If the cylinder is only soiled from smoke or other debris and is found to be intact underneath, it may be returned to service.

9.0 CLEANING OF RESPIRATORS

9.1 Respirators assigned and worn by one individual must be cleaned after each day's use. Visitors' or multi-assigned respirators must be cleaned and disinfected after each use.

9.2 Extreme caution must be exercised to prevent damage from rough handling during the cleaning procedure.

9.3 After cleaning, respirators must be reassembled.

9.4 A respirator spray disinfectant is approved as disinfectant between continuous use but not for cleaning and sanitizing after each day's use.

9.5 Cleaning procedure for individually assigned respirators.

9.5.1 Washing: The respirator must be disassembled and washed with a mild liquid detergent in warm water. A brush should be used. To avoid damaging the rubber and plastic in respirator face pieces, use a soft bristle brush and a cleaner/water solution preferably between 90 and 100°F.

9.5.2 Rinsing: The respirator should be rinsed thoroughly in clean water (140°F maximum) to remove all traces of detergent. This is very important to prevent skin irritation from the detergent.

9.5.3 Disinfection: The respirator should be immersed in a solution of water and chlorine in a hypochlorite solution made from household bleach (50:1 ratio or approximately 2 cap fulls per gallon) to disinfect the respirator. The immersion should last for at least two minutes.

9.5.4 Rinsing: The respirator should be rinsed thoroughly in clean water (140° F maximum) to remove disinfectant solution. This step is important to prevent dermatitis.

9.5.5 Drying: The following drying methods may be used: draining and drying on a clean surface; draining and drying when hung from racks (take care to prevent damage); or towel drying with a soft cloth or paper towels.

9.6 Cleaning procedure for visitor or multi-assigned respirators

9.6.1 Washing: The respirator must be disassembled and washed with a brush in a cleaning solution in warm water. To avoid damaging the rubber and plastic in respirator face pieces, use a soft bristle brush and a cleaner/water solution preferably between 90 and 100°F.

9.6.2 Rinsing: The respirator should be rinsed thoroughly in clean water (140°F maximum) to remove all traces of detergent. This step is important to remove all traces of detergent.

9.6.3 Disinfection: The respirator should be immersed in a solution of water and chlorine in a hypochlorite solution made from household bleach (50:1 ratio) to disinfect the respirator. The immersion should last for a least two minutes.

9.6.4 Rinsing: The respirator should be rinsed thoroughly in clean water (140°F maximum) to remove disinfectant solution. This step is important to prevent dermatitis.

9.6.5 Drying: The following drying methods may be used: draining and drying on a clean surface; draining and drying when hung from racks (take care to prevent damage); and drying in steel storage cabinets with built-in circulation fans. (Solid shelves should be replaced with steel mesh).

10.0 MAINTENANCE OF RESPIRATORS

10.1 Respirator maintenance shall only be performed by trained personnel.

10.2 Manufacturer's approved replacement parts must be used. Substitution of parts from a different brand or type of respirator invalidates the technical approval of the respirator.

10.3 Maintenance performed on a self-contained breathing apparatus shall be done only by an individual who has been certified by the manufacturer.

10.4 Survivair air supplied respirators (SCBA and egress units) shall be flow tested on an annual basis and overhauled every three years by an authorized factory repair facility. It is OHM's policy to test all air supplied respirators, without regard to manufacture's requirement, on this basis unless the manufacturer's requirement is more strict.

11.0 STORAGE OF RESPIRATORS

11.1 When not in use, respirators must be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and physical damage.

11.2 Respirators must be stored in reusable plastic bags between shifts.

11.3 The respirator storage environment must be clean, dry and away from direct sunlight. Upright cabinets and wall-mounted cases are suggested.

12.0 BREATHING AIR

12.1 Breathing air shall meet at least the requirements of the specification for Grade D breathing air or better (D, E, or G not A, K, or L) as described in the American National Standard Commodity Specification for Air ANSI/CGA G-7.1-1989.

12.1.1 Grade D breathing air, as per ANSI/CGA G-7.1 - 1989, shall contain between 19.5 and 23.5 percent oxygen with the balance predominantly nitrogen, a maximum of 5 mg/m^3 oil (condensed), a maximum of 10 ppm carbon monoxide, no pronounced odor, and a maximum of 1000 ppm carbon dioxide.

12.1.2 Grade E breathing air, as per ANSI/CGA G-7.1 - 1989, shall contain between 20 and 22 percent oxygen with the balance predominantly nitrogen, a maximum of 5 mg/m^3 oil (condensed), a maximum of 10 ppm carbon monoxide, no pronounced odor, a maximum of 500 ppm carbon dioxide, and 25 ppm total hydrocarbon content (as methane).

12.1.3 Note: The quality verification for oil is not required for synthesized air whose oxygen and nitrogen components are produced by air liquefaction. Carbon monoxide quality verification is not required for Grade D breathing air if synthesized air when nitrogen component was previously analyzed and meets National Foundry (NF) specification and when the oxygen component was produced by air liquefaction and meets United States Pharmacopeia (USP) specification.

12.2 Quality Verification. Breathing air suppliers must provide certification of analysis stating conformance, as a minimum, to Grade D breathing air standards as referenced in 12.1.1 for each cylinder and/or air lot.

13.0 RECHARGING BREATHING AIR CYLINDERS

13.1 An egress cylinder is fully charged at a pressure of 2550 pounds per square inch (psi). A 45 cubic foot 30 minute low pressure SCBA unit is fully charged at a pressure of 2216 psi.

13.2 Recharge the cylinders with pure, respirable compressed air which as a minimum, conforms to ANSI/CGA G-7.1 - 1989 Grade D breathing air standards. Never recharge a cylinder with oxygen.

13.3 Block or otherwise stabilize a cylinder to be recharged so that it will not fall or forcibly strike another object, cracking the cylinder connection during charging.

Cylinders do not need to be submerged in water during charging.

13.4 A standard breathing connection should be used to recharge a cylinder. CGA connection No. 346 is used for SCBA units and CGA connection No. 1310 is used for egress cylinders.

13.5 Connect the filling hose and open the cylinder valve. Fill the cylinder slowly, at a rate not to exceed 600 psi per minute. Therefore, both types of cylinders (SCBA and egress) should take approximately 4 to 5 minutes to fill. Faster filling times may cause an excessive rise in temperature of the cylinder which results in a decrease of temperature when the cylinder cools. Cylinders may require a slight "top off" when the cylinder cools.

13.6 Close the cylinder valve.

13.7 Slowly bleed pressure from the filling lines.

13.8 Disconnect the filling line.

14.0 SUPPLIED AIR BREATHING AIR SYSTEMS

14.1 Air line couplings shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of air line respirators with nonrespirable gases or oxygen.

14.2 OHM standard air line couplings for breathing air systems is a Foster quick connect fitting with a locking dot. Hansen quick connect fitting may also be used but must not be used where they can be inadvertently actuated and disconnected. For example, Hansen fittings could be used at the regulator connection but not on the airline laying on the ground unless protected from disconnection by some other means.

14.3 Other air line couplings fittings may be used with the approval of the regional health and safety director.

14.4 The hose line length shall not exceed 300 feet from the air bank regulator to the user.

14.5 No more than three connections, excluding the connection to the regulator and final connection to the respirator, shall be between the breathing air cylinders and the user.

14.6 Breathing air hose shall be protected from direct contact with chemical materials which may permeate the hose. Acceptable methods of protection include suspension of the hose from the surface or covering with a commercially available sleeve or visqueen. Breathing air hose which has become contaminated will be removed from service and disposed of properly.

14.7 The breathing air regulator shall be adjusted to provide between 50 to 125 psi pressure.

15.0 COLOR CODE FOR RESPIRATOR CARTRIDGES

NIOSH recognizes the following standard color codes for respirator cartridges. The color codes can be used as a general guideline, however, personnel should refer to the NIOSH technical certification (TC) to verify adequate protection.

Acid gases	White
Organic vapors	Black
Ammonia gas	Green
Acid gases and organic vapors	Yellow
High Efficiency Particulate Air (HEPA) Dust, fumes, and mists (including asbestos and radioactive materials)	Magenta (Purple)
Particulates (dust, fumes, mists, fogs, or smokers in combination with any other of the above gases on vapors.	Canister color for contaminant above, with ½-inch gray stripe completely surrounding the canister near the top.

16.0 OHM RESPIRATORY PROTECTION SELECTION

OHM has designated the following respiratory protection devices for use on OHM projects, shops, and laboratories.

16.1 Air purifying respirators shall be the Mine Safety Appliance (MSA) full face piece twin cartridge silicon rubber Ultra-Twin respirator in sizes of small, medium, and large. The respirator should be issued with a nose cup.

16.2 For employees who do not satisfactorily fit in the MSA Ultra-Twin respirator, the secondary respirator shall be the Survivair full face piece twin cartridge respirator in the sizes of standard or small. The respirator should be issued with a nose cup.

16.3 Self-contained breathing apparatus (SCBA) shall be the Survivair Mark 2 low pressure 30 minute SCBA.

16.4 Egress breathing apparatus shall be the Survivair HIP-PAC to be used with a 5 or 10 minute emergency escape cylinder.

16.5 OHM shall not use one-half face piece air purifying respirators on hazardous waste sites without permission of the regional health and safety director.

16.6 The regional health and safety director may approve other types and manufacturers' NIOSH approved respiratory protection devices to be used based on the particular special requirements of a project site.

16.7 Subcontractors may use any NIOSH/MSHA approved respiratory protection as long as it provides an equivalent level of protection as described in the HASP. Subcontractors may not wear one-half facepiece respirators if OHM employees are using full facepiece respirators.

16.8 It is OHM company policy to provide either MSA or Survivair respiratory protection to OHM employees. Employees are not to use other manufacturers respirator without the approval ot the regional health and safety director or his designee.

16.9 OHM may rent supplied air respiratory devices other than Survivair on a case by case basis. Rental can occur only with the approval of the regional health and safety director or designee.

1.0 OBJECTIVE

All personnel, tools and equipment which have entered the contaminated area (exclusion zone) on OHM Remediation Services Corp. (OHM) job sites involving hazardous materials require decontamination upon leaving the exclusion zone.

2.0 PURPOSE

The purpose of this procedure is to describe the minimum requirements for decontamination as required in 29 CFR 1910.120(k).

3.0 REQUIREMENTS

3.1 The Health and Safety Plan (HASP) will include a section on decontamination with specific requirements including procedures, methods, handling of used solutions, and disposal of used PPE.

3.2 Every exit from the exclusion zone requires decontamination with the exception of emergency situations. If an employee is injured, decontaminate to the extent possible given the nature of the injury.

3.3 Large equipment such as drill rigs and heavy equipment will be decontaminated by using a steam or hot water hose wash, high pressure water, or by detergent wash. The resulting water and material will be collected and disposed of in an acceptable manner.

3.4 Personnel decontamination will be specified in the HASP.

3.5 Personnel assigned to the decontamination process will assist workers and decontaminate equipment and reusable protective gear. Protection levels for decontamination personnel will be generally one level less than that of personnel exiting the exclusion zone. Specific levels of protection will be specified in the HASP.

3.6 An on-site shower facility will be provided when necessary.

3.7 During hazardous waste site activities, the site supervisor will verify that proper decontamination procedures are being followed. Verification of decontamination for personal protective equipment and large equipment may be accomplished by visual inspection and/or direct reading monitoring instruments as it is brought out of the contamination reduction zone. In some cases, wipe samples may be collected to document that the decontamination effort is effective.

1.0 OBJECTIVE

Confined spaces may pose special hazards such as toxic, flammable, or asphyxiating atmospheres, or engulfment. To minimize the hazards presented by confined space entries, OHM Remediation Services Corp. (OHM) shall enforce this procedure as a means of protecting the health and safety of workers while entering, working in, and exiting confined spaces, and providing for compliance with the OSHA permit required confined space standard, 29 CFR 1910.146.

2.0 PURPOSE

The purpose of this program is to establish confined space entry procedures and practices which protect all OHM employees, and subcontractor employees performing entries under OHM supervision.

3.0 APPLICABILITY

This confined space entry program applies to all OHM personnel and subcontractor personnel at OHM supervised project sites, and at OHM facilities. When client confined space requirements may differ from the OHM confined space entry requirements, the more stringent requirement shall be met.

The confined space entry program requirements include identification of confined space personnel including entry supervisor, entrant, attendant, rescue team, and rescue service; training and rescue drills; a permit system for hazard identification and control; a site specific rescue plan; safety equipment and PPE; labeling and posting of confined spaces; and safe work practices and procedures including atmospheric testing and monitoring.

4.0 DEFINITIONS

Attendant - is the individual stationed outside the confined space who monitors the authorized entrants and who performs all attendant's duties assigned in the permit space program.

Authorized entrant - is an employee who is authorized by the employer to enter a permit space.

Confined space - is a space that:

1. In large enough and so configured that an employee can bodily enter and perform assigned work; and

2. Has limited or restricted means for entry or exit; and

3. Is not designed for continuous human occupancy.

Non-Permit Required Confined Space - A non-permit required confined space is any confined space that does not contain, or have the potential to contain, atmospheric hazards or any other hazard capable of causing death or serious physical harm to personnel. OHM considers all confined space entry to be a permit required entry.

Entry - is the action taken by a person to pass througn the opening into a permit required confined space. Entry includes ensuing work activities in that space, and is considered to have occurred as soon as any part of the entrant's body breaks the plane of the opening into the space.

Entry supervisor - is the person responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required.

Hazardous atmosphere - is an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury or acute illness from one or more of the following causes:

1. Flammable gas, vapor, or mist in excess of 10 percent of the lower explosive limit (LEL).

2. Airborne combustible dust at a concentration that meets or exceeds the LEL.

3. Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.

4. Atmospheric concentration of any substance which could result in employee exposure in excess of the permissible exposure limit (PEL).

5. Any other atmospheric condition that is immediately dangerous to life or health (IDLH).

Permit required confined space - (permit space) is a confined space that has one or more of the following characteristics:

1. Contains or has the potential to contain a hazardous atmosphere

2. Contains a material that has the potential for engulfing an entrant

3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a small cross-section; or

4. Contains any other recognized serious safety or health hazard.

Permit system - is the administrative procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Rescue service - is the personnel designated to rescue employees from permit spaces.

Retrieval system - is the equipment (including a retrieval line, chest or full-body harness, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

5.0 RESPONSIBILITIES

Entry Supervisors:

1. Evaluate their work sites to determine if any operations involve permit required confined spaces.

2. Inform employees who may enter confined spaces, of the existence and location of, and the danger posed by the permit spaces, by posting danger signs or other equally effective means.

3. Inform subcontractors of the requirements for permit required confined space program.

4. Reevaluate permit spaces when there are changes in conditions.

5. Identify the hazards that may be faced during entry.

6. Attend confined space training.

7. Assure all employees involved with confined space operations are trained and proficient.

8. Verify that the appropriate entries have been made on the permit, and that all safe operating procedures and equipment have been specified and in place prior to signing the permit and allowing entry to begin.

9. Verify that rescue services are available and that the means for summoning are operable.

10. Remove unauthorized personnel from the area where permit entry is being made.

11. Determine that entry operations remain consistent with the terms of the entry permit and that acceptable entry conditions are maintained.

Authorized entrants:

1. Attend site specific confined space training and rescue drills.

2. Know the hazards that may be present during entry.

3. Properly use equipment required to safely enter the confined space including equipment for testing and monitoring, ventilation, respiratory protection, communication, PPE, lighting, etc.

4. Communicate with the attendant periodically.

5. Alert the attendant whenever a hazardous condition arises.

6. Exit from the space as quickly and safety as possible whenever an order to evacuate is given by the attendant or the entry supervisor; when the entrant recognizes any warning sign or symptom of exposure to a potentially dangerous situation, or when the entrant detects a prohibited condition, or when an evacuation alarm is given.

Attendants:

1. Attend site specific confined space training and rescue drills.

2. Know the hazards that may be present, and the symptoms of overexposure to the chemical and physical hazards faced by the entrants.

3. Be alert to the possible exposure symptoms exhibited by the entrants.

4. Maintain an accurate count of authorized entrants in the permit space and ensure that the permit accurately identifies who is in the permit space.

5. Remain outside the permit space during entry operations until relieved by another attendant.

6. Communicate with entrants to monitor their status.

7. Monitor activities inside and outside the space to determine that it is safe for the entrants to remain in the space, or to evacuate the space in case a hazardous condition arises.

8. Summon rescue and emergency services as necessary.

9. Keep unauthorized personnel from approaching a permit space.

10. Perform non-entry rescue as required.

11. Perform entry rescues only if trained and equipped for rescue operations, and only after being relieved by a qualified attendant.

12. Perform no other duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

Rescue Services: (non-entry rescue/outside rescue services shall be used whenever feasible)

1. Know hazards of confined space.

2. Attend confined space training which includes training on hazard recognition, use of rescue equipment, rescue drill prior to entry into confined space with different configuration.

3. Attend first aid/CPR training. At least one member of the team must be current in first aid/CPR certification.

4. Conduct a rescue drill every twelve months.

6.0 PROCEDURE

6.1 Permitting. An MSDS for the last contents of the confined space must be reviewed prior to issuance of the permit. A permit will be issued for each permit required confined space entry. The permit duration is limited to one shift; a new permit must be issued daily for any ongoing confined space work. The permit requirements must be met by a qualified person; the entry supervisor will ensure that the permit requirements have been met, and sign off on the permit as the Entry Supervisor. The OHM confined space entry permit is attached.

6.2 Written Rescue Procedure. Prior to any confined space work, a site specific written rescue plan will be developed that address the minimum requirements of pre-entry planning, equipment, rescue services on-site and off-site, permits and signs. A generic site safety rescue plan is attached.

6.2.1 Rescue Requirements

- Rescue equipment must be in-place before the first entrant enters the confined space.
- A trained stand-by person (attendant) will be assigned to each confined space with required emergency equipment including a fully charged SCBA or airline and egress unit.
- The attendant is to keep life lines clear, to maintain contact with all workers within the confined space and to summon help if needed.
- The attendant may not leave his post until he is properly relieved by rescue assistance.
- The attendant may attempt non-entry rescue via lifeline while waiting for rescue assistance.

7.0 PERMIT SYSTEM

All confined space entry permits will address the following:

- Location
- Duration
- Hazard identification
- Hazard control, e.g. lockout/tagout
- PPE and special requirements
- Air monitoring requirements and documentation of results
- Personal monitoring
- Training required
- Entrants
- Attendant personnel
- Rescue personnel
- Communication procedures
- Emergency/rescue procedures
- Confined space classification
- Posting of notification

8.0 TRAINING

OHM will train personnel involved in confined space entry and confined space rescue on the hazards associated with confined space work. Training will be provided to each affected employee before performing confined space activities, when there is a change in assigned duties, and when there is any change in safe work procedures. New employees will receive confined space training when they come on site, and prior to performing

confined space work. The training will include an assessment of the proficiency of confined space personnel with the training content. The training will, as a minimum, include the following topics:

- Hazard recognition
- Hazard control
- Emergency entry and exit
- Respirator use
- First Aid/CPR
- Lock-out procedures
- Safety equipment
- Rescue drills for each new entry configuration (at least annually)
- Permit systems
- Work practices
- Communications and requirements

9.0 TESTING AND MONITORING

9.1 Initial Monitoring. Entry into a confined space is prohibited until initial testing of the atmosphere for oxygen content, flammability, and toxic gas concentration is conducted from the outside. Initial monitoring gives critical information concerning oxygen level, flammability, and toxicity hazards. In general, OHM personnel will not enter confined spaces if there is 10% LEL, any oxygen deficiency or excess, or any indication of toxic vapors. If a confined space entry is made where any flammable vapors, any oxygen deficiency or excess, or any indication of toxics are present, that entry must be specifically approved by the Regional Health and Safety Director or his designee.

9.2 Flammability Monitoring. Initial monitoring for flammables shall be conducted from outside the space. Any work producing open flames or sparks (hot work) is prohibited on or in any confined space where monitoring indicates that there are flammable compounds in excess of 10 percent of the Lower Explosive Limit (LEL). The monitoring device will be intrinsically safe for flammable atmosphere or explosion proof. If hot work must be performed in a confined space, a hot work permit must first be completed. Cutting gas cylinders and welding machines will not be taken into confined space. OHM personnel will not enter any confined space until flammable vapor concentrations are below 10 percent LEL. If there is any detection of flammable vapors the Regional Health and Safety Director must approve the entry.

9.3 Oxygen Requirement. Initial monitoring for oxygen shall be conducted from outside the space. The oxygen concentration for entry must not be lower than 19.5, and not higher than 23.5 percent for confined space entry without supplied air respirators. If elevated (here defined as greater than 22 percent) oxygen levels are detected, the confined space must be ventilated prior to any "hot work". Any

oxygen reading above or below 20.5 percent will be reported to the Regional Health and Safety Director or designee before further entry is attempted. No entry will be allowed when the oxygen concentration is less than 19.5 percent which constitutes an oxygen deficient condition without the approval of the Regional Health and Safety Director.

9.4 Toxic Atmospheres. Initial monitoring for toxics shall be conducted from outside the space. Personnel will be provided with, and will be required to properly use protective clothing and respiratory protective equipment when contaminants in the atmosphere reach or exceed the PEL. The personal protective equipment selected will reduce the potential for exposure to acceptable levels.

No IDLH atmospheres will be entered without regional health and safety approval. The site specific health and safety plan must be reviewed to determine action levels and PEP appropriate for the toxic atmosphere.

9.5 All monitoring equipment will be calibrated before each use and those calibration documented in the equipment records. The calibration record will be kept for a minimum of one year from the date of the measurement.

10.0 LABELING AND POSTING

10.1 Permit must be posted at the confined space.

10.2 Any signs warning of dangers in the work area will be in English and the predominant language of any non-English reading workers.

10.3 All entrances to confined spaces will have appropriate signs posted. The signs should include the following if applicable:

DANGER
Confined Space Entry
Entry by Permit Only

The following statements shall be added where necessary:

Respirator Required for Entry
Lifeline Required for Entry
Hot Work Permitted
or
No Hot Work

10.4 Emergency numbers will be conspicuously posted near the work area or at the telephone nearest the work area.

11.0 SAFETY EQUIPMENT AND PPE

The site safety officer or entry supervisor will determine and list on the confined space permit the necessary safety equipment and PPE. The entry supervisor will ensure that the safety equipment is properly used and is maintained in the proper working condition. These items may include, but are not limited to:

- Eye/face protection
- Head protection
- Foot protection
- Protective clothing
- Hearing protection
- Respiratory protection
- Safety bells/alarms
- Harnesses
- Lifelines
- Wrist Harnesses
- Tripods and winches
- Life jackets
- Fall nets
- Barricades
- Retrieval systems

Retrieval systems must meet the following requirements:

- All retrieval system must meet OSHA requirements
- Each authorized entrant shall use a chest or full-body harness with a retrieval line attached at the center of the entrant's back. The other end of the retrieval line must be attached to a mechanical device or fixed point outside the permit space.
- A mechanical retrieval device must be available for vertical entries more than five feet deep.

12.0 WORK PRACTICES

The following work practices must be followed during any confined space entry:

12.1 Purge and Ventilation. During purge and ventilation procedure, blower controls will be at a safe distance from the confined space. Initial testing is to be conducted prior to purge/ventilation to determine what precautions are necessary. If a flammable atmosphere exists, all electrical equipment must be intrinsically safe or explosion proof. Ventilation equipment must be bonded and grounded. Continuous ventilation will be required when welding or painting in a confined space, or where a toxic atmosphere may form from desorption from walls, or

evaporation of chemicals. Ventilation systems must not prevent egress from the area or interfere with communications.

12.2 Isolation/Lock-out/Tag-out. Each confined space will have isolation procedures specifically developed. The confined space must be completely isolated from all systems by physical disconnect, block and bleed, or blanking and tagging. Electrical system must be de-energized and locked-out. All systems should be checked for stored energy before any entry into confined space is attempted.

12.3 Cleaning. Cleaning procedures will be reviewed and approved by the qualified person. Initial cleaning will be conducted from outside the tank whenever possible to minimize exposures to employees. Cleaning must be accomplished by flushing with water or chemical cleaners. At times the use of a "Butterworth" cleaning head may be required. In any case, gross contamination must be removed before entry is performed.

12.4 Communications. Communications between attendant and entrant(s) must be maintained for the duration of the entry. Maintaining visual contact is the preferred method of communications. A positive means of communication such as voice communication or use of radios is required when line of sight is not feasible. The communication system must be established and agreed upon prior to entry into the confined space; hand signals, if used, must be standardized.

Subcontractor and client personnel must be notified of any work they are doing in the area which can impact the work performed in confined space.

13.0 EQUIPMENT AND TOOLS

All equipment that is used in confined space will be inspected and as a minimum, will meet the following requirements:

- Hand tools will be kept clean and in proper working condition.
- Electric tools, equipment, and low voltage lighting will be intrinsically safe or explosion proof for flammable atmosphere and be equipped with ground fault interrupters (GFCI).
- Extension cords will be industrial quality, 3 wire and 12 gauge as a minimum.
- Cylinders of compressed gas will never be taken into a confined space, with the exception of SCBA tanks or life saving equipment.
- Ladder and scaffolding will meet or exceed OSHA requirements in 29 CFR 1910.25-28.

14.0 PROGRAM REVIEW

- The confined space entry program shall be reviewed at least annually. The program shall be revised as necessary to ensure the safety of personnel performing permit required confined space entries.

- Regional Health and Safety Director or designee shall receive a copy of each confined space permit for review.

PERMIT REQUIRED CONFINED SPACE ENTRY
RESCUE PLAN
PROJECT: _____ NO: _____

In the event of an emergency requiring the rescue of one or more employees engaged in a confined space entry, the procedures outlined in this plan will be followed for _____.
(Identification of confined space)

1.0 PRE-ENTRY PLANNING

The following planning will be conducted before confined space entry.

1.1 Equipment. The following equipment will be used for rescue of employee(s) engaged in the confined space work:

_____ Retrieval System
_____ Lifeline(s)
_____ Harness(es)
_____ Protective Clothing/Equipment
Specify:_____

_____

_____

_____ Communication Equipment
Specify:_____

_____

_____

_____ Other Rescue Equipment
Specify:_____

_____

_____

All rescue equipment will be inspected and determined to be fit for use by the supervisor prior to entry into the confined space.

1.2 Rescue Services (on-site). The following on-site personnel have been trained in rescue procedures and will respond to confined space entry rescues:

_____ _____

_____ _____

1.3 Rescue Services (off-site). In the event of a confined space entry rescue the following off-site rescue services will be notified:

Fire Department: _____
Police Department: _____
Ambulance: _____

1.4 Confined Space Entry Permit/Signs. A completed confined space entry permit must be signed by the site supervisor or site safety office before beginning confined space entry work. All entrances to confined spaces will identify the space as follows:

DANGER
CONFINED SPACE ENTRY
ENTRY BY PERMIT ONLY

2.0 RESCUE PROCEDURES

The following procedures will be followed for confined space entry rescues.

2.1 Attendant. A trained stand-by person (attendant) will be assigned to each confined space with a fully charged SCBA or Airline/Egress unit. The stand-by is to keep lifelines clear, to maintain contact with all workers within the confined space, and to summon help if needed. The stand-by must never enter the confined space unless relieved by rescue assistance. The stand-by may attempt a non-entry rescue by lifeline while waiting for rescue assistance.

2.2 Rescue Equipment. The equipment required to rescue a victim (Section 1.1) must be in-place before the first person enters the confined space. A mechanical device will be in place to retrieve personnel from vertical type permit spaces more than five feet deep.

2.3 Evacuations. The attendant will monitor activities inside and outside the confined space to determine if it is safe to remain in the space and shall order the entrants to evacuate the space under any of the following conditions:

- If the attendant detects a prohibited condition, e.g. unacceptable levels of toxic gases, oxygen, or combustible gases (see Site Safety and Health Plan).
- If the attendant detects a situation outside the space that could endanger the entrants.
- If the attendant cannot fulfill his duties.
- If the attendant detects the behavioral effects of hazardous exposure in the entrants.

2.4 Rescue Procedures. If the confined space entry attendant determines that rescue of entrants is necessary, the following procedures will be followed.

2.4.1 All work activities in and around the confined space will be shut-down.

2.4.2 The confined space attendant will notify the site supervisor by radio or other means of communication that a rescue response is necessary.

2.4.3 The site supervisor will notify the off-site rescue services (Section 1.3) to respond to the site.

2.4.4 The attendant will first attempt to rescue the entrants by use of the retrieval system.

2.4.5 If retrieval by the attendant from outside the confined space is unsuccessful, the attendant must wait for back-up assistance before entering the confined space to attempt rescue.

2.4.6 The site supervisor or attendant will notify the on-site rescue services by radios or other means of communication that a rescue response is necessary.

2.4.7 The attendant will brief all on-site/off-site rescue services of the current conditions and hazards before rescue is attempted. Air monitoring data (LEL/0_2, Toxic Gases) will be updated.

2.4.8 No attempt will be made to proceed with rescue if for any reason this would jeopardize the safety of any rescue personnel or exacerbate the problem. All hazards will be abated (e.g., ventilation of space to remove flammable levels of gases) before rescue is attempted.

2.4.9 When all hazards to rescue personnel have been controlled and the necessary rescue equipment is available, proceed with the rescue.

2.4.10 If an injured entrant is exposed to a hazardous substance, a material safety data sheet will be made available to the medical facility treating the exposed entrant.

3.0 TRAINING

All employees authorized to perform rescue services will receive the following training:

- Each member of the rescue service will be trained to use properly the personal protective equipment and rescue equipment.
- Each member of the rescue service will be trained to perform the assigned rescue duties and know the hazards that may be faced during entry/rescue.
- Each member of the rescue service will practice making permit space rescues before actual rescue attempts.
- Each member of the rescue service will be trained in First Aid and CPR. At least one currently certified member shall be available on-site.

4.0 RESCUE PLAN CERTIFICATION

All rescue personnel shall review this plan and document their understanding of its contents by signature.

NAME	SIGNATURE	DATE

5.0 PLAN APPROVAL

This plan has been completed and approved by the following personnel.

Completed by:_____ Title:_____

Approved by:_____ Title:_____

Date:_____

OHM Remediation Services Corp.
A Subsidiary of OHM Corporation

CONFINED SPACE ENTRY PERMIT

Project No.___ ___ _____ Permit No._____

Good on this Date Only:_____ From:_____a.m./ p.m. To:_____a.m./ p.m.

Location:_____ Purpose of Entry:_____

Workers Authorized to Enter	Attendants	Rescue Personnel
_____	_____	_____
_____	_____	_____
_____	_____	_____

EMPLOYEE PRE-ENTRY BRIEFING

Pre-Entry Briefing Conducted by Entry Supervisor: _____ _____
(Name) (Date)

CONFINED SPACE PREPARATION

1. Is Illumination Adequate?	YES_____	NO_____	
2. Must Electrical Devices be Intrinsically Safe or Explosion Proof?	YES_____	NO_____	
3. Are Non-Sparking Tools Required?	YES_____	NO_____	
4. Are GFCI's In Use?	YES_____	NO_____	
5. Have All Power Cords and Tools Been Visually Inspected?	YES_____	NO_____	N/A_____
6. Fire Extinguisher Available at Entrance.	YES_____	NO_____	TYPE_____
7. Eye Wash/Safety Shower Available.	YES_____	NO_____	N/A_____
8. Is Rescue SCBA Available?	YES_____	NO_____	N/A_____
9. Work Area Isolated with Signs/Barriers?	YES_____	NO_____	N/A_____
10. All Energy Sources Locked/Tagged Out?	YES_____	NO_____	N/A_____
11. All Input Lines Capped/Blinded?	YES_____	NO_____	N/A_____
12. Vessel Contents Drained/Flushed/Neutralized?	YES_____	NO_____	N/A_____
13. Vessel Cleaned/Purged?	YES_____	NO_____	N/A_____
14. Ventilation Provided 30 Minutes Before Entry?	YES_____	NO_____	N/A_____
15. Communication Requirements	VISUAL_____	VOICE_____	RADIO_____
16. Level of Respiratory Protection.	B_____	C_____	D_____
17. Type of Chemical Protective Clothing Required.	TYVEK_____	SARAN_____	ACID_____
18. Type of Glove Material Required.	NITRILE_____	PVC_____	ACID_____

PRE-ENTRY ATMOSPHERIC TESTING

TIMES & READINGS:	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____ppm of (TLV=)	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____ppm of (TLV=)	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____ppm of (TLV=)	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____ppm of (TLV=)	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____ppm of (TLV=)

CONTINUOUS MONITORING REQUIRED: YES NO NOTE: Acceptable: LEL<10%, Oxygen-20.9%

SPECIAL PRECAUTIONS:

EMERGENCY/RESCUE PROCEDURES

1. Is a Site Specific Rescue Plan Required?	YES_____	NO_____
2. Are Personnel Trained for Confined Space Rescue Available?	YES_____	NO_____
3. If NO, Has an Outside Agency Been Notified?	YES_____	NO_____

4. Outside Rescue Agency Name:_____ Phone No._____

ENTRY/EGRESS REQUIREMENTS

1. Are Ladders Required for Entry?	YES_____	NO_____
2. Are Vertical Extraction/Rescue Devices Required?	YES_____	NO_____
3. Is Fall Protection Required?	YES_____	NO_____

OTHER POTENTIAL HAZARDS

1. Noise	YES_____	NO_____	CONTROL_____
2. Heat Stress	YES_____	NO_____	CONTROL_____
3. Cold Stress	YES_____	NO_____	CONTROL_____
4. Biological Agents	YES_____	NO_____	CONTROL_____

SUBCONTRACTOR NOTIFICATION

Contractor Notified of: Permit Conditions _____ Potential Hazards _____ N/A _____

PERMIT AUTHORIZATION

I certify that I have inspected the work area for safety and reviewed all safety precautions recorded on this permit.

Entry Supervisor Authorization (Signature): _____ Employee #_____

Distribution: Original to: Project file Copy to: Regional Health and Safety Director for review

1.0 OBJECTIVE

This procedure shall be used by OHM Remediation Services Corp. (OHM) personnel to ensure that the machine or equipment being worked on is isolated from all potential hazardous energy sources, and locked out or tagged out before an employee performs any servicing or maintenance activity where that unexpected energization, start-up or release of energy could cause an injury. Energy sources can be electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

2.0 PURPOSE

This procedure establishes the minimum safety requirements to ensure the proper deactivation of movable, electrically energized, pressurized equipment and systems, and systems containing hazardous materials prior to repairing, cleaning, oiling, adjusting, or similar work. This procedure complies with the requirements in the OSHA standard 29 CFR 1910.147--The Control of Hazardous Energy and 29 CFR 1910.333 Selection and Use of Work Practices.

3.0 REQUIREMENTS

This procedure applies to all equipment that receives energy from electrical power, hydraulic fluid under pressure, compressed air, steam, energy stored in springs, potential energy from suspended parts, or any other source that may cause unexpected movement when it is necessary to perform work on that system. It also applies to similar functions performed on systems containing hazardous materials. Every OHM project which has equipment requiring maintenance must implement a lockout/tagout try program.

4.0 DEFINITIONS

4.1 Lockout. The placement of a lockout device on an energy isolating device, in accordance with this procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed. The lockout device can be key operated or a combination device.

4.2 Tagout. The placement of a tagout device on an energy isolating device, in accordance with this procedure, to indicate that the energy isolating device and the

equipment being controlled may not be operated until the tagout device is removed by the authorized person who originally placed the tagout device in position.

4.3 Authorized Employee. A person who locks or implements a tagout system procedure on machines or equipment to perform the servicing or maintenance on that machine or equipment.

4.4 Affected Employee. An employee whose job requires him to operate equipment which is locked out or whose job places him near a piece of equipment which is locked out.

5.0 PROGRAM ELEMENTS

Prior to initiating any repairs, modifications and/or adjustments to operating equipment, these steps will be followed.

5.1 Notification. The immediate supervisor with jurisdiction over the equipment and all affected employees will be notified that the energy sources are to be deactivated.

5.2 Identify Energy Sources. All sources of power that must be locked out, blocked or released will be identified by the immediate supervisor and the employee who will work on the equipment.

5.3 Lockout Energy Sources. In order to ensure that the equipment cannot be re-energized while maintenance activities are performed, the employee will lockout or blank out all potential energy sources. (The employees will either be assigned individually keyed padlocks or the project will have a supply of individually keyed padlocks for employee use.) If more than one employee is assigned to work on the equipment, a multi-lockout hasp will be used so that all employees working on the equipment can apply their locks and ensure their safety.

5.4 Tag Energy Sources. A tagout device will be affixed to all components or systems de-energized to indicate that lockout has been performed.

5.5 Try Energy Sources. Prior to performing any work activities, the employee will operate the start and stop controls on the equipment to ensure that the equipment has been properly deactivated. After the test, the equipment must be in neutral or off.

5.6 Remove Locks and Tags After Completing Work. After the servicing and/or maintenance is complete and the equipment is ready for normal operations, check the area around the machine or equipment. After all tools have been removed from the machine or equipment, guards have been reinstalled, remove all lockout or

tagout devices. Operate the energy isolating devices to restore energy to the machine or equipment.

6.0 SPECIAL CONDITIONS

6.1 Testing Equipment While Locked Out/Tagged Out. During certain operations it may be necessary to energize the equipment for a short period of time. Employees in the immediate area will be notified and directed to stay clear of the equipment. If the operation is to be deactivated again, the employee should repeat steps 5.3 to 5.5 of this procedure before work resumes.

6.2 Long Term Equipment Lockout. In some instances work will carry over to another shift. The maintenance supervisor shall affix his lock to the equipment to ensure that it is not energized during the transition. During subsequent shift operations, each employee will ensure that steps 5.2 to 5.5 are complete before work resumes on the equipment.

6.3 Prohibition on Removing Locks/Tags. If the work is completed and a lock remains on the equipment, it shall not be removed until the employee responsible for the lock is found or the supervisor of the employee investigates and ascertains that the equipment is safe to operate. Unauthorized removal of a lock will subject the violator to disciplinary action up to dismissal.

7.0 CORD AND PLUG EXCEPTIONS TO LOCKOUT/TAGOUT/TRY

There is no requirement to perform lockout/tagout/try on electrical installations where the unexpected energization of the equipment can be controlled by unplugging the cord from the energy source. The unplugged cord must remain under the exclusive control of the person performing the repair or maintenance.

8.0 TRAINING

Initial and annual training will be provided affected employees to ensure that the purpose and function of the energy control program are understood and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees. The training shall include the following areas.

8.1 Authorized Employee. Each authorized employee shall receive training in the recognition of applicable energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation.

8.2 Affected Employee. Each affected employee shall be instructed in the purpose and use of the energy control procedure.

8.3 Other Employees. All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out.

8.4 Tag Usage. When tags are used, employees shall be informed that these are only warning devices and do not completely secure an energy source as would a lock. Tags are not to be removed without authorization of the authorized person.

8.5 Initial and Refresher Training. Initial training will be performed in the 40-hour HAZWOPER course. Site specific training will be provided during the initial startup of a site's operational process requiring this energy control procedure. Retraining will occur whenever a new or revised control method and procedure is introduced. Periodically, this program will be reviewed in the 8-hour HAZWOPER refresher training and during site safety meetings.

9.0 PERIODIC INSPECTION

Corporate health and safety will conduct an annual audit of the energy control program to ensure that the requirements of these procedures are being followed.

1.0 OBJECTIVE

OHM Remediation Services Corp. (OHM) will control the hazards posed by open excavation through strict compliance with this procedure and the provisions of the excavation permit.

2.0 REGULATORY REQUIREMENTS

This procedure will follow the guidelines of 29 CFP. 1926, Subpart P-Excavations. In the event of a conflict between these referenced stand.. .s and specific client requirements, the more stringent will prevail.

3.0 APPLICATION

Most sections of this procedure apply to all excavations, including trenches made in the earth's surface. The competent person must decide specifically which sections apply and how all hazards presented by the excavation are being controlled.

4.0 EXCAVATION COMPETENT PERSON

Before any excavation activity begins, OHM will designate an excavation competent person who will oversee all activity in and around the excavation. This procedure applies regardless of whether personnel will enter a trench or an excavation. The competent person will determine the safety measures needed at all OHM projects which involve excavation.

4.1 Competent Person Responsibilities. The competent person is defined as one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Additionally the competent person must be on-site during any excavation activity for which he is responsible. The competent person must also perform or be capable of performing the following tasks:

- Application of 29 CFR 1926 Subpart P to the excavation activity;
- Daily inspections of the excavation including an inspection after a hazard increasing event such as a thunderstorm;
- Classifying soil at the excavation;

- Determining proper protective requirements;
- Determining the need for excavation de-watering operations and monitoring all de-watering activity;
- Complete the OHM excavation permit.

5.0 SOIL CLASSIFICATION

Appendix A of 29 CFR 1926 Subpart P outlines the minimum requirements for the classification of soil at OHM project sites. Upon determining the soil type, the competent person must then determine the protection system which will be used to protect any employee or subcontractor who may enter the excavation.

Note: The competent person has the option of following the requirements in section 5 of this procedure to determine soil type or assuming the soil to be Type C and following the protection requirements for Type C soil.

5.1 OSHA Soil Classifications. The following are the soil classifications recognized by OSHA in 29 CFR 1926 Subpart P. The competent person must classify the soil based on the manual and visual tests conducted at the excavation site.

5.1.1 Type A soil means:

Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

- The soil is fissured; or
- The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or
- The soil has been previously disturbed; or
- The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or
- The material is subjected to other factors that would require it to be classified as a less stable material.

5.1.2 Type B soil means:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or
- Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.
- Previously disturbed soils except those which would otherwise be classed by Type C soil.
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration; or
- Dry rock that is not stable; or
- Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

5.1.3 Type C means:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or
- Granular soils including gravel, sand, and loamy sand; or
- Submerged soil or soil from which water is freely seeping; or
- Submerged rock that is not stable; or
- Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

5.2 Soil Classification Requirements. **The competent person must be able to classify each soil and rock deposit associated with a trench or excavation as to stable rock, Type A, Type B, or Type C soil.**

5.3 Basis of Classification. **The classification of soil type must be accomplished by at least one visual and one manual test. There are several allowable tests that can be used to determine soil**

type. This testing must be done by the competent person and performed prior to and during the job. Refer to Appendix A of Subpart P for manual and visual test procedures.

5.4 Reclassification. If, after the soil has been classified, conditions change, the competent person is responsible for evaluating the situation and, if necessary, change the classification.

5.5 OSHA Soil Types

5.5.1 Stable Rock

Stable rock is not one of the texture classes. However, it is one of the OSHA classifications of soil. Stable rock is solid mineral material which can be excavated; and the sides stand vertical and remain stable and vertical throughout construction. Coral is not considered stable rock.

5.5.2 Cemented Soil

Cemented soils are soils that are held together by a chemical agent such as calcium carbonate. Examples of cemented soils would include caliche and hardpan. Cemented soils are classified as Type A soils with an unconfined compressive strength greater than 1.5 tsf.

5.5.3 Cohesive Soil

Cohesive soils are basically fine grained soils. Cohesive soils range from clay through clay loam. A cohesive soil will stand unsupported when excavated and is plastic when moist. That is, cohesive soil can be rolled into a ribbon. A cohesive soil is hard to break up when it is dry. Cohesive soils are classified as Type A soils with an unconfined compressive strength greater than 1.5 tsf.

5.5.4 Granular Soil

Granular soils are composed of coarse grained material that have very little cohesive strength. Granular soils include loamy sand, sand and gravel. A soil is classified as granular if more than 65% of the grains are distinguishable with the unaided eye. Granular soils, when excavated will not stand and the walls of the excavation can crumble easily. Some granular soils will exhibit cohesion when wet, but when dry will fall apart. This type of soil is especially dangerous when found at a construction site because the walls of a trench appear to stand with no support, however, when they dry they could crumble and fall into the trench bottom. Granular soils are classified as soil Type B or C, and may require the highest degree of protection. Type C soils

would have an unconfined compressive strength of less than 0.5 tsf.

5.4.5 Granular Cohesionless

Soils that range from silt through sandy loam or are composed of angular particles are said to be granular cohesionless soils. These are difficult soils to work with because the group ranges from a very stable Type B to the unstable Type C soil. Course angular granular soils are classified as Type B soils and have an unconfined compressive strength range from 0.5 tsf to 1.5 tsf.

5.5.6 Layered Soil System

A layered soils system is composed of two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered. The layers may lay on a horizontal plane or be sloped. When they are sloped into the excavation they represent a collapse hazard to the trench wall. A slope greater than 4H:1V would classify any soil as Type C. Sloped layers less than 4H:1V would be classified as Type B soil. No layered system can be Type A soil.

6.0 SELECTION OF PROTECTIVE SYSTEMS

29 CFR 1926.652 requires that each employee in an excavation be protected from cave-ins by an adequate protective system unless excavations are made in stable rock or are less than five feet in depth and examination by the competent person provides no indication of potential cave-in.

Additionally, whichever protective system is chosen must have the capacity to resist without failure all loads that are intended or could reasonably be applied to the system.

6.1 Design of Sloping and Benching Systems. The slopes and configurations of sloping and benching systems must be determined by the competent person in accordance with the requirements of 29 CFR 1926(b)(1) through (b)(4) as well as 29 CFR 1926 Subpart P-Appendix B.

After the competent person has determined the soil type based on one visual and one manual test, he may design the sloping and benching system for excavations less than 20 feet deep using the following table.

MAXIMUM ALLOWABLE SLOPES
BASED ON SOIL CLASSIFICATION

Soil Line	Maximum Allowable Slope for Excavations Less Than 20 Feet Deep
Stable Rock	Vertical Sides (90°)
Type A Soil	3/4H:1V (53°)
Type B Soil	1H:1V (45°)
Type C Soil	1 1/2H:1V (34°)

Note: Sloping and benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.

6.2 Design of support systems, shield systems and other protective systems. If the competent person determines that personnel will be protected from cave-ins by a protective system other than sloping and benching, the design of the support systems, shield systems, and other protective systems be based on the conditions at the project site and data provided by an OHM or subcontracted registered professional engineer or from tabulated data provided by the manufacturers of the protective systems.

The design of the protective system must be in accordance with the requirements of 29 CFR 1926.652(c)(1) through (c)(4) and 29 CFR 1926 Subpart P-Appendices C, D, E respectively.

In large/deep excavations where traditional shoring and sloping are not practical, alternate protective measures may be implemented to protect personnel in the excavation. Additionally, the top of the excavation must be protected with stop logs, earthen berms, or other types of protective barriers which will keep pedestrians and vehicles from approaching the edge of the excavation. Any deviations from traditional protective systems must be approved by the regional health and safety director.

7.0 EXCAVATION SAFETY REQUIREMENTS

Excavation activity exposes OHM personnel and subcontractors to many dangers which, if not recognized, can cause death or serious injury.

7.1 Surface Hazards. The excavation area should be inspected and any debris, structures, and surface protrusions that are located so as to create a hazard to employees shall be removed as necessary to safeguard employees. Any buildings on the site should be evaluated for structural integrity and supported if necessary.

7.2 Underground Installations/Utility Locations. Before conducting any excavation work, the location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined. This requirement is in addition to the requirements in the procedure titled Buried Utility Location and Associated Subsurface Field Activity.

Utility companies or the state utility protection service shall be contacted at least two working days prior to excavation activities to be advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation.

OHM personnel and sub-contractors should be careful to protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations.

If the markings of utility locations are destroyed or removed before excavation commences or is completed, the OHM competent person must notify the utility company or utility protection service to inform them that the markings have been destroyed and need replaced. Normally, it will take two working days advance notice for the utility protection service to remark the locations.

OHM equipment operators shall maintain at least 3-feet clearance between any underground utility and the cutting edge or point of powered equipment. When excavating with powered equipment within 36 inches of the markings of underground facilities, personnel should conduct the excavation in a careful and prudent manner, excavating by hand to determine the precise location of the facility/utility and to prevent damage.

While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

7.3 Access and Egress. OHM will provide a safe means of access to and egress from all excavations. The following are considered acceptable methods of entering and exiting excavations.

7.3.1 Structural Ramps

Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by the competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design or structural engineering, and shall be constructed in accordance with the design.

Structural members used for ramps and runways shall be of uniform thickness. Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping. Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

7.3.2 Means of Egress from Trench Excavations

A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet or more in depth so as to require no more than 25 feet of lateral travel for employees. Any ramp used for employee egress must be sloped at an angle which would allow employees to walk upright out of the excavation.

7.4 Exposure to Vehicular Traffic. OHM and subcontract personnel who may be exposed to vehicular traffic both on projects and public highways shall be provided with and shall wear warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

7.5 Exposure to Falling Loads. No OHM employee or subcontractor shall be permitted underneath loads handled by lifting or digging equipment. Personnel must stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Truck drivers may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped with over-cab protective structures, in accordance with 29 CFR 1926.601(b)(6), to provide adequate protection for the operator from falling objects during loading and unloading operations.

7.6 Warning System for Mobile Equipment. When heavy equipment and trucks operate adjacent to an excavation or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals or stop logs. If possible, the approach grade should be away from the excavation.

7.7 Hazardous Atmospheres. Because there is a likelihood that excavation activity at OHM project sites involve hazardous atmospheres, the OHM competent person must ensure that acceptable atmospheric conditions exist.

The OHM competent person or his designee shall perform direct reading atmospheric monitoring in all excavations of any depth into which OHM personnel or subcontractors must enter where a hazardous atmosphere exists or could reasonably be expected to exist. If there are any questions, the competent person should treat the excavation like a confined space and follow SOP 6-1, Confined Space Entry.

Based on the competent person's visual observation of the excavation and the soil and/or fill material, atmospheric monitoring may not be necessary. However, if conditions change, the competent person must re-evaluate whether atmospheric monitoring is required.

7.7.1 Atmospheric Monitoring

When atmospheric monitoring is required, the site safety officer must check the atmosphere for the following in the order shown:

- Oxygen Content--acceptable conditions: 21%
- Flammable Conditions--acceptable conditions: less than 10% LEL
- Toxic Atmospheres--based on established PEL or TLV

NOTE: Any oxygen reading other than 21% must be investigated prior to employees entering the excavation.

7.7.2 Ventilation

Adequate precautions shall be taken, for example providing ventilation to prevent employee exposure to harmful atmospheres. When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, direct reading air monitoring shall be conducted periodically as determined by the competent person or SSO to ensure that the atmosphere remains safe.

7.7.3 Emergency Rescue Equipment

Emergency rescue equipment, such as self-contained breathing apparatus (SCBA), a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment shall be kept close to the excavation for use in an emergency.

7.8 Protection From Hazards Associated With Water Accumulation. Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams); diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to run-off from heavy rains will require an inspection by a competent person.

7.9 Stability of Adjacent Structures. Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

- A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.
- A support system, such as underpinning, designed by a registered professional engineer is provided to ensure the safety of employees and the stability of the structure; or
- The excavation is in stable rock; or
- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or
- If a support system has been put in place to stabilize an adjacent structure, it must be inspected for movement and structural integrity daily by the competent person.
- Sidewalks, pavements, and other structures shall not be undermined unless a

support system or another method of protection is provided to protect employees from the possible collapse of such structures.

7.10 Protection of Employees From Loose Rock or Soil. Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the excavation face to stop and contain falling material; or other means that provide equivalent protection.

Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

7.11 Inspections. Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are required when employee exposure can be reasonably anticipated. An Excavation/Trenching Permit must be completed by the competent person to document the inspections. Canceled excavation/trenching permits should be placed in the project file upon completion of the project.

Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

7.12 Fall Protection. Where employees or equipment are required or permitted to cross over excavations; walkways, or bridges with standard guardrails shall be provided.

Since open excavations are often an attractive nuisance to the public, adequate barrier for physical protection shall be provided at all excavations. Remotely located excavations may require special protection including, but not limited to, highly visible snow fence, concrete "jersey" barriers, chain link fence and flashing warning light. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be covered or backfilled.

8.0 PERMITS

An Excavation/Trenching Permit must be completed by the competent person each day that an excavation is open and possesses safety hazards to personnel who work around or may have to enter the excavation.

If a project site has several excavations open, and active, each excavation must have its own permit completed. Conversely, a project site which has an open excavation that is not active does not require a daily Excavation/Trenching Permit if the competent person determines that the excavation is NOT posing hazards to site personnel or the public, and is adequately guarded. The competent person must determine what type of inspections and documentation will be required.

The Excavation/Trenching Permit should be retained in the project file and will serve as a record of daily excavation inspection.

OHM Remediation Services Corp.
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EXCAVATION/TRENCHING PERMIT

Project Name:	
Project Location:	Project Number:
Name of Competent Person:	Permit Good on This Date Only:

EMPLOYEE TRAINING AND PRE-EXCAVATION BRIEFING

1. Does this job require special training: YES____ NO____
2. Safe excavation and rescue training conducted on: _____DATE
3. Mandatory pre-excavation briefing conducted on: _____DATE

SOIL CLASSIFICATION

1. Will the competent person classify the soil based on its properties and site conditions? YES____ NO____

   If yes, proceed to 2-6 of this section. If no, then soil is assumed to be Type C and the competent person will apply the requirements for Type C protective systems.

2. Based on visual observation, which best describes the soil in this excavation?
   □ Stable Rock □ Cemented Soil □ Cohesive Soil □ Granular Soil
   □ Granular Cohesionless □Layered System

3. Based on visual observation, which best describes the moisture condition of the soil?
   □ Dry Soil □ Moist Soil □ Wet Soil □ Saturated Soil

4. Is a pocket penetrometer available for use on site? YES____ NO____ N/A_____

   If yes, what is the average tons per square foot of the soil in this excavation?_____tsf

5. Based on at least one manual test, what classification is the soil in this excavation?
   □ Stable Rock □ Type A Soil □ Type B Soil □ Type C Soil

6. What manual test was used to determine the soil type?
   □ Plasticity □ Dry Strength □Thumb Penetration □Other_____

ELECTRICAL SAFETY

1. Are all electrical devices grounded and/or GFCI protected? YES____ NO____ N/A_____

SURFACE ENCUMBRANCES

1. Have all surface encumbrances that are located so as to create a hazard to employees been removed or supported, as necessary, to safeguard employees? YES____ NO____ N/A_____

UNDERGROUND INSTALLATIONS

1. Have the estimated locations of all underground installations been determined prior to excavation? YES____ NO____ N/A_____
2. Have utility companies been contacted and advised of proposed work? YES____ NO____ N/A_____
3. If underground installations are exposed, are they protected, supported or removed while excavation is open? YES____ NO____ N/A_____

EXCAVATION/TRENCHING PERMIT
(continued)

ACCESS AND EGRESS

1. Are stairways, ladders, or ramps provided every 25 feet? YES____ NO____ N/A_____
2. Are structural ramps that are used for access and egress of equipment and/or personnel designed by a competent person qualified in structural design and constructed in accordance with the design? YES____ NO____ N/A_____

EXPOSURE TO VEHICULAR TRAFFIC

1. Are personnel exposed to public or project vehicular traffic wearing reflectorized or high visibility vests? YES____ NO____ N/A_____

EXPOSURE TO FALLING LOADS

1. Are employees prohibited from standing underneath loads handled by lifting or digging equipment? YES____ NO____ N/A_____

WARNING SYSTEMS FOR MOBILE EQUIPMENT

1. Are warning systems utilized when mobile equipment is operated adjacent to or at the edge of an excavation? YES____ NO____ N/A_____

If yes, which type is being used?
□ Hand Signals □Stop Logs □ Earthen Berm □ Other_____

TESTING FOR HAZARDOUS ATMOSPHERES

1. Are the atmospheric hazards that can be reasonably expected to exist in excavations greater than 4 feet deep tested and controlled? YES____ NO____ N/A_____
2. Is testing conducted as often as necessary to ensure safety or personnel? YES____ NO____ N/A_____

TIMES & READINGS:	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____PPM of _____	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____PPM of _____	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____PPM of _____	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____PPM of _____	Time:_____ LEL:_____% Oxygen:_____% Toxic:_____PPM of _____
SPECIAL PRECAUTIONS:					

EMERGENCY RESCUE EQUIPMENT

1. Is emergency rescue equipment such as SCBA, safety harness and line, or basket stretcher readily available and attended when hazardous atmospheric conditions exist? YES____ NO____ N/A_____

PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

1. Is water being controlled or prevented from accumulating in excavation by the use of water removal equipment? YES____ NO____ N/A_____
2. Is water control equipment operation being monitored by a competent person? YES____ NO____ N/A_____

EXCAVATION/TRENCHING PERMIT
(continued)

STABILITY OF ADJACENT STRUCTURES

1.	Are support systems such as shoring, bracing, or underpinning provided to ensure stability of adjoining structures (i.e., buildings, walls) endangered by excavation activities?	YES____	NO____	N/A_____
2.	Has the support system been designed by a registered professional engineer?	YES____	NO____	N/A_____

PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

1.	Are employees protected from excavated or other material and equipment by placing this material a minimum of two (2) feet from the edge of excavations or by the use of retaining devices?	YES____	NO____	N/A_____

INSPECTIONS

1.	Are daily inspections of excavations where employee exposure can be reasonably anticipated being done by the competent person?	YES____	NO____	N/A_____
2.	Are inspections being performed by a competent person after every rainstorm or other hazard increasing occurrence?	YES____	NO____	N/A_____
3.	Are employees removed from the excavation if the competent person finds evidence at any time of a situation that could result in a possible cave-in, protective system failure, hazardous atmosphere or other hazardous condition?	YES____	NO____	N/A_____

FALL PROTECTION

1.	Are standard guardrails provided on walkways and bridges that cross over excavations?	YES____	NO____	N/A_____
2.	Are all remotely located excavations adequately barricaded or covered?	YES____	NO____	N/A_____

SHORING AND OTHER PROTECTIVE SYSTEM

1.	Has all shoring and/or other protective system been designed by a registered professional engineer or accompanied by tabulated data from the manufacturer?	YES____	NO____	N/A_____
2.	Is shoring and other protective system checked/measured each day to detect movement and possible failure?	YES____	NO____	N/A_____

I have inspected the excavation described in this permit:

_____ _____

(Signature of Competent Person) (Date)

Copy: Project file

1.0 OBJECTIVE

OHM Remediation Services Corp. (OHM) personnel who have been trained in the proper set-up, use, and care of high pressure washers will be authorized to operate this equipment.

2.0 PURPOSE

This procedure describes requirements for the safe operation of the high-pressure washer.

3.0 PERSONAL PROTECTIVE EQUIPMENT

The following equipment will be worn by operators and assistants:

- Safety shoes or boots
- Metal foot and shin guards
- Eye protection (goggles and face shield)
- Hard hat
- Heavy duty PVC rain suit or equivalent
- Heavy chemical resistant gloves
- Hearing protection

4.0 OPERATION PROCEDURE

- The operator should review the operating manual for the unit and follow all instructions and precautions.
- Before use, the operator should inspect the pressure washer, the hoses, and the lance to ensure that all equipment is in acceptable operating condition. The operator should carefully inspect the relief device to ensure proper functioning.
- No modifications can be made to the equipment except those authorized by the manufacturer.

- Only trained, authorized personnel will operate the high-pressure washer.
- The lance must always be pointed at the work area and never at the operator or other personnel.
- The operator must maintain good footing.
- The operator must have an assistant to aid in moving the hose to different areas and backing up the operator. The assistant must remain in back of the operator.
- Non-operators must remain a safe distance from the operator. The distance must be a minimum of 25 feet.
- The operating pressure should never exceed that which is necessary to complete the job.
- No unauthorized attachment may be made to the unit. (The trigger should never be tied down.)
- The operator should be changed at frequent intervals to avoid fatigue (at least hourly).
- Equipment should be cleaned often to avoid oil or dirt build-up, especially around the trigger and guard area.
- Always increase pressure slowly to inspect for leaks. All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- An assistant should always be standing by at the pressure generator to shut down the equipment and monitor the pressure.
- All users must be trained in emergency shut down procedures and general equipment maintenance.
- All lances must be made of seamless stainless steel. Do not use carbon steel which can corrode and result in weakening of the lance.
- DO NOT MODIFY THE LANCE. The lance barrel, from trigger block to the tip, should not be less than 48 inches as recommended by manufacturers of hydroblasting equipment. (This is to prevent the operator from inadvertently directing the lance at himself.)

- A serious risk of infection and further complications is possible from a hydroblasting laceration. If an injection injury is suspected, the treating physician should be informed so he/she can request a surgeon who specializes in injection injuries. The specialist may have to perform surgery on the affected body part in order to remove the material (oil, particles) that was injected directly through the skin.

1. OBJECTIVE

OHM Remediation Services Corp. (OHM) will qualify personnel who operate heavy equipment at field project sites and OHM facilities.

2. PURPOSE

This procedure outlines the minimum requirements for the field qualification of OHM personnel who may have the desire, or are required to operate OHM owned and rented heavy equipment. This procedure applies to the following pieces of heavy equipment:

- Rubber tire backhoes
- Tracked and rubber tire excavators
- Bulldozers
- Vacuum trucks
- Off-road dump trucks (straight body and articulating)
- Compactors
- Water trucks (straight body and articulating)
- Bobcats
- Tracked and rubber tire loaders
- Skid and truck mounted vacuum unit

This procedure does not allow for the field certification of personnel operating sit-down counter balanced (warehouse) and rough terrain forklifts and boom trucks or cranes. The operation of these pieces of equipment are regulated by OSHA and require more extensive training and certification. Refer to SOP 7-4, Fork Lifts, and SOP 7-2, Cranes and Hoisting, for specific operator requirements.

3. GENERAL REQUIREMENTS

No OHM personnel may become field qualified to operate a piece of heavy equipment until they have received instruction on the inspection, proper use, safety features, and maintenance requirements of the specific piece and/or type of heavy equipment which they wish to operate. This includes all pieces of equipment listed in section two of this procedure. For the purposes of this procedure, the following terms will be used for consistency:

- Supervisor - OHM representative who has the authority to field qualify OHM employees on various pieces of heavy equipment.

- Operator - OHM employee with a job title other than equipment operator who wishes to or is required to operate OHM owned or rented heavy equipment.

3.1 Personnel Who May Field Qualify Personnel to Operate Equipment. The project site supervisor or his/her designee (i.e., Senior Equipment Operator) will be the person responsible for the field qualification of OHM employees who wish to or are required to operate heavy equipment. The site supervisor is required to complete the following steps when qualifying personnel to operate equipment.

3.1.1 Determine if the potential operator is physically capable of operating the equipment safely.

3.1.2 Determine if the potential operator is willing to accept the responsibility which accompanies the operation of heavy equipment.

3.1.3 Provide instruction on the pre-startup as well as periodic inspection of the equipment which is required to ensure that the equipment is operating safely and within normal parameters.

3.1.4 Provide instruction on the safe operation of the equipment including all safety features built into the equipment. This should include as a minimum the following items:

- Safe start-up
- Use of safety disabling devices
- Use and application of seat belt/harnesses
- Location and inspection of horns, lights, and backup alarm
- Normal operating parameters
- Function and normal appearance of all gauges and meters
- Equipment travel procedures
- Approximate height and weight, including safe clearance heights
- Safe procedure for loading and unloading of equipment
- Normal shut-down procedures
- Emergency shut-down procedures
- Safe parking or storage of equipment

3.1.5 Provide instruction on the proper maintenance of the equipment required to keep it within safe and normal operating condition. This instruction should include, at a minimum, the following items:

- Location of the vital fluid check and fill ports.
- Location of all lubrication points and procedure for proper lubrication including frequency.
- Cleaning and housekeeping requirements (i.e., procedure and frequency of track cleaning)
- Other equipment specific maintenance procedures

3.1.6 Observe the potential operator perform safe operations with the piece of heavy equipment including all tasks which are required to make the equipment operational including such items as traveling with the equipment and loading and unloading it into its travel trailer.

3.1.7 During the qualification of the potential operator, the supervisor should use the "Heavy Equipment Field Operator Qualification" form as a checklist to ensure that all points have been covered with the operator.

3.1.8 Once the supervisor has observed the potential operator demonstrate the safe operation of the specific piece of equipment, he/she must sign the Qualification form and forward it to Corporate Health and Safety for inclusion into the employee's training file.

3.2 Potential Operator Requirements. OHM employees who wish to or are required to operate heavy equipment must meet the following minimum qualifications.

3.2.1 Possess the physical capability (i.e., adequate vision and hearing) to operate the equipment safety.

3.2.2 Possess a valid and current drivers license.

3.2.3 Experienced no "At Fault" vehicle accidents with OHM owned or rented vehicles within the last 12 months.

OHM Remediation Services Corp.
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Field Qualification of Personnel To Operate Heavy Equipment

Employee Name:_____

Division:_____

Employee No.:_____

Name of Equipment on which employee wishes to Qualify:_____

Inspection and Maintenance:

- ☐ Review location of all vital [illegible]d reservoirs
- ☐ Review location of all lubrication points
- ☐ Review daily inspection checklist
- ☐ Review periodic maintenance requirements (e.g., oil change schedules)

Safety Devices and Start-up:

- ☐ Location and function of safety disabling device (if equipped)
- ☐ Location of fire extinguisher
- ☐ Location and function of back-up alarms
- ☐ Location and function of horn
- ☐ Location and function of lights
- ☐ Location and correct application of seat belts/safety harnesses
- ☐ Proper start-up sequence
- ☐ Function and appearance of all gauges and meters

Operation:

- ☐ Smooth and safe equipment travel procedures
- ☐ Smooth and safe operation
- ☐ Review weight and weight of equipment
- ☐ Demonstration of safe loading and binding of equipment for travel
- ☐ Normal shut-down procedures
- ☐ Emergency shut-down procedures
- ☐ Demonstration of safe parking or storage of equipment

Comments:_____

_____

Operator Acknowledgement:

I have reviewed and understand all of the information listed above. I also understand that as an operator of the equipment, I am responsible for daily inspection and maintenance as well as the safe and efficient operation of the equipment.

_____	_____	_____
Operator Signature	Employee No.	Date

Supervisor/Senior Equipment Operator Acknowledgement: I have reviewed all of the information listed above as well as any other safety or operational features of this equipment with the above signed. He/She has demonstrated competenance in operating this piece of equipment safely.

_____	_____	_____
Supervisor/Senior Equipment Operator Signature	Employee No.	Date

Distribution:
Original - Employee Training File (Corporate Health and Safety)
Copy - Employee
Regional Training File

Approved Department Head Regional Vice President	OHM Remediation Services Corp. A Subsidiary of OHM Corporation *Southern Region* STANDARD OPERATING PROCEDURES	Effective Date October 23, 1995 Page 1 of 2	Number SOP-SHS-01 Revision 0

SUBJECT: BURIED UTILITY LOCATION AND ASSOCIATED SUBSURFACE FIELD ACTIVITIES

1.0 PURPOSE

This Standard Operating Procedure (SOP) defines the responsibilities and procedures for utility identification, location and associated subsurface field activities at project sites.

2.0 SCOPE

This procedure applies to all subsurface field activities performed by OHM, including excavation and subsurface field investigations involving mechanical equipment (i.e., drilling) at project sites.

3.0 REQUIREMENTS

All subsurface field activities performed by OHM require buried utilities to be identified and located prior to performing subsurface field activities at the project site. Buried utilities required to be identified and located include: pressurized utility lines, telephone and electrical cable. Once the buried utility is identified and located, all associated subsurface field activities must be performed in accordance with this SOP. Any deviations from these procedures must be approved by the Regional Health and Safety Director.

4.0 RESPONSIBILITIES

4.1 Project Manager

The project manager is responsible for allocating adequate resources to implement this SOP, for coordinating buried utility location procedures with the utility and for directing the site supervisor to implement this procedure at the project site. The project manager is also responsible for verifying that required documentation be maintained in the Site Safety Plan and project files.

4.2 Site Supervisor

The site supervisor is responsible for implementing this procedure at the project site. The site supervisor is also responsible for documenting the utility locations on the site map and listing the utility emergency contacts in the Site Safety Plan.

5.0 PROCEDURE

5.1 Buried Utility Location

1. Contact the local utility company or utility service locator in your geographic area and identify which underground utilities (i.e., electrical, gas, water, telephone, cable) need to be identified in your proposed excavation/drilling area.

2. Inform the utility company or utility service locator with the exact location of your proposed excavation/drilling area and depth. Provide suitable plans, drawings, and/or maps of the proposed excavation/drilling area and depth. Provide the utility company or locator service a realistic over-estimate of the area to be cleared of underground utilities when the excavation area or depth is in question. Obtain "as built" drawings from clients showing utility locations on-site when available. In some cases, ElectroMagnetic (EM) or Ground Penetrating Radar (GPR) surveys of the proposed work area may be appropriate when little or no information is available on the proposed excavation /drilling area at abandoned industrial facilities.

3. Where feasible, arrange for a responsible OHM person, familiar with proposed excavation/drilling activities, to meet each utility representative or locator service at the site prior to site mobilization.

4. At a minimum, follow up with each utility company or locator service that was provided with suitable plans, drawings or maps and confirm that the proposed excavation/drilling area to be cleared is correctly interpreted by the utility company or locator service.

5.0 PROCEDURE – CONTINUED

5. Once buried utilities have been identified by the utility company or locator service, document their location on the site map and attach to the site safety plan.

6. List the names and telephone numbers of each utility company and locator service representative used, attach to the site safety plan and use during site emergencies.

5.2 *Associated Subsurface Field Activities*

1. All identified buried utilities within 15 feet of subsurface field activities (i.e., excavations, drilling) will be manually exposed by hand excavation, hand augering or air knife techniques to verify the utility location.

2. For excavation activities adjacent to the utilities, hand excavation is required at 15 feet intervals along the utility length until the identified utility location is 15 feet outside the excavation area.

3. Hand excavations are required to expose 2 feet on either side of a low pressure line or telephone cable.

4. Hand excavations are required to expose 4 feet on either side of a high pressure line or electrical cable.

5. Heavy equipment/excavation operations must be prohibited 2 feet from a low pressure line or electrical cable and 4 feet from a high pressure line or electrical cable. A spotter is required in the immediate vicinity of these heavy equipment/excavation operations to warn operators as to their proximity to the utility.

6. For drilling activities, hand augering or hand excavation is required to the anticipated depth of the buried utility, but at least 5 feet, when drilling operations are within 15 feet of an identified and marked buried utility.

7. Excavation spotters and drillers must be made aware of the potential risk for encountering buried utilities, even after proper utility location procedures have been followed.

APPENDIX E

HEALTH AND SAFETY FORMS

Accident/Injury/Illness Report Form
Accident/Injury/Illness Status Report Form
Heavy Equipment Inspection Forms
Instrument Calibration Logs
Air Monitoring Instrument (Direct Reading) Logs
Fire Extinguisher Checklist/Inventory Form
Daily Safety Meeting Log
SCBA/SAR Inspection Forms
Project Site Safety Inspection Checklist (weekly)
Cardinal Safety Rules
Activity Hazard Analysis

OHM Remediation Services Corp.

SUPERVISOR'S ACCIDENT INVESTIGATION REPORT

Check all that apply: ☐ Injury/Illness ☐ Fatality ☐ Complaint ☐ Not Work Related
☐ Auto Liability ☐ Auto Physical Damage
☐ General Liability ☐ Property Damage ☐ Environmental

Exact Date and Time of Incident _____ ____ a.m. ____ p.m. Shift ☐ 1st ☐ 2nd ☐ 3rd

OHM CORPORATION _____
(Employee's Home Division/Regional Office/Subsidiary)

Address _____
City State

PROJECT IDENTIFICATION (Project Related Incidents Only)

Project No. _____ Project Start Date _____ Completion Date _____

Location (Full Address) _____

Telephone _____ Project Manager _____

EMPLOYEE INFORMATION

Employee's Full Name _____ Employee No. _____

☐ Regular Full Time ☐ Regular Part Time ☐ Temporary ☐ Non-Employee

Home Address _____

Date of Birth _____ Age ____ Social Security No. ____ - ____ - ____ Sex ☐ M ☐ F

Job Title _____ Department _____ Date Hired _____

Length of Employment ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs. Time in Job Class ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs.

Name of Employee's Direct Supervisor _____

Supervision at Time of Accident ☐ Directly Supervised ☐ Indirectly Supervised ☐ Not Supervised

Specific Location Where Incident Occurred _____

_____ ☐ OHM Facility ☐ Project Site ☐ Other _____

To Whom Was Incident Reported? _____ When? _____

Witness Name/Address _____

Witness Job Title/Reason in Area _____

Describe Employee's Job Duties Being Performed When Injured _____

_____

_____

Describe Fully the Events Which Resulted in the Accident/Injury/Illness _____

_____

_____

PLEASE CONTINUE ON BACK OF THIS PAGE

(Use Extra Page if Needed)

Describe the Injury/Illness in Detail; Indicate Part of Body Affected _____

Name of Object/Substance Which Directly Injured Employee _____

Has/Will Employee Seek Treatment? ☐ Yes ☐ No Did Employee Die? ☐ Yes ☐ No

Name/Address of Hospital/Doctor _____

Describe Treatment Given _____

Was Employee Able To Return To Work? ☐ Yes ☐ No

If YES: ☐ Regular Work ☐ Work with Restricted Activities

Restriction _____

If NO: Date Lost Time Began _____ Date/Est. Date To Return _____

Identify Personal Protective Equipment Used by Injured Employee _____

What Training or Instruction Had Been Given? _____

How Could This Accident Have Been Prevented? _____

Corrective Action _____

Signature _____ (Supvr/Manager) Date _____

Signature _____ (Safety Officer) Date _____

Signature _____ (Proj. Manager) Date _____

DISTRIBUTION Original To: Division Secretary at Employee's Home Office

Copy To: ☐ Corporate Health & Safety ☐ Regional Health & Safety Manager
☐ Project Manager ☐ Site Safety File

OHM Remediation
Services Corp.

EMPLOYEE'S ACCIDENT REPORT

Check all that apply: ☐ Injury/Illness ☐ Fatality ☐ Complaint ☐ Not Work Related
☐ Auto Liability ☐ Auto Physical Damage
☐ General Liability ☐ Property Damage ☐ Environmental

Date, Day, and Time of Incident _____ _____ ☐ am ☐ pm

Your Name: _____ Your Emp. No.: _____

Home Address: _____ Home Phone # _____

Birth Date: _____ Age: _____ Social Security No.: _____ Sex: _____

Job Title: _____ Dept.: _____ Date of Hire: _____

Accident location (If Project related, give Project #, Client, Address and Phone #): _____

_____

On OHM premises? ☐ Yes ☐ No

Witness Name/Address _____

How did accident occur?: _____

_____

_____

Was medical attention required? ☐ Yes ☐ No

Did you return to work? ☐ Yes ☐ No Your usual Job? ☐ Yes ☐ No If not explain: _____

Was the accident reported to a supervisor? ☐ Yes ☐ No Supervisor's name: _____

_____

Employee's Signature Date

OHM Remediation Services Corp.
A Subsidiary of OHM Corporation

Form 0085
H & S Dept.
2/95

INJURY/ILLNESS STATUS REPORT

Employee _____ Social Security No. _____

Home Address _____ Phone _____

Job Title _____ Home Division _____

Date of Injury/Illness _____ Description of Injury/Illness _____

AUTHORIZATION TO RELEASE INFORMATION

I hereby authorize all physicians, hospitals, clinics and all persons to discuss with, and release to OHM Remediation Services Corp. and its authorized agents, any information or copies thereof acquired in the course of my examination or treatment for the injury identified above. This authorization shall not extend to any other medical condition, past or present, unless the same is causally or historically relevant or related to the injury referred to above.

Employee Signature _____ Date _____

PHYSICIAN OR MEDICAL PERSONNEL TO COMPLETE REMAINDER OF FORM

WORK STATUS

☐ Employee may return to work with no limitations

_____
Date

☐ Employee may return to work on _____
Date
with limitations indicated. These restrictions are in effect until _____ or until Reevaluation
Date
on _____
Date

Employee may work _____ hours in a work day.

☐ Employee is totally incapacitated at this time.

Patient will be reevaluated on _____
Date

DEGREE

☐ **Sedentary Work.** Lifting 10 pounds maximum and occasionally lifting and/or carrying such articles as dockets, ledgers, and small tools. Although a sedentary job is defined as one which involves sitting, a certain amount of walking and standing is often necessary in carrying out job duties. Jobs are sedentary if walking and standing are required only occasionally and other sedentary criteria are met.

☐ **Light Work.** Lifting 20 pounds maximum with frequent lifting and/or carrying of objects weighing up to 10 pounds. Even though the weight lifted may be only a negligible amount, a job is in this category when it requires walking or standing to a significant degree or when it involves sitting most of the time with a degree of pushing and pulling of arm and/or leg controls.

☐ **Medium Work.** Lifting 50 maximum with frequent lifting and/or carrying of objects weighing up to 25 pounds.

☐ **Heavy Work.** Lifting 100 pounds maximum with frequent lifting and/or carrying of objects weighing up to 50 pounds.

☐ **Very Heavy Work.** Lifting objects in excess of 100 pounds with frequent lifting and/or carrying of objects weighing 50 pounds or more.

LIMITATIONS

1. The Employee may:
   a. Stand/walk
      ☐ None ☐ 1-4 hours
      ☐ 4-6 hours ☐ 6-8 hours
   b. Sit
      ☐ 1-3 hours ☐ 3-5 hours
      ☐ 5-8 hours
   c. Drive
      ☐ 1-3 hours ☐ 3-5 hours
      ☐ 5-8 hours
2. Employee may use hands for repetitive:
   ☐ Single grasping ☐ Pushing & pulling
   ☐ Fine manipulation
3. Employee may use feet for repetitive movement as in operating foot controls:
   ☐ Yes ☐ No
4. Employee is able to:

	Frequenty	Occasionally	Not at All
a. Bend	☐	☐	☐
b. Squat	☐	☐	☐
c. Climb	☐	☐	☐

PHYSICIAN'S REPORT

Diagnosis _____

Treatment _____

Other _____

Date of this Report _____

☐ Referred to company physician
☐ Employee referred/admitted to:

Whom _____

Address _____

Phone _____

Date _____ Time _____

Physician's Name _____ Physician's Signature _____
Print

Address _____ Phone _____

White - Company Copy
Canary - Clinic Copy
Pink - Employee Copy

16406 U.S. Route 224 E. • P.O. Box 551 • Findlay, OH 45839-0551 • (419) 425-6182

OHM Corporation

DAILY HEAVY EQUIPMENT SAFETY INSPECTION CHECKLIST

EQUIPMENT I.D. NO.: _____ EQUIPMENT NAME: _____ WEEK OF: _____

ITEM INSPECTED	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
Falling Object Protective Structure (FOP)							
Roll-Over Protective Structure (ROP)							
Seat Belts							
Operator Seat Bar(s)							
Side Shields, Screens or Cab							
Lift Arm Restraining Device							
Grab Handles							
Back-Up Alarm - Working							
Lights							
Guards							
Horn							
Anti-Skid Tread Steps Clear of Mud							
Safety Signs (i.e. counterbalance swing area)							
Fire Extinguisher							
General Condition							
Fuel Connection							
Oil (full and no leaks)							
Clear Of Extra Materials							
Controls function properly							
Damaged Parts							
Hydraulic System (full and no leaks)							
Parking brake							
Lift Arm and Bucket							
Tires/Tracks							
Steering							
Inspectors Name and Employee No.							

INSTRUCTIONS - Inspect all applicable items indicated, each shift. If an unsatisfactory condition is observed, suspend operation of the equipment and report the unsatisfactory condition to the site supervisor immediately.

CHM Remediation
services Corp.

COMBUSTIBLE GAS INDICATOR
CALIBRATION DATA SHEET

_____

_____

PROJECT # _____

INSTRUMENT NO.: _____ CALIBRATION GAS % LEL: _____ _____

CALIBRATION GAS:_____ CHEMICAL MONITORED: _____

CAL GAS O_2 CONCENTRATION: _____ CONVERSION FACTOR: _____

DATE	PERSON CALIBRATING	CGI READING (% LEL)	OXYGEN READING	TOX IN PPM	REMARKS

NOTE: METER READING x CONVERSION FACTOR = LEL OF ATMOSPHERE
(Conversion factor can be found in instrument manual)

OHM Corporation

HNU-PHOTOIONIZATION DETECTOR
CALIBRATION DATA SHEET

____

____

PROJECT # ____________

DATE:_____________
INSTRUMENT NO. ___________
LAMP TYPE: ______________

CALIBRATION GAS: ______________________
CALIBRATION PERFORMED BY:_________________

TIME	WEATHER CONDITIONS (TEMP/HUMIDITY)	SPAN SETTING	READING (PPM)	REMARKS

DIRECT READING INSTRUMENT LOG

Date _____ Project _____

Operator _____ Project No. _____

Instruments _____

_____

Project Activities Being Monitored _____

_____

_____

_____

Instrument/Action Level Background Reading _____

Instrument	Time	Location/Activity	Reading	Duration	Comments

OHM Corporation

PORTABLE FIRE EXTINGUISHER CHECKLIST

Office/Shop Location_____

INVENTORY

Serial No.	Location	Serial No.	Location
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Inspection Points

1. Fire extinguisher is in assigned location
2. Access is not obstructed
3. Fire extinguisher is fully charged
4. Lock-pin in place
5. Test tag attached and current

INSPECTIONS COMPLETED

Month	Initials	Month	Initials
January	_____	July	_____
February	_____	August	_____
March	_____	September	_____
April	_____	October	_____
May	_____	November	_____
June	_____	December	_____

OHM Corporation

DAILY SAFETY MEETING LOG

Date:_____ Client:_____

Specific Location:_____ Job No.:_____

SAFETY TOPICS PRESENTED:

Protective Clothing/Equipment:_____

_____

Chemical Hazards:_____

_____

Physical Hazards:_____

_____

Emergency Procedures:_____

_____

Hospital/Clinic:_____ Phone:_____

Hospital Address:_____

EMS Phone:_____

Special Equipment:_____

_____

Other:_____

_____

ATTENDEES:

Name Printed:	Signature:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted By:

_____ _____

Name Printed **Signature**

DAILY SAFETY MEETING LOG
(CONTINUATION PAGE)

Date:_____ Client:_____

Specific Location:_____ Job No._____

SAFETY TOPICS PRESENTED:

ATTENDEES:

Name Printed:	Signature:

OHM Corporation

SCBA MONTHLY INSPECTION CHECKLIST

SCBA ID NO._____ YEAR_____

ITEM INSPECTED	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Connections are tight												
Face-piece in good condition												
Rubber parts pliable												
Regulator functions properly												
Alarm bell functions properly												
Cylinder fully charged												
Cylinder hydrotest current (within 3 years)												
Unit is clean												
Emergency bypass functions properly												
Inspectors initials and employee number												

DEFICIENCIES IN ABOVE ITEMS REQUIRE UNIT TO BE TAGGED AND REMOVED FROM SERVICE.

OIIM Corporation

SAR MONTHLY INSPECTION CHECKLIST

SAR ID NO._____ EGRESS ID NO._____ YEAR_____

ITEM INSPECTED	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Connections are tight												
Face-piece in good condition												
Rubber part, hoses pliable and good condition												
Regulators function properly/without flutter or free flow												
Cylinder fully charged Pressure gauge intact												
Cylinder hydrostatic test current (due at 5 yrs)												
Unit is clean, straps in good condition												
Exhalation valve functions properly												
Cylinder recharged after inspection												
Inspectors initials and employee number												

OHM Corporation

OHM Corporation
Project Site Safety Inspection Checklist

Project Name:_____
Project Number:_____
Project Location:_____
Site Supervisor:_____
Inspector's Name:_____

MEDICAL AND FIRST AID	YES	NO
1. Are First Aid Kits accessible and identified?	____	____
2. Are emergency eye wash and safety showers available?	____	____
3. Are daily logs for first aid present and up to date?	____	____
4. Are First Aid Kits inspected weekly?	____	____

PERSONAL PROTECTIVE EQUIPMENT		
1. Have levels of personnel protection been established?	____	____
2. Do all employees know their level of protection?	____	____
3. Are respirators used decontaminated, inspected, and stored according to standard procedures?	____	____
4. Have employees been fit-tested?	____	____
5. Is defective personal protective equipment tagged?	____	____
6. Does compressed breathing air meet CGA Grade "D" minimum?	____	____
7. Are there sufficient quantities of safety equipment and repair parts?	____	____
8. Does Level D protection consist of safety glasses, hard hats, and steel toe boots?	____	____

FIRE PREVENTION		
1. Is smoking prohibited in flammable storage areas?	____	____
2. Are fire lanes established and maintained?	____	____
3. Are flammable dispensing systems grounded and bonded?	____	____
4. Are approved safety cans available for storage of flammable liquids?	____	____
5. Has the local fire department been contacted?	____	____
6. Are fire extinguishers available near refueling areas?	____	____

AIR MONITORING		
1. Is air monitoring being conducted as required by the site safety plan?	____	____
2. Are air monitoring instruments calibrated daily?	____	____
3. Is the air monitoring logbooks up to date?	____	____
4. Are user manuals available?	____	____
5. Are instruments clean and charged?	____	____

WELDING AND CUTTING (29 CFR 1926 Subpart J)

1. Are fire extinguishers present at welding and cutting operations? ____ ____
2. Are confined spaces; such as, tanks, pipelines, and trenches; tested prior to cutting and welding operations? ____ ____
3. Are Hot Work Permits available? ____ ____
4. Are proper helmets, goggles, aprons, and gloves available for welding and cutting operations? ____ ____
5. Are welding machines properly grounded? ____ ____
6. Are oxygen and fuel gas cylinders stored a minimum of 20 feet apart? ____ ____
7. Are only trained personnel permitted to operate welding and cutting equipment? ____ ____

HAND AND POWER TOOLS (29 CFR 1926 Subpart I)

1 Are defective hand and power tools tagged and taken out of service? ____ ____
2. Is eye protection available and used when operating power tools? ____ ____
3. Are guards and safety devices in place on power tools? ____ ____
4. Are power tools inspected before each use? ____ ____
5. Are non-sparking tools available? ____ ____

MOTOR VEHICLES

1. Are vehicles inspected daily? ____ ____
2. Are personnel licensed for the equipment they operate? ____ ____
3. Are unsafe vehicles tagged and reported to supervision? ____ ____
4. Are vehicles shut down before fueling? ____ ____
5. When backing vehicles, are spotters provided? ____ ____
6. Is safety equipment on vehicles? ____ ____
7. Are loads secure on vehicles? ____ ____
8. Are vehicle occupants using safety belts if provided? ____ ____

EMERGENCY PLANS

1. Are emergency telephone numbers posted? ____ ____
2. Have emergency escape routes been designated? ____ ____
3. Are employees familiar with the emergency signal? ____ ____
4. Has the emergency route to the hospital been established and posted? ____ ____

MATERIALS HANDLING

1. Are materials stacked and stored as to prevent sliding or collapsing? ____ ____
2. Are flammables and combustibles stored in non-smoking areas? ____ ____
3. Is machinery braced when personnel are performing maintenance? ____ ____
4. Are tripping hazards labeled? ____ ____
5. Are semi-trailers chocked? ____ ____
6. Are fixed jacks used under semi-trailers? ____ ____
7. Are riders prohibited on materials handling equipment? ____ ____
8. Are cranes inspected as prescribed and logged? ____ ____
9. Are OSHA approved manlifts provided for the lifting of personnel?
10. Are personnel in manlifts wearing approved fall protection devices? ____ ____

FIRE PROTECTION

1. Has a fire alarm been established? ____ ____
2. Do employees know the location and use of all fire extinguishers? ____ ____
3. Are fire extinguisher locations marked? ____ ____

WALKING AND WORKING SURFACES

1. Are ladders a Type I or Type II? ____ ____
2. Are accessways, stairways, ramps, and ladders clean of ice, mud, snow, or debris? ____ ____

3. Are ladders being used in a safe manner? ____ ____
4. Are ladders kept out of passageways, doors, or driveways? ____ ____
5. Are broken or damaged ladders tagged and taken out of service? ____ ____
6. Are metal ladders prohibited in electrical service? ____ ____
7. Are stairways and floor openings guarded? ____ ____
8. Are safety feet installed on straight and extension ladders? ____ ____
9. Is general housekeeping up to OHM standards? ____ ____
10. Are ladders tied off? ____ ____

SITE SAFETY PLAN

1. Is a site safety plan available on site or accessible to all employees? ____ ____
2. Does the safety plan accurately reflect site conditions and tasks? ____ ____
3. Have potential hazards been described to employees on site? ____ ____
4. Is there a designated safety official on site? ____ ____
5. Have all employees signed the acknowledgement form? ____ ____

SITE POSTERS

1. Are the following documents posted in a prominent and accessible area?

   A. Minimum Wage ____ ____
   B. OSHA Health and Safety ____ ____
   C. Equal Employment Opportunity ____ ____

SITE CONTROL

1. Are work zones clearly defined? ____ ____
2. Are support trailers located to minimize exposure from a potential release? ____ ____
3. Are support trailers accessible for approach by emergency vehicles? ____ ____
4. Is the site properly secured during and after work hours? ____ ____

HEAVY EQUIPMENT (29 CFR 1926 Subpart O)

1. Is heavy equipment inspected as prescribed by the manufacturer? ____ ____
2. Is defective heavy equipment tagged and taken out of service? ____ ____
3. Are project roads and structures inspected for load capacities and proper clearances? ____ ____
4. Is heavy equipment shut down for fueling and maintenance? ____ ____
5. Are back-up alarms installed and working on equipment? ____ ____
6. Are designated operators only operating equipment? ____ ____
7. Are riders prohibited on heavy equipment? ____ ____
8. Are guards and safety appliances in place and used? ____ ____

EXCAVATION (29 CFR 1926 Subpart P)

1. Has a "competent person" been designated to supervise this excavation activity? ____ ____
2. Have utility companies been advised of excavation activities? ____ ____
3. Prior to opening excavations, are utilities located and marked? ____ ____
4. Has a professional engineer evaluated all excavations greater than 20 feet deep? ____ ____
5. Is there rescue equipment on-site and accessible to excavation? ____ ____
6. Is excavated material placed a minimum of 24 inches from the excavations? ____ ____
7. Are the sides of excavations sloped or shored to prevent caving in on employees? ____ ____

FIRE PROTECTION (Continued)

4. Are combustible materials segregated from open flames? ____ ____
5. Have fire extinguishers been professionally inspected during the last year? ____ ____
6. Are fire extinguishers visually inspected monthly? ____ ____

ELECTRICAL (29 CFR 1926 Subpart K)

1. Is electrical equipment and wiring properly guarded? ____ ____
2. Are electrical lines, extension cords, and cables guarded and maintained in good conditions? ____ ____
3. Are extension cords kept out of wet areas? ____ ____
4. Is damaged electrical equipment tagged and taken out of service? ____ ____
5. Have underground electrical lines been identified by proper authorities? ____ ____
6. Has positive lock-out system been established by a certified project electrician? ____ ____
7. Are GFCI's being used as needed? ____ ____
8. Are extension cords being inspected daily for ground continuity and structural integrity? (i.e., group pin in place, no unapproved splices) ____ ____
9. Are warning signs exhibited on high voltage equipment (250V or greater)? ____ ____
10. Is extension cord inspection documented?

CRANES AND RIGGING (29 CFR 1926.550)

1. Are cranes inspected daily? ____ ____
2. Are crane swing areas barricaded or demarked? ____ ____
3. Is all rigging equipment tagged with an identification number and rated capacity? ____ ____
4. Is rigging equipment inspection documented? ____ ____
5. Are slings, chains, and rigging inspected before each use? ____ ____
6. Are damaged slings, chains, and rigging tagged and taken out of service? ____ ____
7. Are slings padded or protected from sharp corners? ____ ____
8. Do employees keep clear of suspended loads? ____ ____
9. Are employees in the lift area wearing hard hats? ____ ____

COMPRESSED GAS CYLINDERS

1. Are breathing air cylinders charged only to prescribed pressures? ____ ____
2. Are like cylinders segregated in well ventilated areas? ____ ____
3. Is smoking prohibited in cylinder storage areas? ____ ____
4. Are cylinders stored secure and upright? ____ ____
5. Are cylinders protected from snow, rain, etc.? ____ ____
6. Are cylinder caps in place before cylinders are moved? ____ ____
7. Are fuel gas and 02 cylinders stored a minimum of 20 feet apart? ____ ____
8. Are propane cylinders stored and used outside the structure? ____ ____

SCAFFOLDING (29 CFR 1926.451)

1. Is scaffolding placed on a flat, firm surface? ____ ____
2. Are scaffold planks free of mud, ice, grease, etc.? ____ ____
3. Is scaffolding inspected before each use? ____ ____
4. Are defective scaffold parts taken out of service? ____ ____
5. Does mobile scaffold height exceed 4 times the width or base dimension? ____ ____
6. Does scaffold planking overlap a minimum of 12 inches? ____ ____
7. Does scaffold planking extend over end supports between 6 to 18 inches? ____ ____
8. Are employees restricted from working on scaffolds during storms and high winds? ____ ____
9. Are all pins in place and wheels locked? ____ ____
10. Is perimeter guarding (top rail, mid rail, and toe board) present? ____ ____

EXCAVATION (29 CFR 1926 Subpart P - Continued)

8. Has excavation greater than 4-feet deep been monitored for hazardous atmospheres (i.e. LEL/02 deficiency)? ____ ____
9. Are ladders used in excavations over 4-feet deep? ____ ____
10. Are ladders present every 25 feet? ____ ____
11. Are barriers, i.e. guardrails or fences placed around excavations near pedestrian or vehicle thoroughfares? ____ ____
12. Is excavation inspected daily by competent persons and documented? ____ ____

CONFINED SPACES (Proposed Regulation 29 CFR 1910.146)

1. Have employees been trained in the hazards of confined spaces? ____ ____
2. Are confined space permits available on project site? ____ ____
3. Is the contractors confined space safety procedure on the project? ____ ____
4. Has a rescue plan been established? ____ ____

PERSONNEL DECONTAMINATION

1. Are decontamination stations set up on site? ____ ____
2. Are waste receptacles available for contaminated clothing? ____ ____
3. Are steps taken to contain liquids used for decontamination? ____ ____
4. Have decontamination steps and procedures been covered by the site supervisor or safety official? ____ ____
5. Is all personal protective equipment and respiratory equipment being cleaned on a daily basis? ____ ____

EQUIPMENT DECONTAMINATION

1. Has equipment decontamination been established? ____ ____
2. Is contamination wash water properly contained and disposed of? ____ ____
3. Are all pieces of equipment inspected for proper decontamination before leaving the site? ____ ____
4. Is all equipment being cleaned on a daily basis? ____ ____

HAZARD COMMUNICATION (29 CFR 1926.59)

1. Is there a written program on-site? ____ ____
2. Is there a MSDS FOR EACH CHEMICAL present on-site? ____ ____
3. Are all containers properly labeled, as to content, hazard? ____ ____
4. Have employees been trained on chemical hazards? ____ ____
5. Are employee's trained on chemical hazards while doing non-routine tasks? ____ ____
6. Do employees (including subcontractors) know and understand the acute and chemical effects of exposure from the chemicals on-site? ____ ____
7. Have all subcontractors signed the Haz-Comm acknowledgement form? ____ ____

I have reviewed this inspection checklist with the safety inspector and fully understand the recommendation and will make every attempt to correct them immediately.

	Signature	Date
Site Supervisor:	_____	_____
Project Manager:	_____	_____
OHM Compliance Inspector:	_____	_____

OHM Remediation Services Corp.'s
" CARDINAL " SAFETY RULES

- No failure to report Accidents/ Injuries immediately; No misrepresenation of injuries
- No failure to comply with all safety requirements, procedures or policies
- No illicit drugs/alcohol
- No fighting
- No horseplay
- No malicious destruction of company property
- No firearms

Failure to comply with these rules will result in immediate discharge.

HAZARD ANALYSIS

ACTIVITY _____ ANALYZED BY/DATE _____ REVIEWED BY/DATE _____

Principal Steps	Potential Hazards	Recommended Controls
Identify the principal steps involved and the sequence of work activities	Analyze each principal step for its potential hazards	Develop specific controls for each potential hazard
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
List equipment/machinery to be used in conducting the work activities	List inspection requirements for the equipment/machinery listed	Determine requirements for worker training, including hazard communication

QUALITY CONTROL PLAN
FOR
PHASE I, INTERIM AIR SPARGING REMEDIATION SYSTEM
AT OPERABLE UNIT NO. 10, SITE 35
CAMP GEIGER AREA FUEL FARM
MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Atlantic Division
Naval Facilities Engineering Command
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October 1997
Delivery Order 083
OHM Project No. 17536

OHM Remediation
Services Corp.

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1.0 STATEMENT OF QC PROGRAM

OHM Remediation Services Corp. (OHM), a subsidiary of OHM Corporation, will provide and maintain an effective Contractor Quality Control (CQC) Program as required by contract clauses. This program will be performed in conjunction with the Program Quality Control Plan (OHM, December 14, 1995) as applicable and in accordance with the requirements of Contract No. N62470-93-D-3032, Atlantic Division, Naval Facilities Engineering Command, dated August 1993. OHM will perform the inspection and test required to ensure that materials, workmanship, and construction conform to drawings, specifications, and contract requirements. OHM will perform each test or inspection specified, unless the required inspection and/or test is specifically designated to be performed by the Government.

Note to Employees

Quality Control should not be considered a person or an organization of personnel, but a concept to perform in such a manner that the end product of our efforts met established criterion, the customer's needs. The Quality Control individual or group cannot inspect quality into the final product, but only inspect and document the results of our efforts. The only person that can build quality into the product are the individuals performing the task of producing the end product.

It should be noted by all employees that the documentation requirements of OHM procedures, plans and the delivery order specifications are considered equally as important as the end product itself. When it is stated that the documentation will be approved prior to the start of work, this is exactly what is intended. To eliminate problems in this area requires careful planning and execution by everyone.

We would do well to remember that our livelihood depends on how well we satisfy our customer. To accomplish this requires teamwork and attention to detail by all employees and contractors.

2.0 QC ORGANIZATION AND RESPONSIBILITIES

2.1 ORGANIZATION

The QC organization is depicted in the Organizational Chart (Exhibit 2.1). Other positions are reflected to show organizational interface and lines of communication. Depending upon the scope, size and complexity of the project, the Project Superintendent may also fulfill the duties of the Project QC Manager when approved by the Navy.

2.2 QC MANAGERS

The Program QC Manager's resume is included in the Program QC Plan and the QC Manager's resume (delivery order specific) is included herein as Exhibit 2.2.

2.3 DUTIES, RESPONSIBILITIES AND AUTHORITIES

1. The **Program QC Manager** shall report to the Program Manager and shall be responsible for developing, maintaining, and enforcing the quality control program.

2. The **QC Manager** shall report to the Program QC Manager and shall be responsible for the management and implementation of the Program QC Plan and the delivery order specific QC Plan for both on-and off-site activities. Specific duties include: attend the Coordination and Mutual Understanding Meeting; conduct the scheduled QC meetings; perform the three phases of control; perform submittal reviews; perform submittal approval except for submittals designated for Contracting Officer approval; ensure tests are performed; and prepare QC certifications and QC documentation as required by this Plan. Except for managing and implementing the QC program, the QC Manager shall perform no other duties without the authorization of the Contracting Officer. The QC Manager shall also be responsible for delivering the following documentation to the Contracting Officer:

   - Combined Contractor Production Report/Contractor Quality Control Report, original and one copy, by 10:00 a.m. the next working day after each day that work is performed.

   - Testing Plan and Log, three copies, at the end of each month.

   - Monthly Summary Report of Field Tests, original and two copies attached to the Contractor Quality Control Report at the end of each month. (See paragraph entitled "Test Results" in Section 4.0).

   - QC meeting minutes, three copies within two calendar days of the meeting.

   - Rework items list, three copies at the end of each month.

- Completion Certification attesting that "the work has been completed, inspected, tested, and is in compliance with the contract."

3. The QC Manager is expected to attend the daily site safety meetings and abide by all site rules and regulations.

2.4 APPOINTMENT LETTERS

The appointment letter for the site QC Manager is included as Exhibit 2.4. The appointment letter for the Program QC Manager can be found in the Program QC Plan.

3.0 SUBMITTALS

3.1 REVIEWING, APPROVING, AND MANAGING SUBMITTALS

A. Contractor's Responsibility

The following responsibilities are those of the contractor and not the QC organization. They are included only for the purpose of providing an understanding of the contractor's responsibility. While the QC organization is expected to assist the contractor in fulfillment of their responsibilities, no part of these responsibilities shall be assumed by the QC organization without the expressed written permission of the Contracting Officer.

1. Coordinate preparation and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.

2. Except as specified otherwise, allow a review period, beginning with receipt by the approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals requiring Contracting Officer approval. The period of review for submittals with Contracting Officer approval begins when the Government receives the submittal from the QC organization. The period of review for each resubmittal is the same as for the initial submittal.

3. Determine and verify field measurements, materials, field construction criteria; review each submittal; check and coordinate each submittal with requirements of the work and contract documents.

4. Transmit submittals to the QC organization in orderly sequence, in accordance with the submittal register, and to prevent delays in the work, delays to the Government, or delays to separate contractors.

5. Correct and resubmit submittals as directed by the approving authority. Direct specific attention, in writing or on resubmitted submittals, to revisions not requested by the approving authority on previous submissions.

6. Furnish additional copies of submittals when requested by the Contracting Officer, to a maximum limit of 20 copies.

7. Complete work that must be accomplished as a basis of a submittal in time to allow the submittal to occur as scheduled.

8. Ensure no work has begun until submittals for that work have been returned as "approved" or "approved as noted" except to the extent that a portion of the work must be accomplished as a basis of the submittal.

Format of Submittals

Transmittal Form. Transmit each submittal, except sample installations and sample panels, to the office of the approving authority utilizing transmittal forms standard for the project. The transmittal form shall identify the Contractor, indicate the date of the submittal, and include information prescribed by the transmittal form and required in the paragraph entitled "Identifying Submittals". Process transmittal forms to record actions regarding sample panels and sample installations. Transmittal forms for submittals of sample panels and sample installations shall record any actions and locations of the samples.

Identifying Submittals. Identifying submittals, except sample panel and sample installation, submittals shall be identified with the following information permanently adhered to or noted on each separate component of each submittal and noted on the transmittal form. Mark each copy of each identically, with the following:

1. Project title and location.

2. Construction contract number and delivery order number.

3. The section and paragraph number of the section for which the submittal is required.

4. The Submittal Description (SD) number (see Exhibit 3.1) of each component of the submittal.

5. If a resubmittal, add an alphabetic suffix to the submittal description, for example, SD-10A, to indicate the resubmission.

6. The name, address, and telephone number of the subcontractor, supplier, manufacturer, and any other second tier contractor associated with the submittal.

7. Product identification and location in project.

Format of Product Data

1. Present product data submittals for each section as a complete, bound volume. Include a table of contents listing page and catalog item numbers for product data.

2. Indicate, by prominent notation, each product that is being submitted, indicate the specification section number, and paragraph number to which it pertains.

3. Supplement product data with material prepared for the project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for the project.

Format of Shop Drawings

1. Shop drawings shall be not less than 8 1/2 by 11 inches nor more than 30 by 42 inches.

2. Present 8 1/2 by 11 inches sized shop drawings as a part of the bound volume for the submittals required by the section. Present larger drawings in the sets.

3. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to the information required in the paragraph entitled "Identifying Submittals."

4. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Identify materials and products for work shown.

Format of Samples

1. Furnish samples in the sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:
   - Sample of equipment or device: Full size.
   - Sample of materials less than 2 by 3 inches: Built-up to 8 1/2 by 11 inches.
   - Sample of materials exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
   - Sample of linear devices or materials, such as conduit and handrails: 10-inch length or length to be supplied, if less than 10 inches.
   - Sample of non-solid naturals, (e.g., sand, paint, etc.): One pint, unless specified otherwise in technical sections.
   - Sample panel: 4 feet by 4 feet.
   - Sample Installation: 100 square feet.

2. Samples showing range of variation: Where unavoidable variations must be expected, submit sets of samples of not less than three units showing the extremes and middle of the range.

3. Reusable samples: Incorporate returned samples into the work only if so specified or indicated. Incorporated samples shall be in an undamaged condition at the time of use.

4. Recording of sample installation: Note and preserve the notation of the area constituting the sample installation but remove the notation at the final cleanup of the project.

5. When a color, texture, or pattern is specified in naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

Format of Administrative Submittals

1. When the submittal includes a document which is to be used in the project or become a part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document, but to a separate sheet accompanying the document.

2. Operation and Maintenance Manual Data: Submit in accordance with the section entitled "Operation and Maintenance Data" of the individual delivery order.

Number of Copies of Product Data

1. Submit six (6) copies of submittals of product data requiring review and approval only by the QC organization and seven (7) copies of product data requiring review and approval by the Contracting Officer.

Number of Copies of Shop Drawings

1. For shop drawings presented on sheets larger than 8 1/2 by 14 inches, submit seven (7) prints of each shop drawing prepared for this project.

2. For shop drawings presented on sheets 8 1/2 by 14 inches or less, conform to the quality requirements for the product data.

Number of Samples

1. Submit two (2) samples, or two (2) sets of samples showing range of variation of each required item. One (1) approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

2. Submit one (1) sample panel. Include components listed in the technical section or as directed.

3. Submit one (1) sample installation, where directed.

4. Submit one (1) sample of non-solid materials.

Number of Copies of Administrative Submittals

1. Unless otherwise specified, submit administrative submittals which are 8 1/2 by 14 inches or smaller in size in the quantity required for product data.

2. Unless otherwise specified, submit administrative submittals larger than 8 1/2 by 14 inches in size in the quantities required for shop drawings.

B. QC Organization Responsibilities

The Quality Control (QC) organization shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements. The approving authority on submittals is the QC Manager unless submission to the Contracting Officer is specified for the specific submittal. The specific QC responsibilities for submittals are as follows:

1. Note the date on which the submittal was received from the contractor on each submittal for which the Site QC Manager is the approving authority.

2. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.

3. Review submittals for conformance with project design concepts and compliance with the contract documents.

4. Act on submittals, determining the appropriate action based on the review of the submittal.

   - When the QC Manager is the approving authority, take the appropriate action on the submittal from the paragraph of "Possible Actions."

   - When the Contracting Officer is the approving authority or when a variation has been proposed, forward the submittal to the Contracting Officer with the certifying statement or return the submittal marked "Not Reviewed" or "Revise and Resubmit" as appropriate.

5. Ensure that the material is clearly legible.

6. Stamp each sheet of each submittal with the appropriate stamp, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only. When agreed to by the Contracting Officer, a single cover sheet containing the required certification wording (see Exhibit 3.1a and 3.1b) may be utilized instead of the above. The stamp or cover sheet shall contain the following wording:

   - When the approval authority is the Contracting Officer, the QC organization will certify submittals forwarded to the Contracting Officer with the following certifying statement:

     I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated into Contract Number N62470-93-D-3032, is in compliance with the Contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval. Government approval of proposed variation, if any, is recommended.

     Certified by Submittal Reviewer _____, Date _____

     Certified by QC Manager _____, Date _____

   - When approving authority is the QC Manager, the QC Manager will use the following approval statement when returning submittals to the Contractor as "Approved" or "Approved as Noted":

     I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated into Contract Number N62470-93-D-3032, is in compliance with the Contract drawings and specification, can be installed in the allocated spaces, and is ____ approved for use, ____ approved for use subject to Government approval of proposed variation.

     Certified by Submittal Reviewer _____, Date _____

     Approved by QC Manager _____, Date _____

7. Sign the certifying statement or approval statement. The signatures shall be in original ink. Stamped signatures are not acceptable.

8. Update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance by the Contracting Officer.

9. Retain a copy of approved submittals at the project site, including the contractor's copy of approved samples.

10. When the approving authority is the QC Manager, forward two copies of each approved submittal, except "Samples", where only one set is required, to the Contracting Officer.

Actions Possible

Submittals returned to the contractor shall contain one of the following notations:

1. **"Not Reviewed"** shall indicate the submittal has been previously reviewed and approved, is not required as a submittal, does not have evidence of being reviewed and approved by the Contractor, or is not complete. A submittal marked "Not Reviewed" shall be returned with explanation of the reason it is not reviewed. Returned submittals deemed to lack review by the Contractor or to be incomplete shall be resubmitted with appropriate action, coordination, or change.

2. Submittals marked **"Approved"** or **"Approved as Submitted"** authorize the Contractor to proceed with the work covered.

3. Submittals marked **"Approved as Noted"** authorize the Contractor to proceed with the work as noted provided the Contractor takes no exception to the notations.

4. Submittals marked **"Revise and Resubmit"** or **"Disapproved"** indicates the submittal is incomplete or does not comply with the design concept or the requirements of the Contract documents and shall be resubmitted with appropriate changes.

3.2 PERSONNEL AUTHORIZED TO REVIEW AND CERTIFY SUBMITTALS

In addition to the QC Manager, the personnel listed in Exhibit 3.2 are authorized to review and certify submittals as indicated. Any additional personnel required to review and certify submittals will be submitted in writing to the Contracting Officer for approval.

3.3 SUBMITTAL REGISTER

The submittal register is shown in Exhibit 3.3. The submittal register shall be maintained as follows:

1. Column (a): List each specification section in which a submittal is required.

2. Column (b): List each submittal description (SD No. and type, e.g., SD-04, Drawings) required in each specification section. Follow each submittal description with the list of material of products to be addressed in each submittal description.

3. Column (c): List one principle paragraph in the specification section where a material or product is specified. This listing is only to facilitate submittal reviews. Do not consider entries in column © as limiting project requirements; do not consider that a blank must be filled in by the Contractor or the Government.

4. Column (d): Indicates approving authority for each submittal. A "G" indicates approval by the Contracting Officer; a blank indicates approval by the Site QC Manager.

5. Column (e): Indicates for submittals to be approved by Contracting Officer, specific reviewers other than the QC organization. This column may or may not be filled out on the copy supplied by the Government.

Columns (f) through (o) will be completed by the QC organization as follows:

6. Column (f): As submittals are processed, list a consecutive number assigned by the Contractor for each group of submittals. Place this same number in the appropriate block on the "Submittal Transmittal Form". For a resubmission, repeat transmittal control number of the original submittal with a suffix; e.g., No. "100B" is second resubmission of material originally transmitted under No. "100".

7. Column (g): List dates scheduled for approving authority to receive submittals. These dates are the scheduled beginnings of submittal review period. The Contractor proposes these dates and the Contracting Officer approves them to establish the approved submittal register.

8. Columns (h) and (I): Use to record Contractor's review when forwarding submittals to the QC organization.

9. Column (j): Enter date QC organization receives submittal from contractor.

10. Columns (k) and (l): If approving authority is Contracting Officer, enter date QC organization forwards certified submittal to Contracting Officer.

11. Columns (m) and (n): If approving authority is Contracting Officer, enter the Government action and date of action as shown on returned submittal. If approving authority is QC Manager, enter QC action and date of action.

12. Column (o): Enter date QC organization returns submittal to Contractor, regardless of who is approving authority. If QC Manager is approving authority, it is also the date the information is forwarded to the Government.

4.0 ACCREDITED LABORATORIES/ TESTING LABORATORIES

4.1 TESTING LABORATORY REQUIREMENTS

Testing services will be provided by an independent accredited testing laboratory qualified to perform sampling and tests. When the proposed testing laboratory is not accredited by and acceptable accreditation program, as described by the paragraph entitled "Accredited Laboratories," submit to the Contracting Officer for approval, certified statements signed by an official of the testing laboratory attesting that the proposed laboratory meets or conforms to the following requirements:

1. Sampling and testing shall be under the technical direction of a registered professional engineer (PE) with at least five years of experience in sampling and testing.

2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C 1077, 1990.

3. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D 3666, 1990 (Rev. A).

4. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740, 1988.

5. Laboratories engaged in nondestructive testing (NDT)/nondestructive examination (NDE) shall meet the requirements of ASTM E 543, 1989 (Rev. A).

6. Laboratories performing work in connection with specific sampling and chemical analysis of contaminated media according to the delivery order specification shall be handled as defined in the Sampling and Analysis Plan (SAP).

4.2 ACCREDITED LABORATORIES

Acceptable accreditation programs are the National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO) program, and the American Association for Laboratory Accreditation (AALA) program. Furnish to the Contracting Officer, a copy of the Certificate of Accreditation, Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the contract.

4.3 INSPECTION OF TESTING LABORATORIES

Prior to approval of non-accredited laboratories, the proposed testing laboratory facilities and records may be subject to inspection by the Contracting Officer. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and the internal QC procedures.

4.4 TEST RESULTS

Test reports shall cite applicable contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. The QC Manager shall furnish a summary report of field tests by attaching a copy of the report to the last daily Contractor Quality Control Report of each month.

5.0 TESTING PLAN AND LOG

5.1 TESTING PLAN AND LOG

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" (Exhibit 5.1) the date the test was conducted, the date the test results were forwarded to the Contracting Officer, any remarks and acknowledgment that an accredited or Contracting Officer approved testing laboratory was used. Attach a copy of the updated testing plan and log to the last daily Contractor Quality Control Report of each month.

In development of the Testing Plan and Log, consideration shall be given to the use of multiple Testing Plans and Logs subdivided by definable features of the specification and/or of different materials within a definable feature section of the specification. When materials are tested on a specific frequency, accumulated material totals shall be recorded in the remarks section or on an attachment to each specific Testing Plan and Log to provide assurance that the tests are conducted at the required intervals.

5.2 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under the contract.

6.0 REWORK

6.1 REWORK DOCUMENTATION REQUIREMENTS

The QC Manager shall maintain a list of work that does not comply with the contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the Rework Items List (Exhibit 6.1) to the last daily Contractor Quality Control Report of each month. The Contractor shall also be responsible for including on this list, items needing rework including those identified by the Contracting Officer.

7.0 MEETING

7.1 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan and prior to start of construction, meet with the Contracting Officer to discuss the QC program required for this contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including forms to be used; administration of on-site and off-site work, and coordination of the Contractor's management, production and the QC Manager's duties with the Contracting Officer. A sample agenda is included as Exhibit 7.1. As a minimum, the Contractor's personnel required to attend shall include the Project Manager, Project Superintendent and QC Manager. Minutes of the meeting shall be prepared by the QC Manager and signed by both the Contractor and the Contracting Officer.

7.2 QC MEETINGS

After the start of construction, the QC Manager shall conduct QC meetings once every two weeks or as required scheduled by the Contracting Officer or delivery order. The meetings will be held at the work site, or where specified, with the project superintendent and the foreman responsible for the upcoming work in attendance. The QC Manager shall take steps as may be necessary to prevent the QC Meeting from becoming a production meeting. Often it is convenient to hold a production meeting following the QC meeting, however the minutes of these meetings shall be maintained separately. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within two working days after the meeting. As a minimum, the following shall be accomplished at each meeting:

1. Review the minutes of the previous meeting.

2. Review the schedule and the status of work.

- Work or testing accomplished since last meeting.
- Rework items identified since last meeting.
- Rework items completed since last meeting.

3. Review the status of submittals.

    - Submittals reviewed and approved since last meeting.
    - Submittals required in the near future.

4. Review the work to be accomplished in the next two weeks and documentation required. Schedule the three phases of control and testing:

    - Establish completion dates for rework items.

- Identify Preparatory Phases required.
- Identify Initial Phases required.
- Identify Follow-up Phases required.
- Identify Testing required.
- Identify status of off-site work or testing.
- Identify documentation required.

5. Resolve QC and production problems.

6. Address items that may require revising the QC plan such as or changes in procedures.

In addition to the normal project distribution which includes the Contracting Officer, a copy shall be forwarded to the C.O.T.R., LANTDIV, the Program QC Manager, and the OHM Program Manager.

8.0 THREE PHASES OF CONTROL

The QC Manager shall perform the three phases of control to ensure that work complies with contract requirements. The three phases of control shall adequately cover both on-site and off-site work and shall include the Inspection Plan activities (see Exhibit 8.0) of each definable feature of work as listed in Exhibit 9.1.

8.1 PREPARATORY PHASE

Notify the Contracting Officer at least two working days in advance of each preparatory phase. Conduct the preparatory phase meeting with the superintendent and the foreman responsible for the definable feature of work. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report (Exhibit 8.1). Perform the following prior to beginning work on each definable feature of work:

- Review each paragraph of the applicable specification sections.
- Review the contract drawings.
- Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.
- Review the testing plan and ensure that provisions have been made to provide the required QC testing.
- Examine the work area to ensure that the required preliminary work has been completed.
- Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data.
- Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted.
- Discuss construction methods.

8.2 INITIAL PHASE

Notify the Contracting Officer at least two working days in advance of each initial phase meeting. When crews are ready to start work on an a definable feature of work, conduct the initial phase meeting with the personnel responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report. Repeat the initial phase for changes in personnel assigned responsibility for the work, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

- Establish the quality of workmanship required.
- Resolve conflicts.

- Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met.
- Ensure that testing is performed.

8.3 FOLLOW-UP PHASE

Perform the following for ongoing work daily, or more frequently as necessary, until the completion of each definable feature of work and document in the daily Contractor Quality Control Report:

- Ensure the work is in compliance with contract requirements.
- Maintain the quality of workmanship required.
- Ensure that testing is performed.
- Ensure that rework items are being corrected.

8.4 NOTIFICATION OF THREE PHASES OF CONTROL FOR OFF-SITE WORK

Notify the Contracting Officer at least two weeks prior to the start of the preparatory and initial phases.

8.5 RECEIPT INSPECTION

The QC organization shall conduct Receipt Inspection of materials and equipment procured in accordance with the delivery order specification. In addition to the submittal documentation, which will be reviewed and approved as required under Section 3.0, Submittals, the following attributes will be inspected for each order/shipment as applicable:

- Material is same as specified by the Delivery Order Specification
- Quantity as specified by the procurement document
- Dimensions as required by the procurement document
- Shipping Damage
- Physical Damage
- Identification and Marking
- Protective Covers and Seals
- Cleanliness
- Workmanship

Materials and equipment found to be unacceptable at receipt inspection shall be rejected and "RED Tagged" (see Exhibit 8.5) until correction or replacement can be made. This material/equipment shall not be used until the corrective action results in satisfactory

reinspection.

The results of the receipt inspection, by attribute, will be included in the Contractor Quality Control Report (Exhibit 8.1) for the date of inspection.

8.6 DOCUMENTATION

Reports are required for each day that work is performed and for every seven consecutive calendar days of no work and on the last day of no work periods. Account for each calendar day throughout the life of the contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed and dated by the QC Manager and shall contain the following information:

- Identify the control phase and the definable feature of work.
- Results of the preparatory phase meetings held, including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedules have been discussed.
- Results of the initial phase meetings held, including the location of the definable features of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work, the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the contract, and the required testing has been performed and include a list of who performed the tests.
- Results of the follow-up phase inspections held, including the location of the definable features of work. Indicate in the report that for this definable feature of work that the work complies with the contract as approved and that required testing has been performed and include a list of who performed the tests.
- Results of the three phases of control for off-site work, if applicable, including actions taken.
- List the rework items identified, but not corrected by close of business.
- As rework items are corrected, provide a revised rework items list along with the corrective action taken.
- Include in the remarks section of the report pertinent information including directions received, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, QC meetings held, acknowledgment that as-built drawings have been updated, corrective direction given by the QC Manager and corrective action taken by the contractor.

- When the QC Manager believes that an attribute list type inspection is more appropriate for the inspection of specific definable features of work, he/she may use any type of form desired for this purpose. However, this or any other form utilized shall become an attachment to the daily Contractor Quality Control Report and shall not preclude any other requirements of the contract or this plan.

9.0 DEFINABLE FEATURES OF WORK

9.1 DEFINABLE FEATURES OF WORK

Exhibit 9.1 contains a list of definable features of work for this delivery order. A definable feature of work is a task that is separate and distinct from other tasks and requires separate control requirements. As a minimum, each division of the specification is considered a definable feature of work. However, at times there may be more than one definable feature of work in each division of the specification or a definable feature of work may include several specification sections. The QC Manager shall discuss the list with the Contracting Officer for possible expansion of the list.

10.0 EXHIBITS

The following forms are acceptable for providing the information required by this QC Plan and the contract, except as otherwise directed by the Contracting Officer. While use of these specific forms are not required by the contract, any other format used shall contain the same information and be approved by the Program QC Manager. Exhibit 10.1 includes additional forms used by the contractor. These forms and their use are not addressed in this QC Plan.

NOTE: Exhibit numbers refer to the paragraph from which the Exhibit was first addressed.

10.1 INDEX OF EXHIBITS

OHM Remediation Services Corp.
Delivery Order No. 083
OU No. 10, Site 35

Quality Control Plan Review

By signing this document, I am stating that I have read and understand the Site Quality Control Plan for this Delivery Order/project. Any questions or comments should be addressed to either the Program or Site QC Manager.

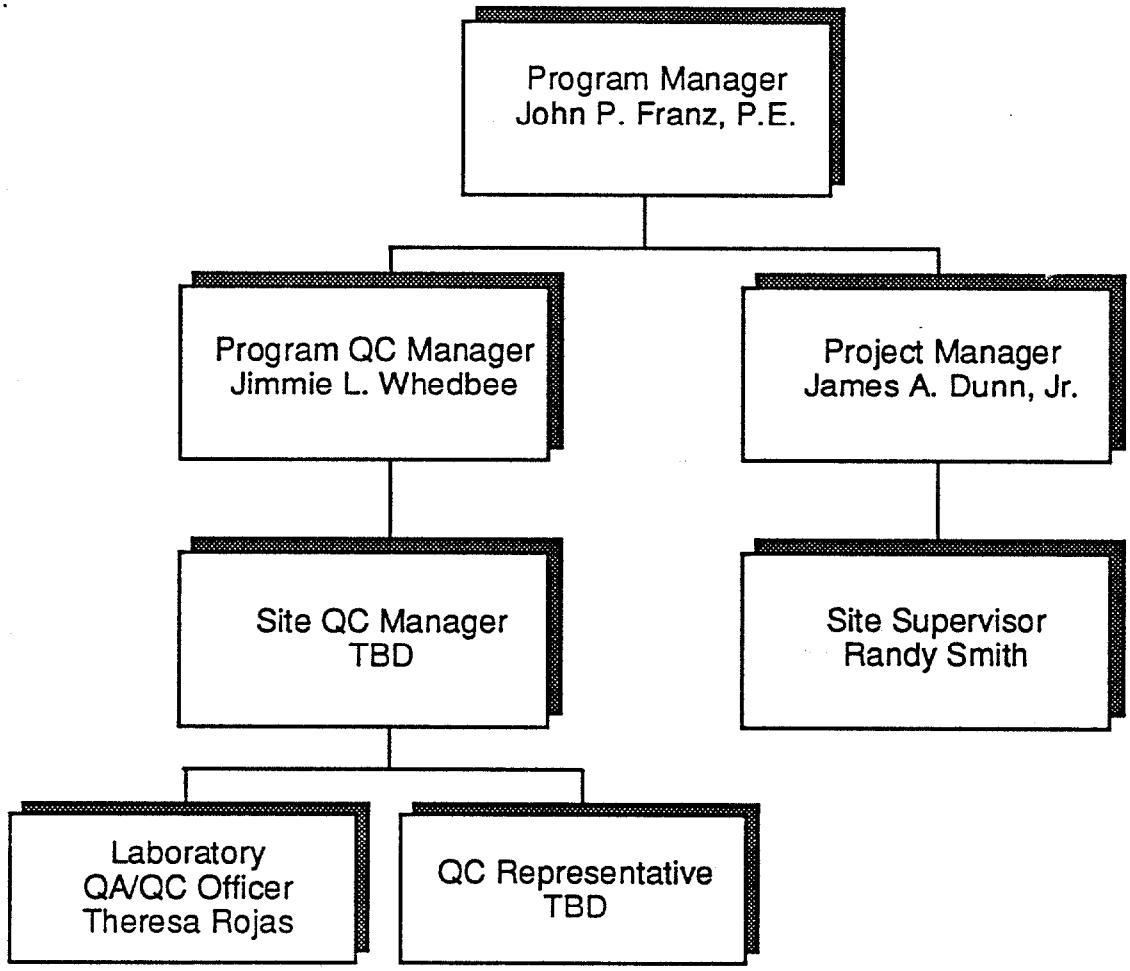
Name (Print)	Signature	Title	Company	Date
James A. Dunn, Jr.		Project Manager		
Randy Smith		Project Superintendent		
TBD		Project Engineer		
Gregory C. Gilles		Technical Manager		

Exhibit 2.1

OHM Remediation Services Corp.

Delivery Order No. 083

QC Organizational Chart



OHM Remediation Services Corp.
A Subsidiary of OHM Corporation

Exhibit 2.4

September 30, 1997

TBD
OHM Remediation Services Corp.
P. O. Box 8116
MCB Camp Lejeune, NC 28547

Re: Site QC Manager, Phase I Air Sparge Groundwater Remedial System Site 35, Camp Geiger
Contract N62470-93-D-3032
Delivery Order 0083

Dear TBD:

This letter will serve as your appointment as the Site Quality Control Manger on the referenced project and will also clarify your duties and authority in this position. In this position, you will be authorized to use available resources to satisfy all applicable requirements of the Program and Delivery Order Quality Control Plans.

This authorization specifically gives you the authority to direct removal and replacement or correction of nonconforming materials or work and stop work authority when continuation would be unsafe to personnel, harmful to the environment, or result in a significant degradation of quality.

You will be expected to work closely with the Project Manager, Site Supervisor and other project personnel, but you will not be directly responsible to anyone but myself for resolution of quality issues when working in the capacity of Quality Control Manager.

If you have any questions in this matter, please call me at (617) 589-2306.

Sincerely,

Jimmie L. Whedbee
Program QC Manager
LANTDIV RAC Program

SUBMITTAL DESCRIPTIONS

Exhibit 3.1

SD-01, Data

Submittals that provide calculations, descriptions, or other documentation regarding the work.

SD-02, Manufacturer's Catalog Data

Data composed of catalog cuts, brochures, circulares, specifications and product data, printed information in sufficient detail and scope to verify compliance with requirements of the contract documents. A type of product data.

SD-03, Manufacturer's Standard Color Charts

Preprinted illustrations displaying choices of color and finish for a material or product. A type of product data.

SD-04, Drawings

Submittals that graphically show relationship of various components of the work, schematic diagrams of systems detail of fabrications, layout of particular elements, connections, and other relational aspects of the work. A type of shop drawing.

SD-05, Design Data

Design calculations, mix design, analyses, or other data written in nature and pertaining to a part of the work. A type of shop drawings.

SD-06, Instructions

Preprinted material describing installation of a product, system, or material, including special notices and Material Safety Data Sheets, if any, concerning impedances, hazards, and safety precautions. A type of product data.

SD-07, Schedules

A tabular list of data or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work. A type of shop drawing

SD-08, Statements

A document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other lower tier contractor, the purpose of which is to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of method or personnel, qualifications, or other verification of quality. A type of shop drawing.

SD-09, Reports

Reports of inspection and laboratory test, including analysis and interpretation of test results. Each report shall be properly identified. Test method used and compliance with recognized test standards shall be described.

SD-10, Test Reports

A report signed by an authorized official of a testing laboratory that a material, product, or system identical to the material, product or system to be provided has been tested in accordance with requirements specified by naming the test method and material. The test report must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. Testing must have been within three years of the date of Contract award. A type of product data.

SD-11, Factory Test Reports

A written report that includes the findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for this project before it is shipped to the job site. The report must be signed by an authorized official of a testing laboratory and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. A type of shop drawing.

SD-12, Field Test Reports

A written report that includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report must be signed by an authorized official of a testing laboratory or agency and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. A type of shop drawing.

SD-13, Certificates

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material meet specified requirements. The statements must be dated after the award of this contract, name the project, and list the specific requirements that it is intended to address. A type of shop drawing.

SD-14, Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work. A type of sample.

SD-15, Color Selection Samples

Samples of the available choice of colors, textures, and finishes of a product or material, presented over substrates identical in texture to that proposed for the work. A type of sample.

SD-16, Sample Panels

An assembly constructed at the product site in a location acceptable to the Contracting Officer and using materials and methods to be employed in the work; completely finished; maintained during construction; and removed at the conclusion of the work or when authorized by the Contracting Officer. A type of sample.

SD-17, Sample Installations

A portion of an assembly or material constructed where directed and, if approved, retained as a part of the work. A type of sample.

SD-18, Records

Documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism. A type of administrative and close-out submittal.

SD-19, Operation and Maintenance Manuals

Data intended to be incorporated in an operations and maintenance manual. A type of administrative and close-out submittal.

Exhibit 3.2

List of Personnel Authorized to Review and Certify Submittals

Specification Section:	Submittal Type:	Authorized Personnel:
01010, 01430, 02223 and 02903	Equipment and materials All others	James A. Dunn, Jr., OHM Randy Smith, OHM OHM Project Engineer (TBD) Greg Gilles

Exhibit 3.3 - Submittal Register

Spec. No.	SD No. and Type of Submittal Material or Product	Spec. Para. No.	Approval by CO	Gov. or A/E Reviewer	Trans. Control No.	Planned Sub. Date	Action Code	Date of Action	Date Forwarded to Appro. Auth./Date Received from Contr.	Date Forwarded to Other Reviewer	Date Received from Other Reviewer	Action Code	Date of Action	Mailed to Contr./Recd. from Appro. Auth.	Remarks
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
01010	Work Plan	1.2.1.1	G			WP 10/1/97									
01010	Material Safety Data Sheets	1.3.1.2	G			WP 10/1/97									w/ HASP
01010	Shop Drawings	1.2.1.1				As received									
01010	Record Documents/ Drawings	1.3.2.1				CR									
01010	Environmental Conditions Report	1.3.2.2				Prior to mobilization									
01010	QC Meeting Minutes	1.3.2.3				As held									
01010	Test Results Summary Report	1.3.2.4				CR									
01010	Contractor Production Report	1.3.2.5				Daily									
01010	QC Report	1.3.2.6				Daily									
01010	Rework Items List	1.3.2.7				CR									
01010	Permits	1.3.2.8				Prior to mobilization									
01010	Contractor's Closeout Report	1.3.2.9				CR									
01430	Waste Characterization Sample Analyses	1.2.2.1				CR									
02222	Excavation and Material Handing Plan	1.4.1.1	G			WP 10/1/97									
02222	Site Health and Safety Plan	1.4.1.2	G			WP 10/1/97									
02222	Field Sampling and Laboratory Testing Plan	1.4.1.3	G			WP 10/1/97									
02223	Waste Shipping Documentation	1.2.2.1				CR									
02223	Waste Delivery Documentation	1.2.2.2				CR									

Spec. No.	SD No. and Type of Submittal Material or Product	Spec. Para. No.	Approval by CO	Gov. or A/E Reviewer	Trans. Control No.	Planned Sub. Date	Action Code	Date of Action	Date Forwarded to Appro. Auth./Date Received from Contr.	Date Forwarded to Other Reviewer	Date Received from Other Reviewer	Action Code	Date of Action	Mailed to Contr./Recd. from Appro. Auth.	Remarks
02223	Disposal Site Decontamination Verification	1.2.2.3				CR									
02223	Work Site Decontamination Verification	1.2.2.4				CR									
02903	Piping and Fittings	2.3				Prior to mobilization									
02903	Valves	2.3				Prior to mobilization									
02903	Air Sparging Equipment	2.7				Prior to mobilization									
02903	Air Sparging System and Piping	1.2.2.1	G			WP 10/1/97									
02903	Electrical Site Layout and Details	1.2.2.3	G			WP 10/1/97									
02903	Engineering Design Calculations	1.2.3.1	G			WP 10/1/97									
02903	Air Sparging System Performance	1.2.4.1				CR and monthly reports									

CR - Closeout Report
WP - Work Plan
A - Approved
AN - Approved as noted

Testing Plan and Log

Exhibit 5.1

Contract Number N62470-93-D-3032 D.O. 083		Project Title and Location OU No. 10, Site 35							Contractor OHM Remediation Services Corp.		
Specification Section and Paragraph Number	Item of Work	Test Required	Accredited /Approved Lab		Sampled By	Tested By	Location of Test		Date Completed	Date Forwarded to Contr. Off.	Remarks
			Yes	No			Onsite	Offsite			

Rework Items List **Exhibit 6.1**

Contract No. and Title: N62470-93-D-3032 - D. O. 0083 OU No. 10, Site 35

Contractor: OHM Remediation Services Corp.

Number	Date Identified	Description	Contract Requirement (spec Section and Par. No., Drawing No. and Detail No., etc.)	Action Taken by QC Manager	Resolution	Date Completed

SAMPLE DOCUMENT
COORDINATION AND MUTUAL UNDERSTANDING MEETING AGENDA FOR DELIVERY ORDER No._____ _____AT THE U.S. NAVAL STATION,

_____

_____ __, 1996

The purpose of this meeting is to develop a mutual understanding of the QC details, including forms to be used; administration of on-site and off-site work, and coordination of the Contractor's management, production and the QC Manager's duties with the Contracting Officer.

The QC program consists of a QC Organization, QC Manager, a QC Plan for this Delivery Order, this Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review, submittal approval except for submittals designated for Contracting Officer approval, testing, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with requirements of this contract.

QC Manager duties (contract para. 6.6.1)

- Attend this meeting
- Conduct the QC Meetings
- Perform the three phases of control
- Perform submittal review
- Perform submittal approval
- Ensure testing is performed
- Prepare QC certifications and documentation
- Perform other activities when approved by the Contracting Officer

Submittal Reviewers Duties and Qualifications (contract para. 6.7)

- Provide submittal reviewers qualified in the disciplines being reviewed other than the QC Manager, to review and certify that the submittals meet the requirements of the contract.

QC Plan (contract para. 6.8)

- (as specified therein)

SAMPLE DOCUMENT

Coordination and Mutual Understanding Meeting (contract para. 6.9)

- (see purpose above)

QC meetings (contract para. 6.10)

- The QC Manager shall conduct QC meetings once every two weeks or as otherwise directed by the Contracting Officer.
- Meeting minutes to be prepared by the QC Manager in accordance with the contract outline and a copy provided to the Contracting Officer within two working days of the meeting.
- A copy will be distributed to the Program QC Manager.

Three phases of control (contract para. 6.11)

- Preparatory Phase Meeting
- Initial Phase Meeting
- Follow-up Phase Inspection

Submittal review and approval (contract para. 6.12 and Part 7.0, "Submittals")

- Review
- Approval
- Certification
- Submittal Register

Testing (contract para. 6.13)

- Testing Laboratory Requirements
- Accredited Laboratories
- Inspection and Testing Laboratories
- Capability Checks
- Test Results

QC certifications (contract para. 6.14)

- Contractor Quality Control Report Certification
- Invoice Certification
- Completion certification

Documentation (contract para. 6.15)

SAMPLE DOCUMENT

- Contractor Production Report
- Contractor Quality Control Report
- Testing Plan and Log
- Rework Items List
- As-built Records
- Report Forms

1. Contractor Production Report
2. Contractor Quality Control Report
3. Testing Plan and Log
4. Rework Items List

INSPECTION SCHEDULE
OU No. 10, Site 35
Delivery Order No. 083

Exhibit 8.0

Spec. Section	Activity*	Preparatory Report No.	Initial Report No.	Follow-up Report Nos.**

*Also include schedule date if CPM Network is involved. **Include first and final inspections only

Exhibit 9.1

Definable Features of Work

Specification Section:	Definable of Feature of Work:
01010 - 1.2.1.1	Work Plan Submission
01010 - 3.1	Mobilization
02222 - 3.2	Trench excavation and backfill
02903 - 1.2	Equipment Installation
02903-2.4.1	Piezometer installation
02903 - 3.7	System Start-up and Monitoring
01010 - 1.3.2.9	Contractor's Closeout Report

CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

PHASE	(BLANK NOT APPLICABLE)	YES	NO	IDENTIFY SPECIFICATION SECTION ... ABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT
PREPARATORY	PLANS AND SPECS HAVE BEEN REVIEWED	☐	☐	
	THE SUBMITTALS HAVE BEEN APPROVED.	☐	☐	
	MATERIALS COMPLY WITH APPROVED SUBMITTALS	☐	☐	
	MATERIALS STORED PROPERLY.	☐	☐	
	PRELIMINARY WORK WAS DONE CORRECTLY.	☐	☐	
	TESTING PLAN HAS BEEN REVIEWED.	☐	☐	
	WORK METHOD AND SCHEDULE DISCUSSED.	☐	☐	
	JOB SAFETY / HAZARD ANALYSIS ADDRESSED	☐	☐	

Exhibit 8.1
Page 1 of 3

PHASE		YES	NO	TESTING PERFORMED & WHO PERFORMED TEST
INITIAL	PRELIMINARY WORK WAS DONE CORRECTLY	☐	☐	
	SAMPLE HAS BEEN PREPARED/APPROVED	☐	☐	
	WORKMANSHIP IS SATISFACTORY	☐	☐	
	TEST RESULTS ARE ACCEPTABLE.	☐	☐	
	WORK IS IN COMPLIANCE WITH THE CONTRACT.	☐	☐	
	WORK COMPIES WITH SAFETY REQUIREMENTS	☐	☐	
FOLLOW-UP	WORK COMPLIES WITH CONTRACT AS APPROVED INITIAL PHASE	☐	☐	
	WORK COMPIES WITH SAFETY REQUIREMENTS	☐	☐	

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)	REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

REMARKS

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the approved drawings and specifications to the best of my knowledge except as noted on this report.

AUTHORIZED QC MANAGER AT SITE DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

GOVERNMENT QUALITY ASSURANCE MANAGER DATE

COMBINED FORM [illegible] (BACK) SHEET OF

CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

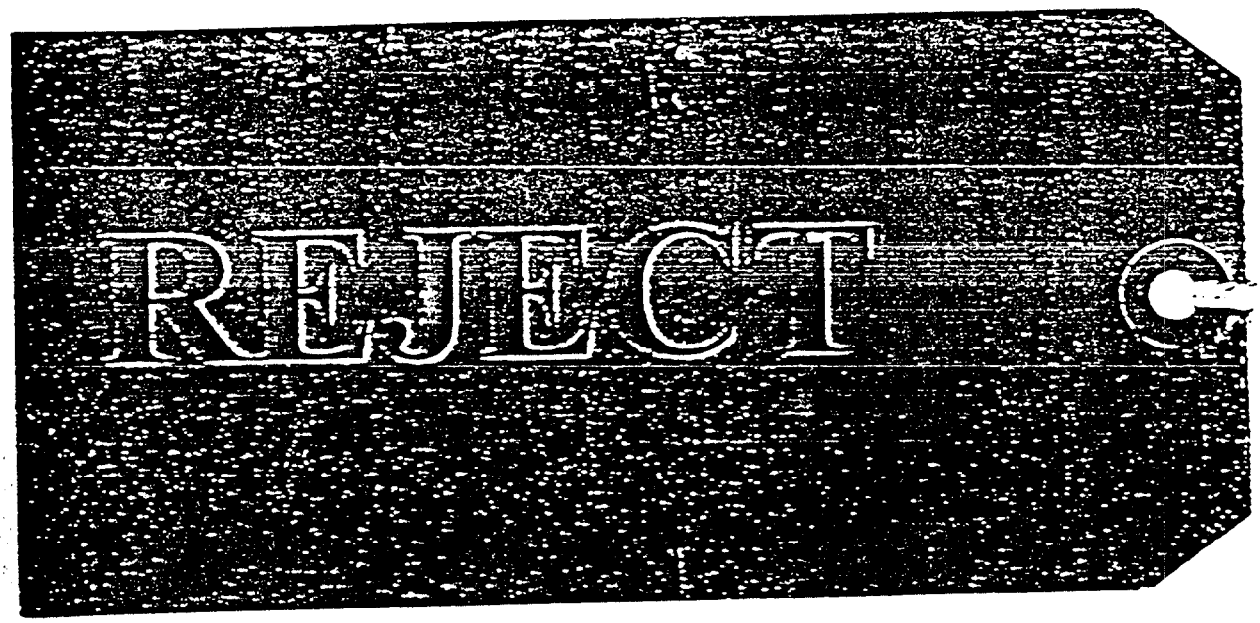
DATE

PHASE	BLANK NOT APPLICABLE!	YES	NO	IDENTIFY SPECIFICATION SECTION, DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT
PREPARATORY	PLANS AND SPECS HAVE BEEN REVIEWED	☐	☐	
	THE SUBMITTALS HAVE BEEN APPROVED.	☐	☐	
	MATERIALS COMPLY WITH APPROVED SUBMITTALS	☐	☐	
	MATERIALS STORED PROPERLY.	☐	☐	
	PRELIMINARY WORK WAS DONE CORRECTLY.	☐	☐	
	TESTING PLAN HAS BEEN REVIEWED.	☐	☐	
	WORK METHOD AND SCHEDULE DISCUSSED.	☐	☐	
	JOB SAFETY / HAZARD ANALYSIS ADDRESSED	☐	☐	

Exhibit 8.1
Page 2 of 3

INITIAL				TESTING PERFORMED & WHO PERFORMED TEST
	PRELIMINARY WORK WAS DONE CORRECTLY	☐	☐	
	SAMPLE HAS BEEN PREPARED/APPROVED	☐	☐	
	WORKMANSHIP IS SATISFACTORY	☐	☐	
	TEST RESULTS ARE ACCEPTABLE.	☐	☐	
	WORK IS IN COMPLIANCE WITH THE CONTRACT.	☐	☐	
	WORK COMPLIES WITH SAFETY REQUIREMENTS	☐	☐	

CONTRACTOR QUALITY CONTROL REPORT CONTINUATION SHEET (ATTACH ADDITIONAL SHEETS IF NECESSARY)				DATE
PHASE	BLANK NOT APPLICABLE	YES	NO	IDENTIFY SPECIFICATION SECTION, DEFINABLE FEATURE OF WORK, LOCATION AND LIST PERSONNEL PRESENT
FOLLOW-UP	WORK COMPLIES WITH CONTRACT AS APPROVED INITIAL PHASE	☐	☐	
	WORK COMPLIES WITH SAFETY REQUIREMENTS	☐	☐	


REJECT

CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

CONTRACT NO | TITLE AND LOCATION | REPORT NO

CONTRACTOR | SUPERINTENDENT

AM WEATHER | PM WEATHER | MAX TEMP °F | MIN TEMP °F

WORK PERFORMED TODAY

WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

Exhibit 10.1a

JOB SAFETY

WAS A JOB SAFETY MEETING HELD THIS DATE? ☐ YES ☐ NO
(If YES, attach copy of the meeting minutes)

WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? ☐ YES ☐ NO
(If YES, attach copy of completed OSHA report)

WAS TRENCHING/SCAFFOLD/HV ELECTRICAL/HIGH WORK DONE? ☐ YES ☐ NO
(If YES, attachment statement or checklist showing inspection performed)

WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT? ☐ YES ☐ NO
(If YES, attach description of incident and proposed action)

TOTAL WORK HOURS ON JOB SITE THIS DATE

CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT

TOTAL WORK HOURS FROM START OF CONSTRUCTION

LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED

SAFETY REQUIREMENTS HAVE BEEN MET

EQUIPMENT MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY INCLUDE NUMBER OF HOURS USED TODAY

REMARKS

CONTRACTOR SUPERINTENDENT | DATE

OHM Remediation Services Corp.

Routing: Contr Adm.
Proj. Mgr
Site Supv
Proj Acct.
CSE
QC
Job File

Project Name: _____ _____
Delivery Order: _____ _____
Contract Purchase Order N62470-93-D-3032 _____
OHM Project Order _____

OVERTIME AUTHORIZATION (OTA)

Date of Request: _____ WBS Code: _____ OTA No: _____

Reason for request

[ ] Emergency
[ ] Equipment Maintenance
[ ] Keep critical activities on schedule
[ ] Accelerate schedule
[ ] Other

Explanation: _____

Exhibit 10.1b _____

Initiated by:

[ ] Navy
[ ] OHM
[ ] Other

Estimated period of overtime work _____ Start Date: _____ End Date: _____

ROM Cost Estimate _____

Requested By: _____ Date: _____
OHM Project Manager

APPROVALS

[ ] Approved [ ] Modified [ ] Rejected

Modification (if any)

_____
_____
_____

RPM: _____ Date: _____

ROICC/NTR: _____ Date: _____

OHM Remediation Services Corp.

Routing: Contr Adm
Site Supv
Proj Asst
CSE
QC
Job File

Project Name: _____
Delivery Order: _____
Contract Purchase Order N62470-93-D-3032
OHM Project Order _____

REQUEST FOR INFORMATION (RFI)

Date of Request: _____ Suspense Date: _____ VR No: _____

SITUATION/CONDITION REQUIRING CLARIFICATION

Dwg Ref: _____ Spec Sec: _____
Site Location _____

DESCRIPTION:

Exhibit 10.1c

DATE RECEIVED BY:
Certifying Engineer: _____ Tech. Rep: _____ ROICC: _____

RESPONSE:

Note: This is a clarification and does not create additional work that could be considered as a change to the contract drawings and /or specification.

RPM: _____ Date: _____

ROICC/NTR: _____ Date: _____

Exhibit 10.1D

OHM Remediation Services Corp.

Routing: Contr Adm
Site Supv
Proj. Acct.
CSE
QC
Job File

Project Name: _____
Delivery Order: _____
Contract Purchase Order N62470-93-D-3032
OHM Project Order _____

VARIANCE REQUEST (VR)

Date of Request: _____ Suspense Date: _____ VR No: _____

PROPOSED VARIANCE Dwg Ref.: _____ Spec Sec: _____
Site Location _____

DESCRIPTION:

Note: Approval of this variance will not result in an increase in cost or in time of performance to this contract.

Initiated By [ ] Navy
[ ] OHM
[ ] Regulatory Agency
[ ] Other

On-Site Engineer: _____ Date: _____
OHM Project Engineer _____ Date: _____
Site Quality Control Manager: _____ Date: _____
OHM Project Manager: _____ Date: _____

APPROVALS [ ] Approved [ ] Modified (see below) [ ] Rejected

Note: This is a clarification and does not create additional work that could be considered as a change to the cost of the project.

RPM: _____ Date: _____
ROICC/NTR: _____ Date: _____

Exhibit 10.1E

OHM Remediation Services Corp.

Routing: Contr. Adm.
Proj. Mgr.
Site Supv.
Proj. Acct.
CSE
QC
Job File
Jonn Franz-Prog
COTR- J. Hasre

Project Name: _____
Delivery Order: _____
Contract Purchase Order N62470-93-D-3032
OHM Project No. _____

WORK DIRECTIVE (WD)

Date of Request: _____ WBS Code: _____ [ ] new code WD No: _____
WBS Description: _____

TITLE OF WORK DIRECTIVE:

DESCRIPTION OF WORK: _____

WORK DIRECTIVE TYPE

[ ] Technical direction — Explanation: _____

[ ] Scope Growth (Mod to follow)
- [ ] Quanity increase
- [ ] New Scope Item
- [ ] Other

[ ] Scope Reduction (Mod to follow)
- [ ] Quanity Decrease
- [ ] Scope Reduction
- [ ] Other

Attachments: _____

Initiated By:
- [ ] Navy
- [ ] OHM
- [ ] Regulatory Agency
- [ ] Other

COST IMPACT — Rough order of Magnitude (ROM) Estimated value of item: _____
NOTE: This estimate includes direct costs, fringes and mark-ups. No fee.

SCHEDULE IMPACT — Estimated Duration of Item _____ Work Days
Estimated Schedule Impact _____ Calender days

Is approval date critical [ ] yes [ ] no — Reason for critical approval date: _____
If yes, indicate date: _____

OHM Representative: _____ Date: _____
On-Site Engineer: _____ Date: _____
OHM Project Manager: _____ Date: _____

APPROVALS — Note: Failure to approve by the critical date may result in additional cost and/or schedule impact.

[ ] Approved [ ] Modified (see attached) [ ] Rejected

RPM: _____ Date: _____
ROICC/NTR: _____ Date: _____

Exhibit 10.1E

Work Directive (WD)

1.0 Purpose: The purpose of the Work Directive is to provide a standardized document that communicates approval, modification, or rejection of either scope change (growth or reduction) or cost change (growth or reduction) by field personnel. The WD is a communication vehicle and individually is not justification for a contract modification. Other factors will determine whether a contract modification is required. The WD should be used for significant issues that will have a cost, scope, and/or schedule impact to a delivery order.

Should the field condition requiring the WD arise from change in scope such as: Differing site conditions, changed or evolving design, design errors or omissions, or direction by the Navy to perform significant additional work, formal contract modification may be required. Several work directives may be consolidated under one contract modification. Submission of a contract modification request should be coordinated in advance with the customer, and in any event should occur prior to 75% financial completion.

Examples of cost growth items requiring the execution of WD are: Technical direction that does not significantly change the scope of work or the need for personnel, equipment or material required to complete the current scope that are not in the budget (this includes modified resources loading due to schedule changes). Refer to program established guidelines for identifying cost versus scope growth as applicable.

2.0 Completing the Form

All lines on the form are to be completed. If particular information is not applicable write N/A on the line.

Lines that should never say N/A are: Date of request, Cost Code, WD No:, Change Title, Reason for Change, ROM Estimate, Schedule Impact, OHM signature, ROICC signature. It is the responsibility of both the Navy and OHM to ensure that sufficient explanation is provided so that the work proceeds as required. If sufficient room is not available on this form additional pages should be attached.

All parties listed on the distribution must be copied on all work directives. All work directives whether accepted or rejected must be logged and kept on-site for inspection by OHM and the Navy.

(ROM) Rough order of magnitude estimate should be included on all work directives. This estimate should be in Navy cost (OHM revenue) dollars.

Schedule Impact. 1) How long will it take to execute the directed task, and 2) How the overall project schedule will be impacted should be addressed. (If you are extending the rental a on piece of equipment, the duration for the extension is put on line 1).

3.0 Flow of Responsibility

A As soon as possible upon OHM's discovery of a cost or scope change or direction by Navy personnel on a proposed change, the OHM project manager should prepare and submits a WD to the ROICC.

The ROICC may elect to confirm the change with the NTR, RPM, the Engineer of Record or the Certifying engineer.

B The ROICC reviews the WD and indicates its approval status: Approved, Modified, or Rejected.

C The ROICC then forwards the WD to OHM for action as required.

D The contractor modifies the Construction Schedule, The Schedule of Values, the WBS and all reports as appropriate. OHM enters the WD in the WD log for submission in the Monthly Status Report to the Navy. OHM will track cost associated with the WD either as separate WBS or as part of an existing WBS.

E If a Modification to the Delivery Order is required, the WD(s) should be used as the basis for the request.

SAMPLING AND ANALYSIS PLAN
FOR
PHASE I, INTERIM AIR SPARGING REMEDIATION SYSTEM
AT OPERABLE UNIT 10, SITE 35
CAMP GEIGER AREA FUEL FARM
MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Atlantic Division
Naval Facilities Engineering Command
6500 Hampton Boulevard
Building A (South East Wing) 3rd Floor
Norfolk, VA 23508

Prepared by:

OHM Remediation Services Corp.
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Reviewed by:

James A. Dunn, Jr., P.E., Project Manager	Date
Sushama Paranjape, Project Chemist	Date
Gregory C. Gilles, Technical Manager	Date
Terence Whitt, Field Analytical Services Mgr.	Date

October 1997
Delivery Order 083
OHM Project No. 17536

OHM Remediation Services Corp.

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) presents, in specific terms, the policies, organization, functions, and Quality Assurance/Quality Control (QA/QC) requirements designed to achieve the data quality goals for the Construction and Monitoring at Phase I Interim Air Sparging Remediation System at Operable Unit 10, Site 35, Camp Geiger, Camp Lejeune. This work will be performed under Delivery Order 083 of Contract Number N62470-93-D-3032 for the Navy Atlantic Division (LANTDIV) at the Marine Corps Base, Camp Lejeune, North Carolina.

This SAP integrates the required components of a generic quality assurance project plan (QAPP) and a field sampling plan (FSP). This document shall be implemented by the Project Manager, Project QC Manager, Project Chemist, Field Chemist/Scientist, and Sample Technicians. Any field changes shall be approved by the Navy's Technical Representative (NTR), OHM Project Manager, and OHM Project Chemist. These changes shall be documented by the Field Chemist/Scientist and distributed to the appropriate persons as amendments to the SAP.

2.0 PROJECT MANAGEMENT

2.1 PROJECT OBJECTIVE AND SCOPE OF WORK

The scope of work for Delivery Order No. 083 is to construct and monitor an *in situ* air sparging (IAS) system at the Site 35 within Operable Unit 10 (OU10) Camp Geiger Area Fuel Farm, Marine Corps Base (MCB), North Carolina. The objectives of the IAS system are as follows:

- Assess the applicability of IAS technology in addressing shallow groundwater contamination at Site 35 by evaluating the effectiveness, implementability, and costs of a full-scale pilot treatment system
- Obtain sufficient data to afford the development of a full-scale system remedial design
- Assess the impact of air emissions on human health and the environment, and verify that air emissions will not impact the proposed highway project

Nature and Extent of Contamination

Extensive groundwater contamination was observed in the surficial aquifer along both the upper and lower monitored intervals. Fuel-related contaminants were more prevalent in the upper portion of the surficial aquifer, and solvent-related contaminants were more prevalent in the lower portion of the surficial aquifer.

Remediation Goals

In accordance with Section 121(d)(1) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 CERCLA, remedial actions must attain a degree of cleanup which ensures protection of human health and the environment. Although groundwater within the limits of the contaminant plume site is not currently used as a source of potable water, results of the human health risk assessment performed under remedial investigation (RI), and modified by a supplemental human health risk assessment performed under the supplemental groundwater investigation (SGI), indicated that the ingestion and dermal exposure to groundwater poses a risk to future residents. Groundwater remediation goals for the contaminants of concern, as identified in the human health risk assessments performed under RI and SGI, were developed as a part of the Draft Feasibility Study (Baker, 1997). These remediation goals are presented in Table 2.1.

Table 2.1 - Groundwater Remediation Goals		
Contaminant of Concern	*Remediation Level (ug/L)*	*Basis*
Benzene	1	NCWQS
cis-1,2-Dichloroethene	70	NCWQS
Ethylbenzene	29	NCWQS
Methyl Tertiary Butyl ether	200	NCWQS
trans-1,2-Dichloroethene	70	NCWQS
1,2-Dichloethene	70	MCL
Trichloroethene	2.8	NCWQS
Tetrachloroethene	0.7	NCWQS
1,1,2,2-Tetrachloroethane	0.41	Risk-based RGO (1)
Xylenes (total)	530	NCWQS
Vinyl Chloride	0.015	NCWQS(2)

Note:
(1) Based on a carcinogenic target risk level of $1x10^{-6}$. The equation used to calculate this RGO is based on guidance in USEPA Region IV Bulletin, November 1995.
(2) Remediation level may not be achievable using the best available method.

2.2 PROJECT TASK DESCRIPTIONS

The following tasks will be performed in support of the remedial actions at OU10, Site 35:

- Collection and off-site analysis of the soils to determine whether or not they can be used for backfill operations
- Collection and analysis of groundwater samples from 10 newly installed piezometers to establish baseline and to evaluate progress of the remedial activities
- Take readings of the following: (1) air injection well pressure readings, (2) water level in piezometers and air injection wells, and (3) dissolved oxygen levels in wells
- Collect and analyze soil cuttings, development water, decontamination fluids, rain water and surface run-offs collected in excavated areas, bulk soil, PPE, bio-polymer sludge, and bio-polymer liquids to determine the appropriate disposal method for each wastestream.

- Take readings of the ambient air at points surrounding IAS trench, especially between the trench and the proposed highway right-of-way, and at specific well heads.

2.3 PROJECT ORGANIZATION

The project manager is the primary focal point for control of the project activities. The project manager will be supported by the QA Management team which will provide reviews, guidance, and technical advice on project execution issues. Members of this staff will be on an "as-needed" basis to assist in smooth project execution. The project manager will be supported by the project team consisting of a supervisory, health and safety, technical, and QA/QC staff to ensure that the project is safely executed in compliance with applicable laws, regulations, statutes, and industry codes. Individuals of the project team are responsible for fulfilling appropriate portions of the project QA program, in accordance with assignments made by the project manager. The project manager is responsible for satisfactory completion of the project QA program. Specific responsibilities may be assigned by the project manager to the deputy project manager and other members of the project staff.

An organizational chart of the project team is presented in Figure 2-1.

The responsibilities of the key members in the project organization are:

Project Manager - James A. Dunn, Jr., P.E.

The project manager is responsible for the overall direction of this project executed under his supervision. He provides the managerial administrative skills to ensure that resource allocations, planning, execution, and reporting meet contract requirements. He is ultimately accountable for all work activities undertaken on this project. The global quality-related responsibilities of the project manager can include, but are not limited to, the following:

- Organization of the project staff and assignment of responsibilities.
- Understanding of contract and scope of work for a specific project.
- Communication to the project staff regarding client requirements and QA practices.
- Identification, documentation, and notification to the client and project staff and QA personnel of changes in the scope of work, project documentation and activities.

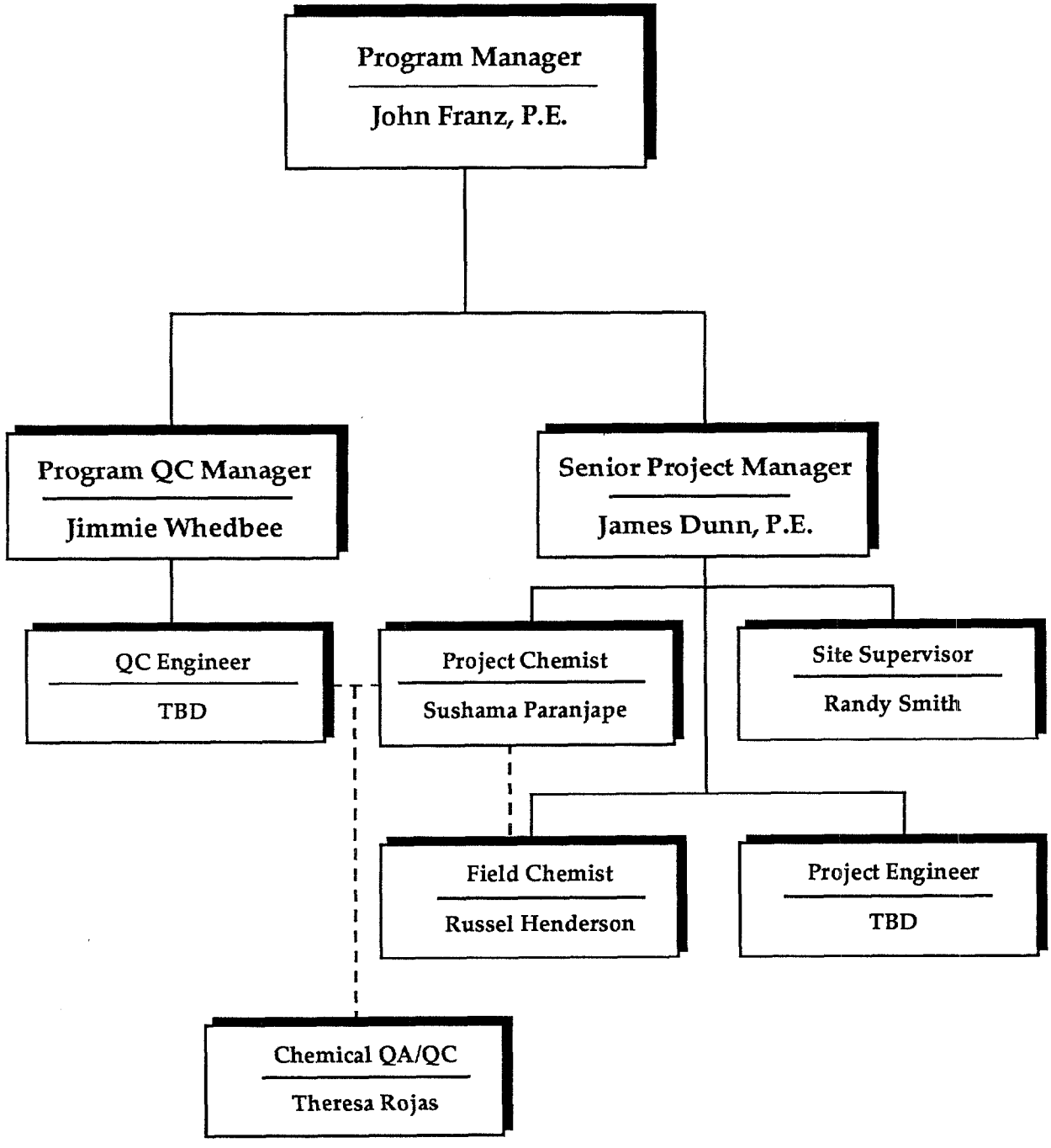

Figure 2.1

OHM Remediation Services Corp.

QC Organization Chart

- Supervision of preparation and approval of project-specific procedures, work plans, and QA project plans.
- Approval of project design bases, design parameters, drawings, and reports.
- Approval of project remedial action/construction methodologies.
- Dissemination of project-related information from the client such as design bases, input parameters, and drawings.
- Liaison for communications with the client and subcontractors. Liaison between the project staff and other internal groups.
- Decision of whether or not drawings require independent review.
- Investigation of nonconformances, notification of QA personnel, and implementation of corrective actions.
- Determination of the effect of nonconformances on the project and the appropriateness for reporting such items to the client, and providing appropriate documentation for reporting.
- Determination that changes, revisions, and rework are subject to the same QC requirements as the original work.
- Serve as final reviewer prior to release of project information.
- Approve and sign outgoing correspondence.
- Custodian of all project related documents.

Some of these responsibilities may be assigned by the project manager to the Site Supervisor, who will remain on-site throughout the project field activities.

Site Supervisor - Randy Smith

The site supervisor is responsible for the day-to-day management of this specific delivery order. He will ensure sufficient resource allocations to maintain project schedule and budget. He will provide daily feedback to the project manager on project progress, issues requiring resolution, etc. The quality-related responsibilities of the site supervisor include, but are not limited to, the following:

- Notification to the project manager if the project cannot be completed with regard to quality, schedule, or cost.
- Oversight and control of subcontractor services.
- Liaison for communications with OHM project staff and other internal groups as well as with the NTR and on-site inspector.

- Supervision of day-to-day site activities in accordance with project and program requirements.
- Preparing the Contractor Production Report.
- Preparing the Quality Control Reports.
- Initiating corrective actions for non-conformance identified on-site.

Project Chemical QA Officer - Theresa D. Rojas

The chemical QA officer is responsible for implementing the project chemical QA program. She is responsible for informing the project manager of any site-specific QA issues. Her responsibilities include, but is not limited to, the following:

- Reviewing subcontractor's QA Manuals and/or Laboratory Quality Management Plans (LQMPs) and if possible, performing audits on the labs.
- Certifying the level of QA that has been achieved during the generation of analytical data
- Initiating and overseeing all audit functions.
- Stopping work if quality objectives are not being met.
- Initiating investigations for nonconformances, identifying appropriate corrective actions, and performing follow-up audits to ensure that the corrective actions were successful.

Project Chemist - Sushama Paranjape

The project chemist is responsible for implementing the project plans and ensuring that the quality assurance and data quality objectives are being met for the project. She is also responsible for informing the chemical QA officer of any site-specific problems and for coordinating QA efforts with the contracted laboratory. Her specific responsibilities include, but are not limited to, the following:

- Determining if the project and data quality objectives are being met.
- Evaluating chemical data for technical validity and ensuring adherence to published guidelines.
- Analyzing and interpreting all subcontracted technical and laboratory results.
- Implementing QA/QC procedures.
- Assuring the continuity of chain-of-custody evidence
- Working with the QC engineer to compile and submit required QA Reports (QARs).
- Compiling, revising, updating, and submitting SAPs

- Implementing corrective actions as required by the QC engineer or chemical QC officer.
- Ongoing QA/QC training of new and current personnel.
- Reviewing laboratory invoices for completeness and accuracy.

Laboratory Coordinator - Elena Rodriguez

The laboratory coordinator is responsible for procuring a certified laboratory based on the requirements needed for the project. Her responsibilities include, but are not limited to, the following:

- Selection of qualified laboratories and control of laboratory services requests.
- Assist coordination of laboratory with field sample shipments.
- Management of laboratory data in conjunction with the project and field chemist.
- Liaison between the field and the laboratories when changes are required in the SAP and Purchase Orders.

Field Chemist -Russel Henderson

The field chemist will:

- Implement the SAP and designated QA/QC procedures.
- Oversee all field sampling activities.
- Report all QC data to the project chemist for review.
- Implement corrective actions as required by the project chemist.
- Perform on-site screening and analyses of samples, if needed.
- Fill out sample tracking forms and related analytical and QC forms and logbooks.
- Ensuring that the samples are handled, packaged, and shipped according to the SAP.
- Ensuring that the laboratory supplies the sample containers, shipping supplies, chain-of-custody records, and the required QC samples (i.e., trip blanks).

Sample Technician - TBD

The sample technician will be responsible for:

- Carrying out all sampling in accordance with approved procedures and methodologies as defined in the SAP.

- Generating field blanks, equipment rinsate blanks, and acquiring field duplicate samples as required by the SAP.
- Completing sampling logbooks, sampling forms, labels, custody seals, and chain-of-custody forms and other paperwork as required by the SAP.
- Packaging and Shipping of samples to appropriate laboratories.

2.4 DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

Data generated from those tasks described in Section 2.2 will be used to make the decisions on Phase II of the project (assess need for subsequent active remediation). Project-specific quality objectives are listed in Appendix A, Table A-2. These include the quantitation, project action, accuracy, precision, and completeness limits by which the data will be evaluated.

A Naval Facilities Engineering Service Center (NFESC)-certified or US Army Corps of Engineers-Missouri River Division (USACE-MRD)-approved laboratory will be used for all sample analyses. The laboratory will also be North Carolina-approved. A copy of the laboratory's QA Manual, statement of qualifications, and appropriate certificates of approval are kept on file in the Norcross office and are available upon request from the NTR, LANTDIV, or other regulatory agencies. A copy of the approved Sampling and Analysis Plan will be forwarded to the laboratory selected to perform chemical analysis of the samples.

All off-site samples will meet OHM's minimum requirement for the QA/QC as specified in OHM QP-650. A copy of QP-650 is included in Appendix D. On-site air measurements will be non-definitive field screening analysis. If disposal analysis is required no duplicates or rinsate blanks will be collected. All sampling and analytical activities will be in accordance with federal, state, and local regulations. A summary of the field QC sampling requirements is shown in Table A-1, "Sampling Summary" in Appendix A.

Data evaluation will be performed by the project chemist on all data before it is used. Third party data validation will not be performed on the final data. Data evaluation results will be provided in the project closeout report.

3.1 SAMPLING METHODS AND PROCEDURES

The following sections describe sampling locations, frequencies, sample matrices, and measurements of parameters of interest. Table A-1 "Sampling Summary" in Appendix A presents a summary of these items.

3.1.1 Construction of the IAS System

The full-scale air sparging pilot test system will consist of a 100-foot long air sparging trench with air injected through three risers along the trench. Air will be supplied to the well through piping from the electric air compressor located in a fenced equipment compound. An additional 10 piezometer/monitoring points will be installed to facilitate collection of data to evaluate system performance.

3.1.1.1 Soil Sample Collection

During the construction of the IAS system, excavations will be performed to install the IAS wells. All soil removed from the excavation will be transferred to the stockpile area, sampled for disposal parameters, and sent for disposal.

It is recommended that a throughly mixed composite soil sample will be collected at every 100 tons of the excavated soils. One grab sample will also be collected for the analyses of volatile organics at every 100 tons.

Soils containing less than 100 parts per million (ppm) of total organic halogens (TOX), less than 50 pm of total petroleum hydrocarbons (TPH) and less than 10 ppm of the sum of benzene, toluene, ethyl benzene, and xylene (BTEX), can be used as fill material. Soils containing concentrations greater than 100 ppm TOX and/or 100 ppm TPH, will be considered contaminated with hazardous materials and/or petroleum products.

To profile the soil for disposal, one grab and one composite sample prepared from six grab samples will be collected from the stockpile. To profile the bio-polymer sludge, one grab and one composite sample of sludge prepared from six grab samples will be collected. The grab sample for volatiles analysis will be collected using the following procedure:

1. At one random sample point within the stockpile, dig to the middle of the roll- off box using a stainless steel shovel or auger.
2. Collect a grab sample from the resulting hole using a stainless steel spoon.
3. Fill a 4 oz glass jar immediately to the top.
4. Tap the jar and fill with more of the soil sample to ensure no headspace.
5. Close the jar, label, and package the sample for shipment to the lab.

The composite sample for the remaining analyses will be collected using the following procedure:

1. At the six random sampling points, collect a grab sample using the shovel or a stainless steel spoon.
2. Place the grab samples into a stainless steel bowl.
3. Homogenize the 6 grab samples by the quartering techniques using the stainless steel spoon.
4. Fill the appropriate sample jars approximately ¾ full with the composite sample
5. Close the jar, label, and package the sample for shipment to the lab.

3.1.2 Start-up and O & M of the IAS System Measurements

During the start-up and throughout the operation and maintenance of the IAS system, the water level, dissolved oxygen, vacuum, pressure, and organic vapors will be monitored to balance, optimize, and evaluate the performance of the system. These will be performed as per the following procedures:

3.1.2.1 Water Level Measurement

It is recommended that the water levels of the piezometers and monitoring wells MW-16 and MW-22 be measured at start-up, weekly for the following 8 weeks, and monthly after that for four months. However, the frequency of measurement is at the discretion of the Technical Lead for the project. The following procedure will be used to perform the measurement:

1. Locate and uncap each well at the beginning of the task and let them equilibrate for at least 30 minutes.

2. Look for a mark at the top of the well casing (TOC) that indicates the measuring point. If no mark is found, measure from the north side of the TOC. Mark the top of the well casing. See note (a).
3. Test the water level indicator with the test button or switch on the unit (refer to the owner's manual if needed).
4. Unreel the line slowly until the unit indicates that the probe has reached the water (signaled by the tone and light). See note (b)
5. Move the probe up and down to find the precise top level of the water. Record the level to 1/100 of a foot. See note (c).
6. If the depth of the well is not known, lower the probe to the bottom and measure to 1/10 of a foot. Record the readings.
7. Reel in the probe cleaning the tape with a towel or clean rag. Stop a few feet before reaching the end of the tape and lift the probe and remaining tape from the well. Then place the probe and tape into a bucket of water and decontaminate.
8. To calculate the well volume, use the formula: Vol (gal) = Pi r^2h * 7.48, where radius (r) and height (h) are in feet and Pi =3.142.

Notes:

a. If the relative concentrations or contaminant are known from previous work, it is a good practice to start with the least contaminated well and work toward the most contaminated. This will minimize possible cross-contamination.
b. If the probe is allowed to "free fall" or if the tape is bent at a sharp angle, the signal wires in the tape can be damaged or destroyed.
c. Some tapes are marked in eighths of an inch. These readings must be converted to 1/100 of a foot units.

3.1.2.2 Dissolved Oxygen Measurement

It is recommended that the dissolved oxygen levels of piezometers and monitoring wells MW-14, 35 MW-31B, MW-26A, 35GWD-2, MW-16 and MW22 be measured at start-up, weekly for the following 8 weeks and monthly after that for four months. However, the frequency of measurement is at the discretion of the Technical Lead for the project. The following procedure will be used to perform the measurement:

1. Locate and uncap each well at the beginning of the task and let them equilibrate for at least 30 minutes. See note (a).
2. Follow the manufacturer's instructions for calibrating the instrument.
3. Lower the probe into the well at about 2-3 feet below the water level (as measured previously). See note (b).
4. Lower and raise the probe at a rate of about 1 foot per second and allow the reading to stabilize. Record the reading.
5. (If the well is too deep, collect a sample with a bailer and transfer to a large-mouth bottle. Stir the water around the probe and allow the reading to stabilize. Record the reading.)
6. Reel in the probe, cleaning the cable with a towel or clean rag. Stop a few feet before reaching the end of the tape and lift the probe and remaining tape from the well. Then place the probe and tape into a bucket of water and rinse with deionized water.

Notes:

a. If the relative concentrations or contaminant are known from previous work, it is a good practice to start with the least contaminated well and work toward the most contaminated. This will minimize possible cross-contamination.
b. If the probe is allowed to "free fall" or if the cable is bent at a sharp angle, the signal wires in the cable can be damaged or destroyed.

3.1.2.3 Pressure Measurement

Record the pressure readings at the air injection wells. The recommended frequency is once at start-up, weekly for the following 8 weeks and monthly after that for four months. However, the frequency of measurement is at the discretion of the Technical Lead for the project.

3.1.2.5 Organic Vapor Measurement

In order to expedite system start-up, balancing, and optimization, a flame ionization and photoionization detector (FID/PID) will be used to obtain organic vapor measurements and evaluate system performance. A Foxboro TVA 1000 Vapor Analyzer with an FID (0-50,000 ppm range) and PID (0-2000 ppm range) or equivalent will be used to delineate the methane from the analytes of concern. The FID/PID will also be used to monitor the system during the

O&M phase. Analyte-specific Drager tubes can also be used to obtain concentration measurements of individual compounds.

Measurements can be obtained from the piezometer well heads, and area surrounding IAS trench. Ambient air samples will be collected once at start-up, weekly for the following 8 weeks and monthly after that for four months. The frequency of sampling is at the discretion of the Technical Lead for the project. The ports will be sampled using the following procedure:

Summa Canister Sampling

Samples from P-1S and P-2S piezometers will be collected with SUMMA Canisters for T-14 analysis. Other analysis (drager tubes, field OVA/FID, LEL) may require Tedlar Bag samples. Procedure for the SUMMA canisters and for Tedlar bag sampling and analysis are summarized below.

1) Connect the canister to the sampling port
2) Open the valve on the port and the canister
3) Monitor the pressure gauge on the canister
4) Close the valves when the canister is at atmospheric pressure

Procedure for Tedlar Bag Sampling

1. Connect a piece of ¼ inch Teflon tubing to the sample port
2. Allow the probe and tubing to purge for one minute. Then connect the other end of the Teflon tubing to the Tedlar bag
3. Open the valve on the bag and allow the sample to flow into the bag. See note (a).
4. Close the bag's valve when it is ¾ full.
5. Analyze the bag with the FID/PID organic monitor and indicator tubes. (Procedures outlined below).

Note:

a. If the sample port does not have the pressure to inflate the bag, a vacuum box will be required. If this is the case, follow the manufacturer's instructions. A Supelco 2 Liter Air Sampler Operations Manual is enclosed in Appendix C.

Procedure for Analysis of Bag Samples using an Organic Vapor Analyzer

1. Calibrate the FID/PID per manufacturer's instructions.
2. Connect the Tedlar bag to the FID/PID probe using ¼ inch Teflon tubing. Record the concentration reading.
3. If the sample is over the range of the FID/PID (usually 10,000 ppm), connect the dilution probe to the FID/PID tip as per the manufacturer's recommendations and analyze the sample. Record the results and final dilution factor. See note (a).
4. Evacuate the sample bag and purge three times with clean air or nitrogen.
5. Test the bag for cross-contamination with the FID/PID before reuse.

Note:

a. The dilution probe kit has several dilution orifices. Choose the dilution ratio that best meets the sample levels.

Procedure for Analysis of Bag Samples using Indicator Tubes

1. Test the indicator tube bellows pump by inserting an unopened tube and squeeze the pump. After releasing, the position of the pump body should not change within one minute. To test the suction, squeeze completely and release. The pump should open instantly. If the pump fails any of these test, replace.
2. Break the ends off the tube.
3. Place the tube into the bellows pump fitting with the arrow pointing into the pump (with the air flow).
4. Squeeze the bellows and let it recharge.
5. Repeat per the tube instructions and remove the tube.
6. Read the concentration from the tube and record along with the number of pumps. Also record the manufacturer and lot number of the tube used.

3.1.3 System Start-Up and O&M of IAS System

1. Startup vacuum truck by activating PTO switch in cab; (note: vac truck will idle at 750-1000 RPM and vacuum will build)

2. Ensure vac truck pump is set for vacuum operations and not pressure

3. Open the dilution air valves completely on each of the individual well head assemblies

4. Close any sampling ports on inlet/outlet of piping manifold

5. Allow vacuum to build to 8-10 "Hg vacuum as the truck idles; read the vac gauge on the truck and record time

6. Open flow control valve (ball valve at the manifold) on the first AFVR well to be put on-line while closing others

7. Begin bringing on the first AFVR well, setting the entrainment hose at the oil/water interface; note slurping or entrainment action

8. Tighten down well seal, close bleed valve, record vacuum

9. Repeat process for each of the AFVR wells

10. Once all wells are on-line, note and record the blower RPM, vacuum level at vac truck, and vacuum level at each well head

11. The throttle control on the vacuum pump can be used if necessary to increase RPM of the blower and thus increase flow

12. The dilution air valve on the vac truck can be opened to control vacuum at the vac truck

3.1.4 Groundwater Sampling to Evaluate System Performance

In order to evaluate the IAS system's remedial activities, the following piezometers will be sampled:

Shallow Piezometers, 1-inch diameter, 15 feet depth, screened interval 5-15 feet

P-1S P-4S
P-2S P-5S
P-3S

Deep Piezometers, 1-inch diameter, 40 feet depth, screened interval 35-40 feet

P-1D P-4D
P-2D P-5D
P-3D

The newly-installed wells will be assigned temporary IDs. The base will assign permanent IDs at a later time. All 10 piezometers and monitoring wells 35, MW-31B, MW-14 and MW-26Awill be sampled prior to IAS start-up to determine the baseline contamination.

To evaluate system performance, monitoring well 35 MW-31B, MW-14 and MW-26A will be sampled monthly for 6 months, and the 10 piezometers will be sampled weekly for weeks 2 through 8, and then monthly for four months after 8 weeks.

Prior to sampling, all wells will be purged with a minimum of three well volumes or until the pH, temperature, and specific conductivity readings have stabilized to within 10 percent between consecutive readings. Purge water will be collected and disposed with the other liquid waste on site. Samples from the wells will be collected using disposable or dedicated Teflon bailers. The volatile sample is always collected first followed by the semi-volatile, then metal samples. Standard Operating Procedure (SOP) QP-618 included in Appendix C provides general information and procedures for collecting samples with a bailer.

Non-disposable sampling equipment will be thoroughly cleaned between samples using the decontamination procedures described in Section 3.5. Field sampling personnel will wear disposable sampling gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination. Other PPE may be required for sampling as per the SSHP. Contact with the sample should be avoided to minimize the potential for cross-contamination.

3.1.5 Liquid Waste Sampling

The liquid waste for this site will be collected and held in a frac tank until samples are analyzed and disposal can be arranged. Liquid waste will consist of: (1) decontamination water, (2) well-development water, and (3) water from degrading bio-polymer sludge. At least one sample per frac tank will be collected either through the top port of the tank using a sludge judge or via a tap. It is best to collect the sample through the top port of the tank because this method collects a representative composite sample of the tank contents. The SOPs for using a sludge judge and sampling from a tap are included in Appendix C.

3.2 SAMPLE IDENTIFICATION

The samples collected on-site will be provided with a unique sample designation. The number will serve to identify the site, location, and specific sample identification number. The sample designation format will be as follows:

CLJXX-NNN-DD
where:
CLJ = Camp Lejeune
XXX= Delivery Order for the project (83)
NNN = Sequential number starting at 001
DD = QC identifier

If sample is a field QC sample, the following designations will be added as a suffix, with sequential number increasing with every new QC sample collected. For example, CLJ083001RB, CLJ083002RB and so on.

FB - Field Blank
RB- Equipment Rinsate Blank
TB - Trip Blank
(Duplicates must not to be identified to the laboratory)

Sample location information will be included in the sample description area of the COC. Sample sequential numbers are not to be duplicated. Duplicate samples will be sent to the off-site laboratory blind. The latest OHM COC has been designed so that the cross-reference of the duplicate to the original sample can be included on the last page of the COC that does not go to the laboratory.

3.3 SAMPLE PRESERVATION AND HOLDING TIMES

Samples collected for off-site analyses will be sent to the laboratory within 24 hours after collection to ensure that the most reliable and accurate answers will be obtained as a result of the analysis. The holding time begins from the date and time of collection in the field.

All environmental and treatment system samples, except for aqueous samples for metals, will be preserved to a temperature of 4°±2°C prior to shipment to the analytical laboratory, using ice or refrigeration. This temperature should be maintained during shipment by placing ice in leak-proof containers, and placing it above and below the sample containers. Other sample preservation requirements and holding times applicable to the sample matrix and analyses are listed in Appendix A, Table A-1.

3.4 FIELD QC SAMPLES

The appropriate number of field QC samples, as specified in the NFESC, 1996 document will be collected during this project. These samples will include field blanks, equipment rinsate blanks and field duplicate samples. These samples will be collected at the following frequencies and analyzed for the parameters listed in Appendix A, Table A-1:

- Field Blanks (Ambient Blanks) – Field blanks , sometimes referred to as ambient blanks, are samples of contaminant-free media (reagent grade water) witch are prepared at the site and handled in the field in the same manner as all other field samples. Field blanks are collected during the course of field sampling and, to the extent possible, in the actual sampling locations. Field blanks are collected by placing contaminant-free medium (reagent grade water) in the same type of container as field sample. Field blanks are preserved and stored in the same manner as field samples. At a minimum, one field blank per contiguous

site from each sampling event is collected and is analyzed for those interfering contaminants that could potentially be present in ambient air at the sampling site. Approximate number of field blank samples planned to be collected is presented in Appendix A, Table A-1.

- Equipment Rinsate Blank – Equipment rinsate blanks are the final analyte-free water rinse from equipment cleaning collected daily for each matrix sampled. An equipment rinsate blank is collected in the same type of sample containers, and in all other ways is handled in the same manner as other field samples. The equipment rinsate blank must be collected during the sampling event (after collection of at least one field sample) after the sampling equipment has been decontaminated and prior to collection of the next field sample. All equipment that comes into contact with field samples must be decontaminated prior to use. The use of disposable equipment is acceptable, but does not obviate the requirement for decontamination prior to use, or the requirement for collection of equipment rinsate blanks. Equipment rinsate blanks for disposable equipment are collected by passing contaminant-free medium through or over the decontaminated equipment. One equipment rinsate blank is collected per day, per sampling event for each matrix sampled that day. Equipment rinsates are analyzed for the same parameters as the sample collected that day. Approximate number of equipment blank samples planned to be collected is presented in Table A-1, Appendix A.

- Field Duplicate – Duplicates for soil samples are collected, homogenized, and split. All samples except volatiles are homogenized and split. Volatiles are not mixed, but select segments of soil are taken from the length of the core and placed in 4 oz glass jars. The duplicates for water samples are collected simultaneously. Field duplicates must be collected at a frequency of one sample per day per matrix or 10% of the field samples per matrix. All the duplicates should be sent to the primary laboratory responsible for analysis, along with the samples. Approximate number of field duplicates planned to be collected are presented in Table A-1, Appendix A. Duplicates will be sent to the off-site laboratory blind.

- Trip Blank -- Trip blanks are defined as samples which originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile samples. One trip blank should accompany each cooler containing aqueous and non-aqueous volatile samples, should be stored at the laboratory with the samples, and analyzed by the laboratory. Trip blanks are only analyzed for volatile organic compounds and may not be

required for this project if disposal samples are not taken. Approximate number of trip blank samples planned to be analyzed is presented in Table A-1, Appendix A.

3.5 DECONTAMINATION

All sampling equipment (hand augers, spoons, stainless steel/glass mixing bowls, etc.) will be decontaminated before sampling commences, between each sample location, and prior to leaving the site. The procedures for decontamination of equipment according to NEESA 20.2-047B are as follows.

1) Remove gross contamination by scraping or brushing.
2) Clean with tap water and phosphate-free laboratory detergent (liquinox), using a stiff brush to remove all surface contaminants.
3) Rinse thoroughly with tap water.
4) Rinse with 1:1 nitric acid (HNO3) metals grade (only if samples are analyzed for metals).
5) Rinse thoroughly with tap water.
6) Rinse thoroughly with deionized/distilled water.
7) Rinse twice with reagent grade isopropanol or methanol.
8) Rinse thoroughly with organic-free water and allow to air dry. (Do not rinse with deionized/distilled water. If organic-free water is not available, allow equipment to air dry.)
9) Wrap equipment with aluminum foil prior to storage or transportation to sample locations.

Decontamination fluids will be collected in properly labeled 55-gallon drums, and staged in a secure area until final disposal unless other arrangements are made.

3.6 CROSS-CONTAMINATION MINIMIZATION

Cross-contamination is the introduction of contaminants into the sample through the sampling and/or sample-handling procedures. It can cause an otherwise representative sample to become non-representative. The most important means of minimizing cross-contamination are as follows:

- Sampling expendables, i.e., sample gloves, pipettes, string, dip jars, etc., must not be reused. Used expendables should be labeled so they are not confused with non-contaminated trash
- Minimum contact should be made between the sampler and the sample medium. For example, a sampler should not touch the sample during while loading the sample in the container.
- Sample collection activities should proceed progressively from the least contaminated area to the most contaminated area.
- Sampling equipment should be constructed of Teflon, stainless steel, or glass that has been properly precleaned for collecting samples. Equipment constructed of plastic or PVC should not be used to collect samples for trace organic analyses.
- Any tools used in sampling must be carefully decontaminated prior to first use and after each use.
- Activities that could contaminate samples are prohibited in the sample handling and preparation area. These activities and the possible contaminants include:

Activity	*Possible Contaminants*
Smoking	Poly Aromatic Hydrocarbons
Spraying for insects	Pesticides, oils, solvents
Spraying for weeds	Herbicides, oils, solvents
Refueling	BTEX, hydrocarbons
Painting and paint stripping	Solvents

3.7 SAMPLE LOG BOOK

It is necessary for the sampling crew to maintain daily field notes. Items that must be included are sampling protocol, any changes to the procedures, meetings, instructions, safety precautions, personnel protection, and activities pertaining to the samples. The person taking notes must be knowledgeable enough about these activities to know which details are important.

- Repetition of information recorded in other permanent logs should be avoided, but enough should be recorded to present a clear and accurate picture of technical activities. At a later

date, should a question arise concerning a specific event or a procedure used, it will be answered from these notes. The following information should be logged into the logbooks and/or database:

- Date and time of sampling
- Sample number, locations, type, matrices, volumes, sample ID and descriptions, type and number of sample containers, names and signatures of individuals performing sampling tasks, Chain-Of-Custody (COC) and air bill numbers, preservatives, and date samples were sent
- Name of laboratories and contacts to which the samples were sent, turn around time (TAT) requested, and data results, when possible
- Termination of a sample point or parameter and reasons
- Unusual appearance or odor of a sample
- Measurements, volume of flow, temperature, and weather conditions
- Additional samples and reasons for collecting them
- Levels of protection used (with justification)
- Meetings and telephone conversations held with LANTDIV, NTR, regulatory agencies, project manager, or supervisor
- Details concerning any samples split with another agency
- Details of QC samples collected

These notes must be dated and signed (each page) for validity. All logbooks will be bound and pre-numbered. All log book entries will be made with indelible ink and legibly written. The language will be factual and objective. No erasures will be permitted. If an incorrect entry is made, the error will be crossed out with a single strike mark, initialed, and dated. When audits are performed, the auditor's remarks and decisions must also appear in these notes. These audits should be followed up by written report submitted by the auditor, including opinions and conclusions. A copy of this report should be placed in the project file and one copy kept in the sampling file for easy reference. This information will also be entered in to the data base program that been prepared for the site. It will be entered daily by the field chemist or sample technician. This person will be the point of contact for all sampling and analytical information. Report outputs from the database is an acceptable substitute for the sample logbook. In addition logbook standard forms are used to record pertinent data. A drum inventory log is included in Appendix B to record information on IDW drums.

3.8 SAMPLE LABELS

Any samples placed into a sample container will be identified by a sample label. Sample label will identify the following information:

(1) PROJECT NUMBER
(2) DATE- Month, day, year
(3) TIME- Military time
(4) SAMPLE NUMBER- See Section 3.2 for designations
(5) SAMPLE DESCRIPTION
(6) SAMPLER- Sampler's name
(7) PRESERVATIVES
(8) ANALYSIS REQUIRED- See Appendix A, Table A-1

The information described above should be printed neatly using an indelible marker. After the sample is taken and the label is securely attached, the sample is logged into the sample log book. An example of a sample label is presented in Appendix B.

3.9 CUSTODY SEALS

Custody seals are narrow strips of adhesive tape of glass fiber used to demonstrate that no tampering has occurred. They may be used on sampling equipment, sample transport containers, and individual sample containers. They should be signed and dated by the sampler and placed from one side, across the top, and to the other side of the sample container or across the openings of the sample transport containers. An example custody seal is presented in Appendix B.

3.10 CHAIN-OF-CUSTODY PROCEDURES

In order to generate legally defensible data of the samples collected throughout the project, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. To maintain and document sample possession, chain-of-custody procedures are followed as described below:

A sample is under your custody if:

(1) It is in your actual possession, or
(2) It is in your view, after being in your physical possession, or
(3) It was in your physical possession and then you locked it up to prevent tampering, or
(4) It is in a designated secure area

An example of a COC form is presented in Appendix B. The following information is required on the COC:

(1) Project Name
(2) Project Location- City and State in which the project site is located
(3) Project Number
(4) Project Contact-OHM employee responsible for overseeing the sampling operation. This person should be the individual to whom questions are to be directed or verbal results are given (Project Manager, Site supervisor, or Project Chemist)
(5) Site Telephone Number- The telephone number of on-site office trailer or number where person responsible for samples can be contacted.
(6) Sample Date-Month, Day, Year
(7) Sample Time- Military time
(8) Sample Identification- Sample number and location
(9) Sample Type-Designation of sample as grab or composite
(10) Sample Description- Sample matrix, and a brief description of the sampling location
(11) Sample Preservation- Preservatives used
(12) Analytical Parameters Requested -- Analytical parameter, method numbers, and specific compounds of interest, if applicable.
(13) Air bill Number
(14) Laboratory -- Laboratory where samples are to be sent
(15) Laboratory Phone -- Telephone number of laboratory
(16) Laboratory Contact -- Contact person for laboratory
(17) Relinquished By -- Signature of sender (OHM)
(18) Date Relinquished -- Date samples were relinquished
(19) Accepted By -- Signature of acceptor

(20) Date Received -- Date samples were accepted

(21) Turnaround Time -- Turnaround times requested or date the results are required from the lab

(22) Sampler's Signature -- Signature of sampler

The COC will be sealed in a ziploc bag and taped in place on the underside of the top of the sample transport container (cooler).

3.11 PACKAGING, HANDLING, AND SHIPMENT OF SAMPLES

Samples will be packaged as to minimize shifting of the samples during shipment. An absorbent, such as vermiculite or kitty litter, will be placed at the bottom of the shipment container in order to absorb any liquids in the event of sample breakage. All samples will be individually placed into appropriately sized ziploc bags and sealed.

Samples, which must be kept at 4°±2°C, will be shipped on ice in insulated containers. Ice will be placed in a container such as a ziploc bag and sealed so that water will not fill the shipping container as the ice melts. The ice will be double bagged to insure the ice does not leak. Aqueous samples for metals analysis, except hexavalent chromium, shall not be shipped or stored under refrigeration.

Samples will be shipped via an overnight shipping agency to the appropriate laboratory. IATA regulations will be followed as they are more applicable to OHM's method of sample shipment. Instructions for filling out shipment documentation are included in Appendix B. These instructions are for shipping samples with unknown or limited hazards. All information will be entered as directed. No changes or substitutions to these instruction will be made irrespective of their significance. A copy of the OHM sample shipping label is included in Appendix B.

4.0 DATA ACQUISITION

4.1 ANALYTICAL METHOD REQUIREMENTS

Analytical requirements for this project are listed in Appendix A, Table A-1. All samples will be analyzed according to USEPA SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods whenever possible. Alternative methods of analysis from other sources (ASTM, NIOSH, Standard Methods, etc.) may also be used.

Soil samples and air samples will be screened using a FID organic hydrocarbon analyzer. The procedures for these non-standard analysis have been included in Section 3 discussions.

4.2 QUALITY CONTROL REQUIREMENTS

Project Quality Control (QC) requirements for precision, accuracy, completeness, and quantitation limits are listed in Appendix A, Table A-2. QC procedures and acceptance limits must be met as specified in the individual methods. In addition, the laboratory must meet the specification and requirements as described in the NFESC, 1996 document.

4.3 INSTRUMENT TESTING, INSPECTION, AND MAINTENANCE

Proper maintenance is critical to the performance of minimization of downtime of all equipment, whether it be for measurement or support. Inspection will be performed , at a minimum, prior to use of the instruments. Preventive maintenance will be performed as recommended by the manufacturer of the respective equipment. All routine maintenance and major repairs performed on field screening or analytical equipment will be recorded in bound maintenance logbooks that have been specifically designated for that instrument. Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent use, or will be tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated or completely replaced.

4.4 INSTRUMENT CALIBRATION

All calibrations on field instruments will be performed , as a minimum, on a daily basis. Every calibration will be recorded in the maintenance logbook for each instrument. Quality

control check standards from a separate source will be used to check initial calibration, and acceptance and rejection criteria.

Monitoring instruments, such as the FID/PID, O2/LEL meter, Monitox, etc. will be calibrated as specified in the manufacturer's instructions and the HASP. Off-site analytical instruments will be calibrated according to the method specifications and the laboratory's QA Manual.

5.0 DATA MANAGEMENT

Data management is the system by which data is reduced, reviewed, validated, reported, distributed, and finally archived. The criteria in this system are designed to meet the project objectives.

5.1 LABORATORY DATA REDUCTION

Data reduction includes the identifications and calculations necessary to convert the raw instrument readings to the final reported compounds and their respective concentrations.

Responsibilities of Analyst

Each analyst is responsible for converting raw data into reportable values. These specific duties include:

- Proper identification of the analyte
- Generation of calculations
- Checking associated calibrations to ensure support of data
- Associated QA/QC checks are supportive of data
- Associated documentation is complete and accurate in respective log books
- Associated chromatograms and strip chart recordings are labeled with data, instrument number, run parameters and analyst

5.2 LABORATORY DATA VALIDATION

All data generated for the project within the laboratory will be extensively checked for accuracy and completeness. The data validation process consists of data generation, reduction, and three levels of review.

The analyst who generates the raw data has the prime responsibility for the correctness and completeness of the data. All data generated and reduced will follow protocols specified in the laboratory SOP. Each analyst reviews the quality of his work based on an established set of guidelines. The guidelines are:

- Sample preparation information is correct and complete
- Analysis information is correct and complete

- The appropriate Standard Operating Procedures have been followed
- Analytical results are correct and complete
- Analysis is performed within prescribed holding times.
- QC samples are within established control limits
- Blanks are within appropriate QC limits
- Special sample preparation and analytical requirements have been met
- Documentation is complete

The next level of review is performed by the section supervisor or data review specialist. The review is structured to ensure that:

- Calibration data are scientifically sound, appropriate to method, and completely documented.
- QC results are within established limits.
- Reporting units are consistent with the method and the matrix.
- Quantitative results are correct.
- Data results are consistent with information on the COC.
- Documentation is complete.
- The data is ready for incorporation into a final report.
- The data package is complete and ready for data archive.

The second level of review is structured to ensure all calibration data and QC sample results are reviewed and all of the analytical results from 10 percent of the samples are checked back to the bench sheet. If no problems are found with the data package, the review is complete. If problems exist, an additional 10 percent is reviewed, the process continues until no errors are found or the package has been reviewed in its entirety.

The final level of review by the laboratory comes from the program administrator or laboratory QA Officer. He/she reviews the report to ensure that the data meets the overall objectives of the project.

Once the data has been validated, it is ready for report production. The report will contain:

- Description of sample types
- Tests performed, problems encountered during testing

- Dates sampled
- Date received
- Date extracted
- Date analyzed
- Analytical results
- Reportable limits
- QC information: percent recovery, relative percent difference, control limits, blanks analyses, matrix spikes, and other additional special QC information
- Qualifiers for data falling outside of QC limits
- Methodology
- Name of the analyst
- Signature of laboratory representative
- Dual column confirmation results
- Calibrations (when requested)
- Instrument performance checks (when requested)
- QC Batch number

The report from the laboratory will be paginated and will also include a copy of the original COC for the samples analyzed.

5.3 PROJECT DATA REVIEW

Project Chemist Data Review Responsibilities

The project chemist is responsible for initial review of the data from the laboratory. This review includes:

- Verifying that all requested data are reported
- Verifying that samples are analyzed according to the contract specified method
- Verifying that all analytes requested are reported
- Verifying that soil sample results are reported on dry weight basis
- Verifying that holding times are not exceeded
- Verifying that matrix spike, matrix spike duplicate, and surrogate recoveries fall within the laboratory's acceptable criteria
- Reviewing blank data for contamination

- Reviewing field quality control results for inconsistencies
- Verifying that the data generated meet the project Data Quality Objectives
- Verifying that the calibrations meet the criteria specified by the methods or data validation quidelines.

The project chemist is responsible for informing the Project Manager and Project Chemical QA/QC Officer of any laboratory and/or sampling deficiencies or issues. These issues and subsequent decisions will be documented on the data evaluation report produced by the Project Chemist for each data package.

Project QC Engineer Data Review Responsibilities

The Project QC Engineer is responsible for interfacing with the project chemist, project manager, and the laboratory's QA Officer to resolve any QA/QC issues affecting the data. He/she is also responsible for finalizing any QA/QC issues with the laboratory and/or the project chemist. This includes obtaining a corrective action from the parties involved.

5.4 DATA REPORTING

The preliminary data will be faxed to the project chemist. This data may or may not have undergone the full laboratory review process and may contain errors and discrepancies. Prior to the use of data results for any decisions, the data will be reviewed by the project chemist and assessed against the project goals and data quality objectives. A copy of the preliminary data, including review comments from the project chemist will be submitted to the site and/or the project manager.

The hard and final copy data will be evaluated by the project chemist and assessed against the project goals and data quality objectives. Any errors, discrepancies, and nonconformances will be brought to the laboratory's and project manager's attention.

When QA issues have been satisfactorily settled and data evaluation has been completed, the project manager may release the data to the client and/or regulating agencies.

5.5 DATA STORAGE AND ARCHIVE

After OHM has completed its work for the project, all documents generated will be assembled in the project file. Individuals may retain clean (no handwritten comments) copies of documents for their personal files but only after personally verifying that the original or similar copy is in the project file. The project manager/supervisor is responsible for ensuring the collection, assembly, and inventory of all documents relative to the project at the time the objectives are met. The file then becomes accountable. Any records leaving the file must be signed out.

When a contractor has completed the project objectives, all file documents are reviewed and submitted to the central file. The project file contains the following document classes:

A. Project logbooks
B. Drum logs and other forms
C. Sample identification documents
D. Chain-of-custody records
E. Analytical logbooks, laboratory data, calculations, graphs, etc.
F. Correspondence
   - Inter-office
   - Client
   - Regulating agencies
   - Record of confidential material
G. Report notes, calculations, drafts
H. References, literature
I. Sample (on-hand) inventory
J. Check-out logs
K. Litigation documents
L. Miscellaneous – photographs, maps, drawings, etc.

Once deposited in the file, documents must be checked out. The final report is usually generated by use of computer. A back-up copy of the report on diskette is filed along with the project file. The original report remains in the hard drive of the computer until such a time is required to download it on a diskette. This diskette is also archived. All information under the

corresponding project number is maintained in the archive system for five years. All archives are accessed by the archives file master list which is maintained in a separate location from the archives.

6.0 DATA ASSESSMENT PROCEDURES

Reliability in analytical determination is maintained through strict adherence to quality control procedures. Procedures are designed to control both the accuracy and precision of analytical results. For the validation of the data, a known method spike is routinely analyzed to ensure the accuracy of results. The procedure is to run the standard QA/QC and sample analysis with each lot of samples sent to the laboratory. If more than ten individual analyses are made, additional standards will be analyzed at a rate of one standard per ten analyses. Some procedures call for the use of either a surrogate spike or the standard addition of a known quantity of the analyte to a split of the sample being analyzed.

Control charts will be prepared using an estimate of the spike recovery obtained from the literature or determined by repeated analyses run in the laboratory. Each time the analyst runs a method spike, the results is entered on the control table. If a standard addition technique is used, a plot of instrument response versus added analyte concentration is made in order to determine analyte concentration in the original sample. These are further explained in the laboratory's QAM.

Replicate analyses will be performed on at least 10 percent of the samples processed by the laboratory. A record of the precision of most analyses is kept by calculating and plotting the industrial statistic I (which is equivalent to the coefficient of variation). Blanks are also run with each batch of samples or individual sample analyzed regardless of the level of certification of the data.

The purpose of spikes, blanks, and replicates is to provide a sound scientific basis from which the degree of certification of the resultant data can be objectively concluded. These are not management decisions, but follow naturally from the results of the above QC procedures.

6.1 ACCURACY

Data accuracy is a reflection of the efficiency of the analytical procedure. It is determined by use of spiked samples and standard reference materials or laboratory control samples performed at the rate of one set every 20 samples. A control chart is generated using historical laboratory data where warning and control limits are established to assess data accuracy.

The accuracy (check standards) samples will have concentration values of the mid-standard. During analysis, a minimum of 10 percent of samples are accuracy samples. The accuracy samples are staggered through the analysis, not placed one after another. After a minimum of seven accuracy samples are analyzed, the percent recovery is calculated for each sample.

The accuracy criteria is determined by calculating the standard deviation of seven or more percent recovery values and setting the upper and lower control limits using the following equations:

Upper control limit = p + 3 SD
Lower control limit = p - 3SD

Where:
p = Average percent recovery
SD = Standard deviation

After the standard deviation, for the seven or more samples has been calculated, the accuracy control limits are generated and are then used to determine if the analysis is out of control. This is done by checking the results against the control limits. If any values are above the upper control limit or below the lower control limit, all sample results after the last qualifying accuracy sample must be repeated or discarded. If seven consecutive values fall below the lower control limit, new limits are calculated using the new accuracy check values. If the values fall between the upper and lower limits, then conditions are reported as "within limits."

6.1.1 Recovery Control

Recovery control is necessary to determine if the sample matrix is interfering with the constituent being analyzed. A minimum 5 percent of samples will be recovery check samples (matrix spikes). Samples involving different types of matrices will have at least one recovery check sample for each matrix.

Control limits will be determined for each matrix, determining the deviation for seven or more percent recovery values.

6.2 PRECISION

Duplicate and replicate samples analyzed by the laboratory assess the precision of the sampling effort. Control limits for duplicate/replicate RPDs are listed in Appendix A, Table A-2. Once a sufficient amount of replicate data becomes available, field precision control charts are constructed similar to the laboratory precision charts. For any given concentration, the mean and the standard deviation(s) of the replicates are calculated. Data from each sample set are pooled with the previous sample sets to generate control and warning limits for the next set. Control and warning limits for water samples are set at ± 2s and ± 3s, respectively. Control limits for solid samples are more liberally established due to matrix heterogeneity. Data outside any control limit are subject to QA review.

Precision is based upon the results of the relative percent differences as calculated from the percent recoveries of the matrix spike and duplicate samples. The control limits for precision is based on historical laboratory data.

MS and MSD samples on a per batch or a minimum frequency of 5 percent are analyzed to assess precision. Duplicate results are compared and the relative percent difference (RPD) is then determined. The RPD will be entered into the laboratory's data system and will be used to define the precision of the analysis. Minimum limits are listed in Appendix A, Table A-2.

6.3 COMPLETENESS

The field supervisor must ensure all sites are sampled for all the specified analyses, that sufficient sample volume has been provided to complete those analyses, and that all of the QA samples have been included with each sample set. The goal for completeness for each sample set shipped to the laboratory is 100 percent. Minimum limits are listed in Appendix A, Table A-2.

Completeness is expressed as the percentage of the amount of valid data obtained to the amount of data expected. For a set of data to be considered complete, it must include all QC data verifying its accuracy and precision.

If samples analyzed do not meet all QC requirements in terms of accuracy and precision for any specific parameter, the sample preparation and analysis will be repeated pending adequate volume.

6.4 CRITERIA FOR REJECTION OF OUTLYING MEASUREMENTS

There are many statistical tests for rejection of outlying data points obtained from a set of measurements from a single population. A test recommended in "Statistical Manual of the Associate of Official Analytical Chemists," 2nd Edition, W. J. Youden and E. H. Steiner, 1975, pg. 86, is the Dixon Test. This test is not dependent on the distribution of the data and can be used for as few as three measurements. A more complete description for this broadly applicable test can be found in the referenced text.

Another reference is the USEPA National Functional Guidelines for Data Validation of Organics and Inorganics. Also, specific programs may have quality objectives with criteria for rejection of outlying measurements.

6.5 METHOD DETECTION LIMITS AND PRACTICAL QUANTITATION LIMITS

Method detection limits (MDLs) must be established by the laboratory. This should, at a minimum, be established on a yearly basis. MDL is the minimum concentration of a substance that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero.

Practical quantitation limit (PQL) is the lowest level that can be reliably determined within specified limits of precision and accuracy during routine laboratory operating conditions. The PQLs are generally 5-10 times the MDL. The PQL is the most applicable limit of reporting for this program.

6.6 LABORATORY AND FIELD CONTAMINATION

It is not unusual to find the following analytes at trace levels in the samples:

- Methylene chloride

- Acetone
- Freon (1,1,2-trichlorotrifluorethane)
- Bis(2-ethylhexyl)phthalate
- Hexane
- Isopropanol
- 2-Butanone

These are common solvents used in the field and in the laboratory.

In order to fully evaluate data containing trace levels of these contaminants, one must have data from trip blanks, field blanks, equipment blanks, and all applicable laboratory blanks for that batch of samples.

The determination on the use of the data will be made during the Data Validation process.

7.0 PERFORMANCE AND SYSTEM AUDITS

Audit is defined as systematic check to determine the quality of operation of field and laboratory activities. It is comprised of the following:

- Performance audit
- System audits

These include a detailed review of each operating component of the network. Auditing will ultimately assist in determining if each element within a system is functioning appropriately per the QA program requirements.

7.1 FIELD PERFORMANCE AUDITS

Field performance audits are performed on an ongoing basis during the project as field data is generated, reduced, and analyzed. All numerical analyses, including manual calculations are documented. All records of numerical analysis are legible, of reproduction quality, and supporting to complete permit logical reconstruction by a qualified individual other than the originator.

Other indicators of the level of field performance are the analytical results of the blank, duplicate, and replicate samples. Each blank analysis is an indirect audit of effectiveness of measures taken in the field to ensure sample integrity. The results of the field duplicate and replicate analysis is an indirect audit of the ability of each field team to collect representative sample portions of each matrix type.

7.2 FIELD SYSTEM AUDITS

System audits of site activities are accomplished by an inspection of all field activities by the Project Chemical QC Officer. This audit is composed of comparisons between current field practices and standard procedures. The following is a list of criteria to be used in the evaluation of field activities:

- Overall level of organization and professionalism
- All activities conducted in accordance with work plan
- All procedures and analyses conducted according to procedures outlined in this document

- Sample collection techniques versus the site sampling and analysis plan
- Level of activity and sample documentation
- Working order of instruments and equipment
- Level of QC conducted by each field team
- Contingency plans in case of equipment failure or other event preventing the planned activity from proceeding
- Decontamination procedures
- Level of efficiency which each team conducts planned activities at the site
- Sample packaging and shipment

After the audit, any deficiencies are discussed with the field staff, and corrections are identified. If any of these deficiencies might affect the integrity of the samples being collected, the QA Officer informs the field staff immediately, so corrections can be made. The field performance audit will be conducted at the start of the project, one before the end of the project, and as directed by the project manager. OHM will also submit to all requests by regulatory agencies, or other clients for external field systems audits.

7.3 LABORATORY PERFORMANCE AUDIT

The laboratory performance audit verifies the ability of the laboratory to correctly identify and quantitate compounds in blind check samples submitted by an auditing agency. If the laboratory participates in Performance Evaluation (PE) programs such as USEPA WS/WP studies, AIHA, PAT studies, etc., results from these studies will be generally acceptable by OHM. However, during the course of the project, it may be necessary for the Project QA/QC Officer to send PE samples to the laboratory to evaluate specific parameters.

The contracted laboratories will undergo performance audits throughout the project consisting of field QC samples. Occasionally PE samples will be supplied by the client or external organizations which will be spiked with the same analytical parameters that are being investigated on site. External laboratory performance audits by auditing agencies such as the USEPA, USACE-MRD, DOD, NFESC, etc., are not routinely scheduled. However OHM and its subcontracted laboratories will submit to any external audit upon request by the USEPA or the client.

7.4 LABORATORY SYSTEM AUDITS

The laboratory system audit is a review of analytical laboratory operations to verify that the facility has the necessary equipment, staff, and procedures in place to generate acceptable data. It is also to determine that each element within an activity is functioning appropriately and within the guidelines of applicable methodology, approved procedures, and the site QAPP. An on-site inspection is routinely performed by the laboratory's QA Manager and may also be frequently performed by the OHM Project Chemical QA/QC Officer. If the laboratory participates in certification programs, audits performed by the certifying agencies may satisfy the criteria of systems audits for the project.

If the laboratory is in question, a system audit can be directed by the client and performed by OHM or the client's representative. Any recommendations made will be considered for implementation and any corrective actions will be taken to correct any deficiencies found. Project-specific audit reports will be placed in the project files and laboratory audit reports will be kept by the laboratory for future reference.

8.0 CORRECTIVE ACTION

This Corrective actions may be necessary as a result of the following QA activities:

- Field and laboratory performance audits
- Field and laboratory system audits
- Inter-laboratory comparison studies
- Calibration data fall out of specified limits
- Failure to adhere to the CQMP
- Failure to adhere to the site
- Failure to adhere to standard operating procedures and methods
- Data completeness below required limits
- Control limits are exceeded for QC samples

If, during system and performance audits, deficiencies or problems are discovered, corrective action will be initiated immediately. The appropriate field and laboratory personnel will be notified immediately and an investigative process will be implemented immediately to find solutions to these issues. The investigative process will consist, but is not limited to, the following:

- Determining when the problem occurred
- Determining which systems were affected by the problem
- Determining the cause of the problem
- Determining a corrective action to eliminate the problem
- Assigning the responsibility for implementing the corrective action
- Implementing the corrective action
- Evaluating the effectiveness of the corrective action
- Investigating alternative corrective actions if the original action was not sufficient in eliminating the problem
- Documenting that the corrective action has eliminated the problem

The Project Chemical QC Officer has the authority to require that all site activities threatened by the problem be stopped or limited until the corrective action has been implemented and satisfactorily verified to eliminate the problem.

Corrective actions may include, but is not limited to:

- Modifications to procedures
- Recalibration of instruments
- Replacement of solvents, reagents, and/or standards
- Additional training of personnel
- Reassignment of personnel

8.1 CORRECTIVE ACTION REPORT

A Corrective Action Report (CAR) is necessary documentation of the investigative process. Depending on the issues, the CAR may be generated by the laboratory or the field personnel. Copies of the CAR will be given to the Project QC Officer and Project Manager, who will distribute it to the client. A copy of the CAR will be placed in the project files for future reference.

The CAR should include, but is not limited to:

- A description of the problem, deficiency, or issue
- Proposed resolutions
- Resulting actions
- Effectiveness of the resolutions
- Personnel responsible for implementation of the corrective actions
- Personnel responsible for monitoring the effectiveness of the actions.

8.2 QUALITY ASSURANCE REPORT

The Project Manager, Project QC Officer, and Project Chemist will converse on a regular basis to review possible and potential problem areas and to ensure that all QA/QC procedures are being carried out. It is important that all data abnormalities be investigated to ensure that they are not a result of operator or instrument deviation but are a true reflection of the methodology or task function. The project final report will contain a separate section that covers the data quality and validity. At a minimum, the following information will be included in the report:

- Assessment of measurement data precision, accuracy, and completeness
- System and performance audit results
- Significant QA problems and corrective actions implemented
- Copies of documentation such as memos, reports, etc.

The Project QC Officer will be responsible for preparing this report weekly or daily, as well as monthly written QA reports to OHM QA management. The Regional QA/QC Director will be responsible for reviewing and approving these monthly reports. Verbal reports will be made on a more frequent basis. All reports will be made available to the Project Manager, client, and regulating agencies. If no project audits were performed and no significant QA/QC problems occurred, a letter stating these facts will be submitted to the referenced parties in lieu of a QA Report.

APPENDIX A

TABLE A-1 SAMPLING SUMMARY
TABLE A-2 PROJECT QUALITY CONTROL OBJECTIVES

TABLE A-1
SAMPLING AND ANALYTICAL SUMMARY

Sample Task	Sample Point	Matrix	Sampling Frequency	Approx Sample No	Sampling Method	Sampling Equipment	TAT[1]	QC Level	Required Analysis	Analytical Method	Holding Time	Sample Preservtation	Containers
Interim Air Sparging System Sampling and Off-Site Analytical Activities													
Baseline Determination	Piezometers: Shallow P-1S, P-2S, P-3S, P-4S, P-5S Deep P-1D, P-2D, P-3D, P-4D, P-5D Monitoring Well 35MW-31B, MW 14, MW 26A	Water	Once prior to IAS start-up	13 +2 Dups	Grab	Dedicated Teflon Bailer	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2; Cool to 4°C	(2) 40 ml vial
	Piezometers: Deep P-1D, P-2D, Monitoring Well 35MW-31B, MW 14, MW 26 A			5+ 1 Dup					Total metals (Ca, Fe, Mn)	6010 A	180 days	HNO_3 to pH< 2;	(1) 500 ml HDPE
	Equipment Rinsate Blank	Water	1 per day of sampling after final rinse of the last decontamination of the day	1	Prepared in the Field	N/A	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
									Total metals (Ca, Fe, Mn)	6010 A	180 days	HNO_3 to pH< 2;	(1) 500 ml HDPE
	Field (Ambient) Blank	Water	1 per distinct area suspected of contributing volatile contamination	1	Prepared in the Field	N/A	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
	Trip Blank	Water	1 per VOC cooler	3	Prepared by Lab	N/A	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
	Shallow Piezometers P-1S, P-2S	Soil Vapor	Once prior to IAS start-up	2	Direct Fill	SUMMA Canister	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	Method 18/ TO14M/ 8260B, Mod. *	14 days	None	SULMMA Canister

Notes:
1) Cal days prelim; fin data due 7 cal days from TAT
2) TCL A--14d TCLP ex, 14d an; SVOA--14d TCLP ex, 7d ex, 4d an; Hg--28d TCLP ex, 28d an; 80d TCLP ex, 180d an

TABLE A-1
SAMPLING AND ANALYTICAL SUMMARY

Sample Task	Sample Point	Matrix	Sampling Frequency	Approx Sample No	Sampling Method	Sampling Equipment	TAT[1]	QC Level	Required Analysis	Analytical Method	Holding Time	Sample Preservtation	Containers
Progress Evaluation of Remedial Activities **First 8 Weeks**	Piezometers: Shallow P-1S, P-2S, P-3S, P-4S, P-5S Deep P-1D, P-2D, P-3D, P-4D, P-5D Monitoring Well 35MW-31B, MW 14, MW 26A	Water	Weekly for first 8 weeks	104 +16 Dups (2 Dups per sampling event for 13 wells)	Grab	Dedicated Teflon Bailer	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2; Cool to 4°C	(2) 40 ml vial
	Piezometers: Deep P-1D, P-2D, Monitoring Well 35MW-31B, MW 14, MW 26 A			40 + 8 Dups (1 Dup per sampling event)					Total metals (Ca, Fe, Mn)	6010 A	180 days	HNO_3 to pH< 2;	(1) 500 ml HDPE
	Equipment Rinsate Blank	Water	Every round of sampling	8	Prepared in the Field	N/A	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
									Total metals (Ca, Fe, Mn)	6010 A	180 days	HNO_3 to pH< 2;	(1) 500 ml HDPE
	Field (Ambient) Blank	Water	1 per distinct area suspected of contributing volatile contamination for each round of sampling	8	Prepared in the Field	N/A	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
	Trip Blank	Water	1 per VOC cooler	1 per VOC cooler	Prepared by Lab	N/A	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod*	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
	Shallow Piezometers P-1S, P-2S	Soil Vapor	Monthly	4 (2 rounds for 2 wells)	Direct Fill	SUMMA Canister	48 Hrs	NEESA C, OHM Maximum	TCL Volatiles	Method 18/ TO14M/ 8260B, Mod. *	14 days	None	SULMMA Canister

Notes:
1) Cal days prelim; fin data due 7 cal days from TAT
2) TCL VOA--14d TCLP ex, 14d an; SVOA--14d TCLP ex, 7d ex, 4d an; Hg--28d TCLP ex, 28d an; M 80d TCLP ex, 180d an

TABLE A-1
SAMPLING AND ANALYTICAL SUMMARY

Sample Task	Sample Point	Matrix	Sampling Frequency	Approx Sample No	Sampling Method	Sampling Equipment	TAT[1]	QC Level	Required Analysis	Analytical Method	Holding Time	Sample Preservtation	Containers
Progress Evaluation of Remedial Activities (Continued…) **For months 3 through 6**	Piezometers: Shallow P-1S, P-2S, P-3S, P-4S, P-5S Deep P-1D, P-2D, P-3D, P-4D, P-5D Monitoring Well 35MW-31B, MW 14, MW 26A	Water	Monthly for 4 months	52 +8 Dups (2 Dups per sampling event for 13 wells)	Grab	Dedicated Teflon Bailer	7 Days	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2; Cool to 4°C	(2) 40 ml vial
	Piezometers: Deep P-1D, P-2D, Monitoring Well 35MW-31B, MW 14, MW 26 A			20 +4 Dups (1 Dup per sampling event)					Total metals (Ca, Fe, Mn)	6010 A	180 days	HNO_3 to pH< 2;	(1) 500 ml HDPE
	Equipment Rinsate Blank	Water	Every round of sampling	4	Prepared in the Field	N/A	7 Days	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
									Total metals (Ca, Fe, Mn)	6010 A	180 days	HNO_3 to pH< 2;	(1) 500 ml HDPE
	Field (Ambient) Blank	Water	1 per distinct area suspected of contributing volatile contamination for each round of sampling	4	Prepared in the Field	N/A	7 Days	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod. *	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
	Trip Blank	Water	1 per VOC cooler	1 per VOC cooler	Prepared by Lab	N/A	7 Days	NEESA C, OHM Maximum	TCL Volatiles	8260B, Mod*	14 days	HCl pH< 2 Cool to 4°C	(2) 40 ml vial
	Shallow Piezometers P-1S, P-2S	Soil Vapor	Monthly	8 (4 rounds for 2 wells)	Direct Fill	SUMMA Canister	7 Days	NEESA C, OHM Maximum	TCL Volatiles	Method 18/ TO14M/ 8260B, Mod. *	14 days	None	SULMMA Canister

* Method 8260 B modified to include MTBE

** Metals list include metals required by WWTP at Lot 203 + Calcium

Notes:

1) Cal davs prelim; fin data due 7 cal days from TAT

2) TCL(A--14d TCLP ex, 14d an; SVOA--14d TCLP ex, 7d ex, 4d an; Hg--28d TCLP ex, 28d an;) 80d TCLP ex, 180d an

TABLE A-1
SAMPLING AND ANALYTICAL SUMMARY

Sample Task	Sample Point	Matrix	Sampling Frequency	Approx Sample No	Sampling Method	Sampling Equipment	TAT[1]	QC Level	Required Analysis	Analytical Method	Holding Time	Sample Preservtation	Containers
Disposal Sampling And Off-Site Analytical Activities													
Disposal of Well Develop-ment Material and Construction and O&M of IAS System	"Contaminated" Drill Cuttings, Trench Cuttings, PPE	Soil and Solids	Once	5*	Composite of Roll-Offs	SS Spoons or Shovels; SS Bowls	7 Days	NEESA C, OHM Maximum	TCLP Volatiles	1311/8260B	See Note 2	Cool to 4°C	(1) 4 oz Glass
									TPH GRO	5030A/8015B	14 days	Cool to 4°C	(1) 4 oz Glass
									TCLP Semi- Volatiles	1311/8270C	See Note 2	Cool to 4°C	(2) 16 oz Glass
	Broken polymer			1					TCLP Metals	1311/6010B;7471A	See Note 2		
									Reactive CN	Section 7.3	None		
									Reactive S	Section 7.3	None		
									pH	9045B	None		
									Ignitability	1010	None		
									Paint Filter Test	9095A	None		
	Development Water, Decon Fluids, and Liquids from broken polymer	Water	Once per tank full	2**	Holding/ Storage Tanks	Disposable bailers	7 Days	NEESA C, OHM Maximum	TCL Volatiles	8260B	14 days	HCl pH< 2; Cool to 4°C	(2) 40 ml vial
									TCL Semi- volatiles	8270C	7 days ext;40 days analysis	Cool to 4°C	(1) 1L Amber Glass
									TAL Metals	6010B/7470A	6 months; Hg = 28 days	HNO_3 pH< 2;	(1) 500 ml HDPE

* 5 samples based on 500 tons of soil /1.3 cu. yard per ton / 1 sample per cu. yard
** 2 samples based on one sample per frac tank* 2 frac tanks for 40,000 gallons

Notes:
1) Cal days prelim; fin data due 7 cal days from TAT
2) TCL[illegible]OA--14d TCLP ex, 14d an; SVOA--14d TCLP ex, 7d ex, 4d an; Hg--28d TCLP ex, 28d an; M[illegible] 180d TCLP ex, 180d an

TABLE A-1
SAMPLING AND ANALYTICAL SUMMARY

Task	Location	Activitiy	Frequency	Parameter	Method	QC Level	QC Requirements
On-Site interim Air Sparging System Measurement and Sampling Activities							
System Start-Up and O&M	Piezometers: Shallow P-1S, P-2S, P-3S, P-4S, P-5S Deep P-1D, P-2D, P-3D, P-4D, P-5D Monitoring Wells 35GWD-2, MW-16, MW-22	Measurement	At start-up, weekly for two months; and monthly for months 3 through 6 or as specified by the OHM Technical Lead to Verify Air Injection System Performance	Water Level	Water Level Indicator	None	None
	Piezometers: Shallow P-1S, P-2S, P-3S, P-4S, P-5S Deep P-1D, P-2D, P-3D, P-4D, P-5D Monitoring Wells Upgradient: MW-14, 35MW-31B, MW-26A Downgradient: 35GWD-2, MW-16, MW-22	Screening	At start-up, weekly for two months; and monthly for months 3 through 6 or as specified by the OHM Technical Lead to Verify Air Injection System Performance	Dissolved Oxygen	DO Probe	Screening	None
	Air sparging wells AS-1A, AS-1B, AS-1C	Measurement	At start-up, weekly for two months; and monthly for months 3 through 6 or as specified by the OHM Technical Lead to Verify Air Injection System Performance	Well Pressure Reading	Pressure Gauge	None	None
	Piezometers: Shallow P-1S, P-2S, P-3S, P-4S, P-5S Deep P-1D, P-2D, P-3D, P-4D, P-5D	Screening	At start-up, weekly for two months; and monthly for months 3 through 6 or as specified by the OHM Technical Lead to Verify Air Injection System Performance	Organic Vapor Analysis	FID/PID	Screening	Calibrate as per manufacturer's instructions

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TABLE A-2
PROJECT QUALITY CONTROL OBJECTIVES

		Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
Method No[1]	Analyte / Component	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]
PETROLEUM HYDROCARBONS BY GC		mg/L	mg/kg	mg/L	mg/kg	%	%	%	%	%	%	%	%	%	%
5030A/ 8015A (mod)	TPH-Gasoline	NS	50	0.1	1	50-150	30-170	<30	<50	67-136	67-136	<50	<75	95	90
5030A/ 8015A (mod)	Chlorobenzene (Surr)					74-138	64-148								
VOLATILES BY GC/MS		ug/L	ug/kg	ug/L	ug/kg	%	%	%	%	%	%	%	%	%	%
8260A	1,1,1,2-Tetrachloroethane	NS	NS	2.5	15	60-140	20-150	<30	<50	62-108	62-108	<50	<75	95	90
8260A	1,1,1-Trichloroethane	NS	NS	4	20	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,1,2,2-Tetrachloroethane	0.41	NS	0.05	10	60-140	20-150	<30	<50	64-135	64-135	<50	<75	95	90
8260A	1,1,2-Trichloroethane	NS	NS	5	25	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,1-Dichloroethane	NS	NS	2	10	60-140	20-150	<30	<50	62-135	62-135	<50	<75	95	90
8260A	1,1-Dichloroethene	NS	NS	6	30	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,1-Dichloropropane	NS	NS	5	25	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,2,3-Trichlorobenzene	NS	NS	1.5	10	60-140	20-150	<30	<50	65-147	65-147	<50	<75	95	90
8260A	1,2,3-Trichloropropane	NS	NS	16	100	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,2,4-Trichlorobenzene	NS	NS	2	10	60-140	20-150	<30	<50	65-145	65-145	<50	<75	95	90
8260A	1,2,4-Trimethylbenzene	NS	NS	6.5	35	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,2-Dichloroethane	NS	NS	3	15	60-140	20-150	<30	<50	58-137	58-137	<50	<75	95	90
8260A	1,2-Dichlorobenzene	NS	NS	1.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,2-Dibromo-3-chloropropane	NS	NS	13	50	60-140	20-150	<30	<50	49-135	49-135	<50	<75	95	90
8260A	1,2-Dichloropropane	NS	NS	2	10	60-140	20-150	<30	<50	60-135	60-135	<50	<75	95	90
8260A	1,2-Ethylene Dibromide	NS	NS	3	15	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,3,5-Trimethylbenzene	NS	NS	2.5	15	60-140	20-150	<30	<50	62-135	62-135	<50	<75	95	90
8260A	1,3-Dichlorobenzene	NS	NS	6	30	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,3-Dichloropropane	NS	NS	2	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1,4-Dichlorobenzene	NS	NS	1.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	1-Chlorohexane	NS	NS	2.5	15	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	2,2-Dichloropropane	NS	NS	17.5	100	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	2-Chlorotoluene	NS	NS	2	10	60-140	20-150	<30	<50	63-135	63-135	<50	<75	95	90
8260A	4-Chlorotoluene	NS	NS	3	15	60-140	20-150	<30	<50	64-135	64-135	<50	<75	95	90
8260A	Benzene	1	10**	0.05	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Bromobenzene	NS	NS	1.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90

Notes:
1) SW-846 Methods unless otherwise noted
2) Includes Sediments, Waste, Solids

NS = N ified
NA = N licable

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TABLE A-2
PROJECT QUALITY CONTROL OBJECTIVES

		Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
Method No[1]	Analyte / Component	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]
8260A	Bromochloromethane	NS	NS	2	10	60-140	20-150	<30	<50	63-135	63-135	<50	<75	95	90
8260A	Bromodichloromethane	NS	NS	4	20	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Bromoform	NS	NS	6	30	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Bromomethane	NS	NS	5.5	25	60-140	20-150	<30	<50	62-135	62-135	<50	<75	95	90
8260A	Carbon Tetrachloride	NS	NS	10.5	50	60-140	20-150	<30	<50	52-135	52-135	<50	<75	95	90
8260A	Chlorobenzene	NS	NS	2	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Chloroethane	NS	NS	5	25	60-140	20-150	<30	<50	55-135	55-135	<50	<75	95	90
8260A	Chloroform	NS	NS	1.5	10	60-140	20-150	<30	<50	64-135	64-135	<50	<75	95	90
8260A	Chloromethane	NS	NS	6.5	35	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Cis-1,2-Dichloroethene	70	NS	6	30	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Cis-1,3-Dichloropropene	NS	NS	5	25	60-140	20-150	<30	<50	64-135	64-135	<50	<75	95	90
8260A	Dibromochloromethane	NS	NS	2.5	15	60-140	20-150	<30	<50	63-135	63-135	<50	<75	95	90
8260A	Dibromomethane	NS	NS	12	50	60-140	20-150	<30	<50	59-137	59-137	<50	<75	95	90
8260A	Dichlorodifluoromethane	NS	NS	5	25	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Ethylbenzene	29	10**	3	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Hexachlorobutadiene	NS	NS	5.5	25	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Isopropylbenzene	NS	NS	2.5	40	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	m-Xylene	530*	10**	2.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Methylene Chloride	NS	NS	1.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Methyl Tertiary Butyl Ether	200	NS	1.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	n-Butylbenzene	NS	NS	5.5	25	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	n-Propylbenzene	NS	NS	2	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Naphthalene	NS	NS	2	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	o-Xylene	530*	10**	5.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	p-Isopropyltoluene	NS	NS	6	30	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	p-Xylene	530*	10**	6.5	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Sec-Butylbenzene	NS	NS	6.5	35	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Styrene	NS	NS	2	10	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Trichloroethylene	2.8	NS	1	50	60-140	20-150	<30	<50	61-135	61-135	<50	<75	95	90
8260A	Tert-Butylbenzene	NS	NS	7	35	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Tetrachloroethane	0.7	NS	0.05	35	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Tetrachloroethylene	NS	NS	7	35	60-140	20-150	<30	<50	61-135	61-135	<50	<75	95	90
8260A	Toluene	NS	10**	5.5	10	60-140	20-150	<30	<50	64-135	64-135	<50	<75	95	90
8260A	Trans-1,2-Dichloroethene	70	NS	3	15	60-140	20-150	<30	<50	65-135	65-135	<50	<75	95	90
8260A	Trans-1,3-Dichloropropene	NS	NS	5	25	60-140	20-150	<30	<50	56-135	56-135	<50	<75	95	90
8260A	Trichlorofluoromethane	NS	NS	4	20	60-140	20-150	<30	<50	57-135	57-135	<50	<75	95	90
8260A	Vinyl Chloride	0.015	NS	0.17***	45	60-140	20-150	<30	<50	36-144	36-144	<50	<75	95	90
8260A	Dibromofluoromethane (surr)	NS	NS	NA	NA	75-125	65-135	NA	NA	NA	NA	NA	NA	95	90

Notes:
1) SW-846 Methods unless otherwise noted
2) Includes Sediments, Waste, Solids

NS = N cified
NA = N pplicable

Camp Lejeune
OU 10, Site 35
Project No. 17536
DO.083

TABLE A-2
PROJECT QUALITY CONTROL OBJECTIVES

		Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
Method No[1]	Analyte / Component	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]	Water	Soil[2]
8260A	Toluene-d8 (surr)	NS	NS	NA	NA	75-125	65-135	NA	NA	NA	NA	NA	NA	95	90
8260A	4-Bromofluorobenzene (surr)	NS	NS	NA	NA	75-1225	65-135	NA	NA	NA	NA	NA	NA	95	90
8260A	1,2-Dichloroethane-d4 (surr)	NS	NS	NA	NA	62-139	52-149	NA	NA	NA	NA	NA	NA	95	90
METALS BY ICP		mg/L	mg/kg	mg/L	mg/kg	%	%	%	%	%	%	%	%	%	%
6010	Aluminum	NS	NS	0.5	50	50-150	30-170	<30	<50	84-115	84-115	<50	<75	95	90
6010	Antimony	NS	NS	0.4	40	50-150	30-170	<30	<50	81-112	81-112	<50	<75	95	90
6010	Arsenic	NS	NS	0.6	60	50-150	30-170	<30	<50	79-115	79-115	<50	<75	95	90
6010	Barium	NS	NS	0.02	2	50-150	30-170	<30	<50	85-112	85-112	<50	<75	95	90
6010	Beryllium	NS	NS	0.003	0.3	50-150	30-170	<30	<50	83-114	83-114	<50	<75	95	90
6010	Cadmium	NS	NS	0.04	4	50-150	30-170	<30	<50	78-118	78-118	<50	<75	95	90
6010	Calcium	NS	NS	0.1	10	50-150	30-170	<30	<50	84-114	84-114	<50	<75	95	90
6010	Chromium	NS	NS	0.07	7	50-150	30-170	<30	<50	82-115	82-115	<50	<75	95	90
6010	Cobalt	NS	NS	0.07	7	50-150	30-170	<30	<50	82-113	82-113	<50	<75	95	90
6010	Copper	NS	NS	0.06	6	50-150	30-170	<30	<50	83-114	83-114	<50	<75	95	90
6010	Iron	NS	NS	0.07	7	50-150	30-170	<30	<50	84-115	84-115	<50	<75	95	90
6010	Lead	NS	NS	0.5	50	50-150	30-170	<30	<50	79-116	79-116	<50	<75	95	90
6010	Magnesium	NS	NS	0.3	30	50-150	30-170	<30	<50	84-112	84-112	<50	<75	95	90
6010	Manganese	NS	NS	0.02	2	50-150	30-170	<30	<50	84-114	84-114	<50	<75	95	90
6010	Molybdenum	NS	NS	0.08	8	50-150	30-170	<30	<50	83-113	83-113	<50	<75	95	90
6010	Nickel	NS	NS	0.15	15	50-150	30-170	<30	<50	82-112	82-112	<50	<75	95	90
6010	Potassium	NS	NS	5	500	50-150	30-170	<30	<50	82-114	82-114	<50	<75	95	90
6010	Selenium	NS	NS	0.8	80	50-150	30-170	<30	<50	68-121	68-121	<50	<75	95	90
6010	Silver	NS	NS	0.07	7	50-150	30-170	<30	<50	75-123	75-123	<50	<75	95	90
6010	Sodium	NS	NS	0.3	30	50-150	30-170	<30	<50	84-115	84-115	<50	<75	95	90
6010	Thallium	NS	NS	0.4	40	50-150	30-170	<30	<50	80-112	80-112	<50	<75	95	90
6010	Vanadium	NS	NS	0.08	8	50-150	30-170	<30	<50	82-112	82-112	<50	<75	95	90
6010	Zinc	NS	NS	0.02	2	50-150	30-170	<30	<50	82-113	82-113	<50	<75	95	90
METALS BY GFAA		mg/L	mg/kg	mg/L	mg/kg	%	%	%	%	%	%	%	%	%	%
7421	Lead	NS	NS	0.001	0.1	50-150	30-170	<30	<50	74-124	74-124	<50	<75	95	90
9040	pH	NS	NA	0.05 su	NA	NA	NA	<30	NA	NA	NA	<50	NA	95	NA

* Total xylenes

** Total BTEX

*** 25 mL purge required. Remediation level may not be achievable.

Notes:
1) SW-846 Methods unless otherwise noted
2) Includes Sediments, Waste, Solids

NS = No[illegible]cified
NA = N[illegible]licable

TABLE A-2
PROJECT QUALITY CONTROL OBJECTIVES

Method No	Analyte / Component	Project Action Limits TCLP	Minimum PQL TCLP	Accuracy Limits MS/MSD Recoveries TCLP	Precision Limits MS/MSD Deviation TCLP	Accuracy Limits LCS Recoveries TCLP	Precision Limits Field Dup Deviation TCLP	Completeness Limits TCLP
TCLP Volatiles		(mg/L)	(mg/L)	(%)	(%)	(%)	(%)	(%)
8260B	1,1-Dichloroethylene	0.7	0.1	50-150	<50	70-130	<50	90
8260B	1,2-Dichloroethane	0.5	0.1	50-150	<50	70-130	<50	90
8260B	Benzene	0.5	0.1	50-150	<50	70-130	<50	90
8260B	Carbon Tetrachloride	0.5	0.1	50-150	<50	70-130	<50	90
8260B	Chlorobenzene	100	20	50-150	<50	70-130	<50	90
8260B	Chloroform	6	1	50-150	<50	70-130	<50	90
8260B	Methyl Ethyl Ketone	200	20	50-150	<50	70-130	<50	90
8260B	Tetrachloroethylene	0.7	0.7	50-150	<50	70-130	<50	90
8260B	Trichloroethylene	0.5	0.1	50-150	<50	70-130	<50	90
8260B	Vinyl Chloride	0.2	0.05	50-150	<50	70-130	<50	90
TCLP Semi-Volatiles		(mg/L)	(mg/L)	(%)	(%)	(%)	(%)	(%)
8270C	1,4-Dichlorobenzene	7.5	1	50-150	<50	70-130	<50	90
8270C	2,4,5-Trichlorophenol	400	80	50-150	<50	70-130	<50	90
8270C	2,4,6-Trichlorophenol	2	0.4	50-150	<50	70-130	<50	90
8270C	2,4-Dinitrotoluene	0.13	0.02	50-150	<50	70-130	<50	90
8270C	Cresol	200	40	50-150	<50	70-130	<50	90
8270C	Hexachlorobenzene	0.13	0.02	50-150	<50	70-130	<50	90
8270C	Hexachloroethane	3	0.5	50-150	<50	70-130	<50	90
8270C	Hexachlorobutadiene	0.5	0.4	50-150	<50	70-130	<50	90
8270C	Nitrobenzene	2	0.4	50-150	<50	70-130	<50	90
8270C	Pentachlorophenol	100	80	50-150	<50	70-130	<50	90
8270C	Pyridine	5	1	50-150	<50	70-130	<50	90
TCLP Pesticides		(mg/L)	(mg/L)	(%)	(%)	(%)	(%)	(%)
8081A	Endrin	0.02	0.004	50-150	<50	70-130	<50	90
8081A	Lindane	0.4	0.08	50-150	<50	70-130	<50	90
8081A	Methoxychlor	10	1	50-150	<50	70-130	<50	90
8081A	Toxaphene	0.5	0.1	50-150	<50	70-130	<50	90
8081A	Chlordane	0.03	0.005	50-150	<50	70-130	<50	90
8081A	Heptachlor and its Hydroxide	0.008	0.001	50-150	<50	70-130	<50	90

TABLE A-2
PROJECT QUALITY CONTROL OBJECTIVES

Method No	Analyte / Component	Project Action Limits TCLP	Minimum PQL TCLP	Accuracy Limits MS/MSD Recoveries TCLP	Precision Limits MS/MSD Deviation TCLP	Accuracy Limits LCS Recoveries TCLP	Precision Limits Field Dup Deviation TCLP	Completeness Limits TCLP
TCLP Herbicides		(mg/L)	(mg/L)	(%)	(%)	(%)	(%)	(%)
8151A	2,4-D	10	2	50-150	<50	70-130	<50	90
8151A	2,4,5-TP	1	0.2	50-150	<50	70-130	<50	90
TCLP Metals		(mg/L)	(mg/L)	(%)	(%)	(%)	(%)	(%)
6010B	Arsenic	5	1	50-150	<50	70-130	<50	90
6010B	Barium	100	20	50-150	<50	70-130	<50	90
6010B	Cadmium	1	0.2	50-150	<50	70-130	<50	90
6010B	Chromium	5	1	50-150	<50	70-130	<50	90
6010B	Lead	5	1	50-150	<50	70-130	<50	90
7470	Mercury	0.2	0.04	50-150	<50	70-130	<50	90
6010B	Selenium	1	0.2	50-150	<50	70-130	<50	90
6010B	Silver	5	1	50-150	<50	70-130	<50	90
Characteristics		(mg/kg)	(mg/kg)	(%)	(%)	(%)	(%)	(%)
7.3	Reactive Sulfide	500	50	N/A	<50	N/A	<50	90
7.3	Reactive Cyanide	250	25	N/A	<50	N/A	<50	90
1010	Ignitability (Pensky Martens)	< 60 C or <140°F	40 C or 100°F	N/A	<50	N/A	<50	90
1020A	Ignitability (Setaflash)	< 60 C or <140°F	40 C or 100°F	N/A	<50	N/A	<50	90
1030	Ignitability of Solids	< 60 C or <140°F	40 C or 100°F	N/A	<50	N/A	<50	90
9040	pH (Corrosivity)	≤ 2 ; ≥ 12.5	N/A	N/A	<50	N/A	<50	90
Miscellaneous				(%)	(%)	(%)	(%)	(%)
9095A	Paint Filter	Pass	Pass/Fail	N/A	N/A	N/A	N/A	90

APPENDIX B

CUSTODY SEAL
CHAIN-OF-CUSTODY RECORD
OHM SHIPPING LABEL
SHIPPING INSTRUCTIONS FOR SENDING SAMPLES TO THE LABORATORY

Client _____

Sample ID _____

Location _____

Analysis _____

Preservative _____

Collection Date/Time _____

Collected By _____

CUSTODY SEAL

Person Collecting Sample _____ Sample No. _____
(signature)

Date Collected _____ Time Collected _____

Custody Seal

Sample Label

OHM Remediation Services Corp.

OHM Remediation Services Corp
Subsidiary of OHM Corporation
*U.S. Route 224 East * Findlay, Ohio 45840 * (419) 423-3526*

CHAIN-OF-CUSTODY RECORD

LABORATORY COPY

205391

FORM OHM REV. 2/92

OHM LABORATORY NAME (1)	LAB COORDINATOR'S PHONE (2)	LAB COORDINATOR'S FAX (3)	LABORATORY SERVICE ID (16)	LABORATORY CONTACT (17)	MAIL REPORT TO (COMPANY NAME) (22)
PROJECT NAME (4)	PROJECT LOCATION (5)	PROJECT NUMBER (6)	LABORATORY PHONE (18)	LABORATORY FAX (19)	RECIPIENT NAME (23)
PROJECT CONTACT (7)	PROJECT MANAGER'S NAME (8)	PROJECT FAX (9)	LABORATORY ADDRESS (20)		ADDRESS (24)
PROJECT ADDRESS (10)	CITY, STATE AND ZIP CODE (11)	CLIENT (12)	CITY, STATE AND ZIP CODE (21)		CITY, STATE AND ZIP CODE (25)
PROJECT MANAGER (13)	PROJECT MANAGER'S PHONE (14)	PROJECT MANAGER'S FAX (15)			

Item	Sample Identifier (26)	Matrix (27)	Date (28)	Time (29)	Preserved (30)	# of Cont. (31)	QC Level (32)	T.A.T. (33)	Analyses (34)	Comments (35)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

SAMPLER'S SIGNATURE (36) | CHAIN OF CUSTODY NUMBER (37) | COOLER TEMPERATURE UPON RECEIPT

RELINQUISHED BY (38)	RECEIVED BY (39)	DATE (40)	TIME (41)	SAMPLE CONDITION UPON RECEIPT

Distribution: White - Laboratory (To be returned with Analytical Report); Goldenrod - Project File; Yellow - Project Data Manager

(45)

Project Information Section
For Project Personnel Only
Do Not Submit to Laboratory

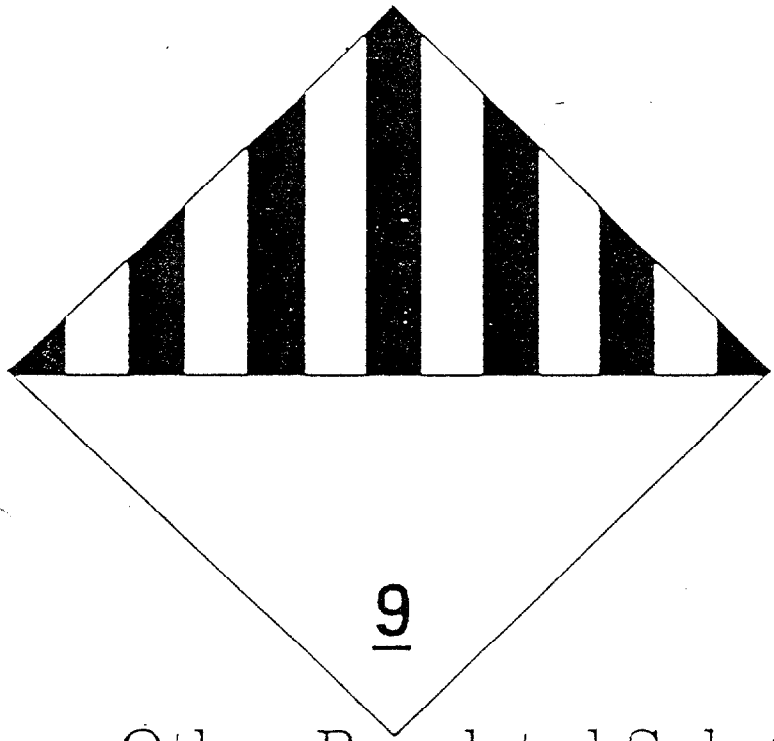
Sample Point Location (42)	Sample Type (43) G	C	F	QC

Comment (44)

Sample Type: G - Grab, C - Composite, F - Field Sample
QC - Quality Control Sample

CHAIN OF CUSTODY RECORD

OHM Corporation



OHM Corporation

From:

Phone:

To:

Phone:

Other Regulated Substances, ID# 8027

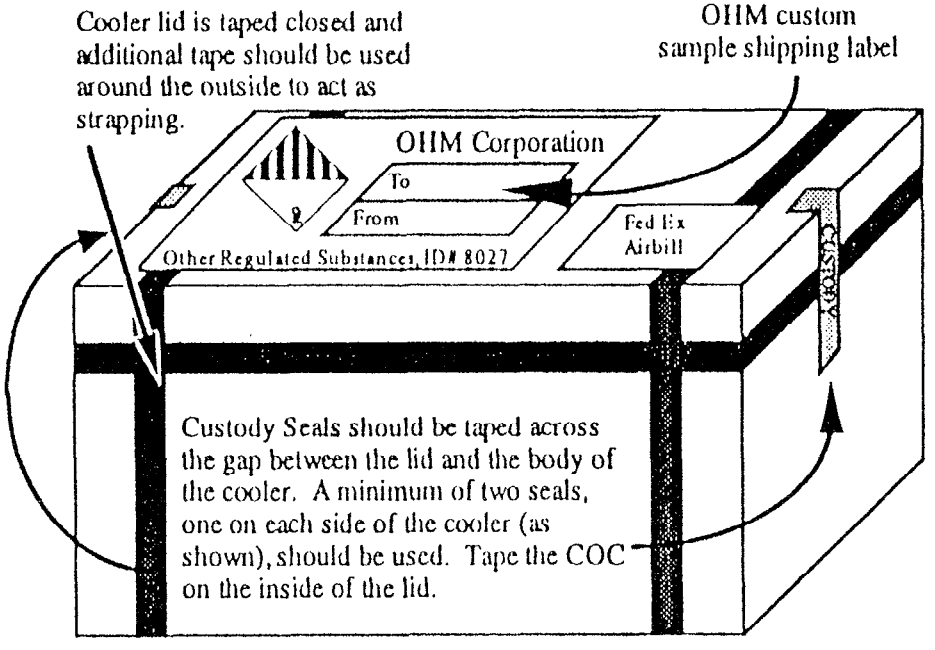
Class 9 Shipping Label

OHM Remediation Services Corp.

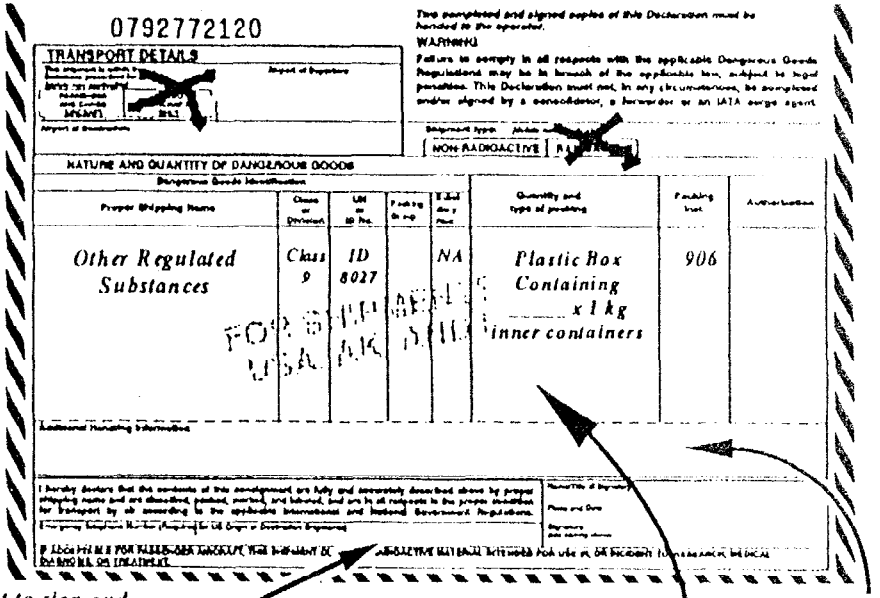
OHM Remediation Services Corp

Shipping Instructions Sending Samples to the Lab

NOTE: These procedures are ONLY for shipping unknown environmental samples such as sludge, soil, or water samples for laboratory analysis and identification. Materials which are known to be explosive, compressed gases, flammable, oxidizers, poisons, radioactive, or corrosive cannot be shipped by this method. Call the Regional T&D Coordinator for help in that case. Drum or tank materials must be shipped as per the Regional T&D Coordinator's instructions.



Lower Portion of Fed-Ex DANGEROUS GOODS airbill



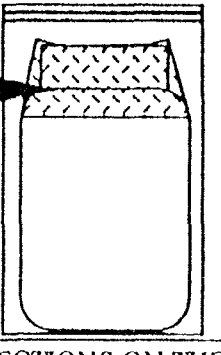
Don't forget to sign and include the 24-hr Emergency Response Phone number. Check with the Regional T&D Coordinator for this number

Fill in the blank with the number of containers

___ x 1 kg for quart jars
___ x 500 g for 8 oz jars
___ x 40 g for VOA vials

Fill in the Additional Handling space with:

"Samples from OHM Job # _____ see attached chain of custody. In case of emergency refer to ICAO Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods drill #9A"



Lids are taped to prevent leaks or loosening. Entire jar is sealed in a zip-lock baggie

1) Samples must be shipped in "Strong outer packaging". Fed-Ex stated that a rigid plastic cooler like we are currently using would be acceptable.

2) Use one of OHM's custom sample shipping labels. The To/From address portion of the label should be filled out completely including phone numbers. This label should be placed on last and cannot be covered by tape, the Fed-Ex airbill or anything else. This label should go on the TOP of the cooler.

3) Inner packages cannot exceed 1 gallon each, and the entire shipment (cooler & samples) cannot exceed 66 lb.

4) Coolers must be packed with absorbent material (vermiculite or kitty litter) which will absorb any spills or leaks, not react with the sample contents, and which will minimize the chance that inner containers will break. The coolers should also be fastened shut securely using tape or strapping. See the SAP for special instructions.

5) Inner containers should have their lids securly closed and packed in a ziplock baggie to prevent leaks

6) The materials must be shipped using a Federal Express Hazardous Materials Airbill. Use the example above or call the Hazardous Materials group at Federal Express at (800) GO-FEDEX for more instructions on filling out this form.

7) The COC must be filled out completely, placed in a gallon zip-lock baggie, and taped to the inside lid of the cooler. A copy of the COC should be placed behind the airbill in the pouch on the outside of the cooler.

READ THE DIRECTIONS ON THE AIRBILL SO YOU UNDERSTAND WHAT YOU ARE FILLING OUT. Fill out the Fed-Ex airbill completely. Don't forget to sign the bottom and include the Emergency Response phone number. Changing even one thing from the example above may mean that Fed-Ex will refuse to accept the shipment. This procedure has been checked-out with Fed-Ex several times. If a driver refuses to pick it up make sure you have filled out the airbill right and followed ALL the instructions before you complain.

OHM Corporation

DRUM INVENTORY LOG

DRUM NO. _____

PROJECT NUMBER _____

PAGE _____ OF _____

PROJECT LOCATION _____ LOGGER _____ DATE _____

PROJECT CONTACT _____ SAMPLER _____ TIME _____

PHONE _____ WEATHER _____

DRUM TYPE: FIBER ☐ POLY-LINED ☐ STEEL ☐ POLY ☐ STAINLESS STEEL ☐ NICKEL ☐

UD TYPE: RINGTOP ☐ CLOSED TOP ☐

DRUM CONDITION: MEET DOT SPEC. ☐ GOOD ☐ FAIR ☐ POOR ☐

DRUM SIZE: 110 ☐ 85 ☐ 55 ☐ 42 ☐ 30 ☐ 16 ☐ 10 ☐ 5 ☐ OTHER ___

DRUM CONTENTS: VOLUME FULL ☐ 3/4 ☐ 1/2 ☐ 1/4 ☐ <1/4 ☐ MT ☐

OVERPACKED: NO ☐ YES ☐ Overpack Type: FIBER ☐ STEEL ☐ POLY ☐

	PHYS. STATE				COLOR	CLARITY			LAYER THICKNESS
LAYERS	LIQUID	SOLID	GEL	SLUDGE	USE STD COLORS	CLEAR	CLOUDY	OPAQUE	INCHES
T									
M									
B									

FIELD ANALYSIS

pH _____ SU PID _____ ppm

DOSIMETER _____

OTHER _____

DRUM LABELS/MARKINGS

DOT HAZ _____ UN/NA _____

MFG NAME _____

CHEMICAL NAME _____

ADDITIONAL INFORMATION _____

LABORATORY COMPATIBILITY DATA

☐ MARK IF PHYSICAL STATE AND COLOR MATCHES THE ABOVE INFORMATION. IF NOT, STOP ANALYSIS AND NOTIFY PROJECT CONTACT. FURTHER WORK WILL NOT BE PAID FOR.

COMPATIBILITY CAT: _____

ANALYSTS: _____

DATE PERFORMED: _____

RADIATION: POS ☐ NEG ☐ _____ MREM/HR

	PHYS. STATE				COLOR	CLARITY			WATER SOL	REACT	pH	HEX. SOL	PER	OXID	CN	SUL	BIEL-STEIN	FLASH POINT	PCBs (25ppm)	PCB TEST COMP. NUMBER
LAYERS	LIQUID	SOLID	GEL	SLUDGE	USE STD COLORS	CLEAR	CLOUDY	OPAQUE	SOLUBILITY SPSI DENSITY H OR L	A=AIR W=WATER	STD. UNIT	S OR I	+ OR −	+ OR −	+ OR −	+ OR −	+ OR −	<60°C + OR −	+ OR −	
T																				
M																				
B																				

COMMENTS: _____

PCB CONC. _____ PPM FLASH POINT _____ °C COMPATIBILITY COMP. BULK # _____

DATA REVIEWER: _____ DATA REVIEW DATE: _____

FIELD REVIEWER: _____ FIELD REVIEW DATE: _____

TRANSFER NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME
1				
2				
3				

APPENDIX C

SOPs

OHM Corporation

QUALITY POLICY AND PROCEDURE APPROVAL AND REVISION RECORD

Document # QP-650	*Title:* Standard Analytical Data Deliverable Requirements

APPROVAL

Name	Title	Signature	Date
Guy Gallello	Midwest Region FAS Manager	Guy Gallello	7/19/96
Emma Popek	Western Region FAS Manager		
Ron Kenyon	Eastern Region FAS Manager	Ronald B. Kenyon	7/17/96
Terry Whitt	Southern Region FAS Manager	Terry A. Whitt	7/17/96
Mary Schneider	Southwestern District FAS Manager	Mary Schneider	7/17/96

REVISION RECORD

Ltr.	Date	Change Description	Initials						
1		Issue	-	-	-	-	-	-	-
2									
3									
4									
5									
6									
7									
8									
9									
10									

OHM Corporation

STANDARD OPERATING PROCEDURE

Title: Standard Analytical Data Deliverable *Document #:* QP-650

Date Issued: June 20, 1996 **Rev:** 0 **Date:**

1.0 PURPOSE

1.1 The purpose of this procedure is to set forth guidelines for the standardization of hard copy analytical data packages provided to OHM by Analytical Laboratories. This procedure defines the specific deliverable requirement to be included when minimum data packages, standard data packages and maximum data packages are requested by OHM employees.

2.0 SCOPE

2.1 These procedures apply to all purchases of analytical services and the analytical data packages provided to OHM by all analytical laboratories.

3.0 RELATED DOCUMENTS

3.1 HAZWRAP, July 1990. Quality Control Requirements for Field Methods DOE/HWP69/R1.

3.2 HAZWRAP, July 1988. Requirements for Quality Assurance of Analytical Data, DOE/HWP-65, Rev. 0, July 1988.

3.3 USEPA, Test Methods for Evaluating Solid Waste Physical/Chemical Methods SW-846

3.4 United States Environmental Protection Agency, 1984. User's Guide to the Contract Laboratory Program, Office of Emergency and Remedial Response, Washington, D.C.

4.0 GENERAL INFORMATION

4.1 In the past OHM has experienced that each analytical laboratory has a different report format that they call their standard deliverable package. Many times the laboratory's standard deliverable package does not include all of the information required to meet our client's expectations in performing data assessment and data validation of the analytical deliverable. When the additional information has been requested from the laboratories often additional charges are levied. In order to better service our client and to assure each and every laboratory bid for a given set of samples understands precisely what is required to be included within each analytical report, the following procedures have been developed.

5.0 DEFINITIONS

5.1 Accuracy - A measure of how close a measured value is to a known true value.

5.2 Aliquot - A measured portion of a sample taken for analysis.

5.3 Analytical Batch - Batch size is determined by the analytical method and project specific quality assurance requirements. Batch size is usually set at 20 or less samples of the same matrix being analyzed for the same parameters at the same time. All samples in a batch are prepared and analyzed together with a basic set of QC samples. Specific project requirements are listed in the Quality Assurance Project Plan (QAPP).

5.4 Background Correction - A technique usually employed relative to metals analysis which compensates for variable background contribution to the instrument signal in the determination of trace elements.

5.5 Blank - An artificial sample designed to monitor the introduction of artifacts into the measurement process.

5.6 Calibration - The systematic determination of the relationship of the response of the measurement system to the concentration of an analyte of interest.

5.7 Chain-of-Custody - A form used to track the custody of the samples from the time they are taken until the time they are analyzed.

5.8 Continuing Calibration - Subsequent checks on the instrument calibration performed throughout the analysis of samples.

5.9 Data Assessment - A systematic review of the analytical data to assure all method specific requirements were performed.

5.10 Data Quality Objectives - The established quality of the data required to support specific decisions or regulatory actions. DQOs must take into account sampling considerations as well as analytical protocols.

5.11 Data Validation - A systematic effort to review data for identification of errors for the purpose of flagging suspected values to assure the validity of the data for the user.

5.12 Deliverables - Analytical Report Package provided by the analytical laboratory which includes the analytical data and a specified set of supporting documentation.

5.13 Hold Times - The time stipulated in the method or regulations which is allowed to elapse from the time of sampling to the time of extraction and/or analysis. Samples analyzed after the hold times are of questionable usefulness.

5.14 ICP - Inductively coupled argon plasma (also referred to ICAP). An instrument used for metals analysis.

5.15 Internal Standard - A compound added to every standard, blank, matrix spike, matrix spike duplicate, sample and/or sample extract at a known concentration, prior to analysis. Internal standards are used as the basis for quantification of the target compounds.

5.16 Initial Calibration - Instrument calibration performed before any samples are analyzed.

5.17 Laboratory Control Sample - An artificial sample usually prepared in the laboratory, which either contains all or some of the compounds of interest. The sample is processed through the entire procedure including sample preparation and analysis. This sample is used to verify that the method is being performed properly. One laboratory control sample should be analyzed with each analytical batch.

5.18 Matrix Spike - An aliquot of a sample that has been spiked with a known quantity of specified compounds of interest. The matrix spike is used to measure the accuracy of the analytical system.

5.19 Matrix Spike Duplicate - A second aliquot of the same sample used for the matrix spike spiked the same way as the matrix spike. The matrix spike duplicate is used to measure the precision of the analytical system.

5.20 Maximum Deliverable Package - Specific requirements set forth in this document to be provided to OHM by the analytical laboratory when a Maximum Deliverable Package is requested.

5.21 Minimum Deliverable Package - Specific requirements set forth in this document to be provided to OHM by the analytical laboratory when a Minimum Deliverable Package is requested.

5.22 Precision - A measure of the analytical method's ability to reproduce analytical results.

5.23 Preparation Logs - An official laboratory record of the sample preparation procedures used in processing a sample prior to analysis.

5.24 Standard Deliverable Package -Specific requirements set forth in this document to be provided to OHM by the analytical laboratory when a Standard Deliverable Package is requested.

5.25 Surrogate - An organic compound that is similar to the analytes of interest in chemical composition, extraction and chromatography, but are not normally found in environmental samples. These compounds are spiked into quality control samples, calibration and check standards, and samples prior to analysis.

5.26 Tentatively Identified Compounds (TICs) - Compounds detected in samples that are not target compounds. Usually TICs consist of up to 30 peaks identified that are greater than 10 percent of the peak areas or heights of the nearest internal standard are subjected to mass spectral library searches for tentative identification.

5.27 Tuning - A technique used in gas chromatography/mass spectrometry procedures to verify that the instrument is properly calibrated to produce reliable mass spectral information.

6.0 RESPONSIBILITIES

6.1 Regional Field Analytical Manager - Responsible for the management of the Regional Field Analytical Department. Responsible for distributing these requirements to all subcontract laboratories used within their region.

7.0 PROCEDURE

7.1 All laboratories providing analytical services to OHM will be provided with a

copy of these specifications for minimum, standard and maximum data deliverable packages.

7.2 The desired data deliverable package will be selected at the time of procuring the analytical services. All price quotations must include providing OHM with the requested deliverable package.

7.3 All data packages received must meet the requested requirements as specified in the Data Deliverables Package Requirements.

8.0 ATTACHMENTS

8.1 Data Deliverables Package Requirements Table

Data Deliverables Package Requirements

Method	Deliverable Requirement	Equivalent EPA Form	OHM Minimum Level	OHM Standard Level	OHM Maximum Level
Metals	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OHM Sample Numbers, Lab IDs, and analytical QC batches		X	X	X
	Chain-of-Custody Form, Cooler Receipt form		X	X	X
	Data Summary for Each Sample (See Note 1)	I-IN	X	X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)	VII-IN	X	X	X
	Matrix Spike (MS) Report (including concentration spiked, percent recovered, percent recovery acceptance limits)	V (PART 1)IN	X	X	X
	Post-digestion Spike Recovery for ICP	V (PART 2)IN	X	X	X
	Duplicate Sample Report		X	X	X
	Blank Results	III-IN	X	X	X
	Initial Calibration Data	III-IN		X	X
	Continuing Calibration Data	II (PART I)-IN		X	X
	ICP Interference Check Sample Report	II (PART I)-IN		X	X
	Standard Addition Results	IV-IN		X	X
	ICP Serial Dilution Results	VIII-IN			X
	Copies of Preparation Logs	IX-IN			X
	Copies of Analysis Run Logs	XIII-IN		X	X
	Copies of Standard Preparation Logs	XIV-IN			X
	Raw Data and Instrument Printouts				X
	Percent Moisture		X	X	X
	pH				X (Note 2)

Notes:
1) Must include: OHM sample ID, Lab ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, Dilution Factor, comments, approval signature/date
2) For water samples only.

Method	Deliverable Requirement	Equivalent EPA Form	OHM Minimum Level	OHM Standard Level	OHM Maximum Level
Organics by GC or HPLC	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OHM Sample Numbers, Lab IDs, and analytical QC batches	IV	X	X	X
	Chain-of-Custody Form, Cooler Receipt form		X	X	X
	Data Summary for each blank and sample (See Note 1)	I	X	X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Surrogate Recovery Report (including concentration spiked, percent recovered, and percent recovery acceptance limits)	II	X	X	X
	Matrix Spike/Matrix Spike Duplicate (MS/MSD) Report (including concentration spiked, percent recovered, percent recovery acceptance limits, relative percent difference (RPD), and RPD acceptance limits)	III	X	X	X
	Initial Calibration Data for each column (indicate which column was used for quantitation)	VI		X	X
	Continuing Calibration Data (indicate which column was used for quantitation)	VII		X	X
	Chromatograms for each sample (and reruns), confirmation runs, blank, spike, duplicate, and standards			X (Note 4)	X
	Raw Quantitation Report (area vs. retention time)				X
	Copies of Sample Preparation Bench Sheets			X	X
	Copies of Standard Preparation Logs				X
	Copies of Run Logs	VIII			X
	Percent Moisture		X	X	X

Notes:

1) Must include: OHM sample ID, Lab ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, Dilution Factor, comments, approval signature/date.

4) For petroleum fuels analyses chromatograms for samples with positive results only.

Method	Deliverable Requirement	Equivalent EPA Form	OHM Minimum Level	OHM Standard Level	OHM Maximum Level
rganic mistry ote 2)	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OHM sample numbers, Lab IDs, and analytical QC batches		X	X	X
	Chain-of-Custody Form, Cooler Receipt form		X	X	X
	Data Summary for each blank and sample (See Note 1)		X	X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Matrix Spike/Matrix Spike Duplicate (MS/MSD) Report (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Duplicate Sample Report		X	X	X
	Calibration Reports Initial and Continuing			X	X
	Copies of Sample Preparation logs				X
	Raw Data and Instrument Printouts				X
	Percent Moisture		X	X	X

lotes:
1) Must include: OHM sample ID, Lab ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, Dilution Factor, comments, approval signature/date
2) Deliverables depend on method's QC

Method	Deliverable Requirement	Equivalent EPA Form	OHM Minimum Level	OHM Standard Level	OHM Maximum Level
Organics by GC/MS	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OHM sample numbers, Lab IDs, and analytical QC batches	IV		X	X
	Chain-of-Custody Form, Cooler Receipt Form		X	X	X
	Data Summary for each blank and sample (See Note 1)	I	X	X	X
	Tentatively Identified Compounds (TICs) for each sample (ten peaks)	I,TIC		X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Surrogate Recovery Report (including concentration spiked, percent recovered, and percent recovery acceptance limits)	II	X	X	X
	Matrix Spike/Matrix Spike Duplicate (MS/MSD) Report (including concentration spiked, percent recovered, percent recovery acceptance limits, relative percent difference (RPD), and RPD acceptance limits)	III	X	X	X
	Instrument Performance Check (Tuning) Report	V		X	X
	Initial Calibration Data (including acceptance limits)	VI		X	X
	Continuing Calibration Data (including acceptance limits)	VII		X	X
	Internal Standard Areas and Retention Times Reports (including acceptance limits and out-of-control flags)	VIII		X	X
	Reconstructed Ion Chromatogram for each sample and rerun, blank, spike, duplicate, and standard				X
	Raw Quantitation Report				X
	Raw and background subtracted mass spectra for each target analyte found				X
	Mass spectra of TICs with library spectra of 5 best-fit matches				X
	Copies of Sample Preparation Bench Sheets			X	X
	Copies of Standard Preparation Logs				X
	Copies of Run Logs				X
	Percent Moisture		X	X	X
	pH				X (Note 3)

Supelco's
2 Liter Air Sampler
Model 1060

Operations Manual

CAUTION:
Read rules for safe operation carefully.

SUPELCO, INC.

Supelco Park • Bellefonte , PA • 16823-0048 • USA
Phone (814) 359-3441 TWX 510-670-3600 FAX 814-359-5459

2 Liter Air Sampler, Model 1060

This active vacuum chamber-based sampler can fill a sample bag **without** the sample gas going through the vacuum pump. This sampler is best used for quick sample volume collections. This portable sampler can collect an air sample from a vacuum system up to 80" H_2O. Sampler has a see through window and an external pump module with a rechargeable battery. Applications include environmental soil vapor clean up, indoor and outdoor monitoring, and ambient VOC sampling. Sampler includes a 1.9 liter/min vacuum pump, 12volt rechargeable battery, light weight water tight enclosure with carry strap, and needle valve for coarse fill rate control.

Features and Specifications

- 1-2 liter bag capacity
- Zero pump contamination design
- Sample inlet: 1/4in. OD tubing
- Direct vacuum force: 80in.(202cm) H_2O
- Continuous running time: 8 hrs.
- Rechargeable 12volt-1.2amphr battery
- Vacuum filling rate: 1.9L/min.
- Metering needle valve for coarse fill rate control
- Dimensions: 9" x 9" x 6" (24cm x 23cm x 15cm)
- Weight: 5 lbs. (2.27kg)

Model 1060 **2-4622**

Optional Parts

1-liter Tedlar® Bags, pk. of 10 **2-4633**
2-liter Tedlar® Bags, pk. of 10 **2-4654**
with push/pull polypropylene valve & septum port

Battery, 12 volt-1.2amphr **2-4635**
Battery Charger, 110VAC **2-4643**
Battery Charger, 220VAC **2-4679**

RULES FOR SAFE OPERATION

1. Do not recharge battery in an explosive environment.
2. Do not over fill sample bag. The vacuum pump is strong enough to break the sample bag.
3. Exercise extreme caution when filling sample bag with explosive gases.

2 Liter Air Sampler, Model 1060

CE COMPLIANCE: The Model 1060 bears the CE mark and is in compliance with the EMC Directive 89/336/EEC and its Standards EN 50081-1 and EN 50082-1.

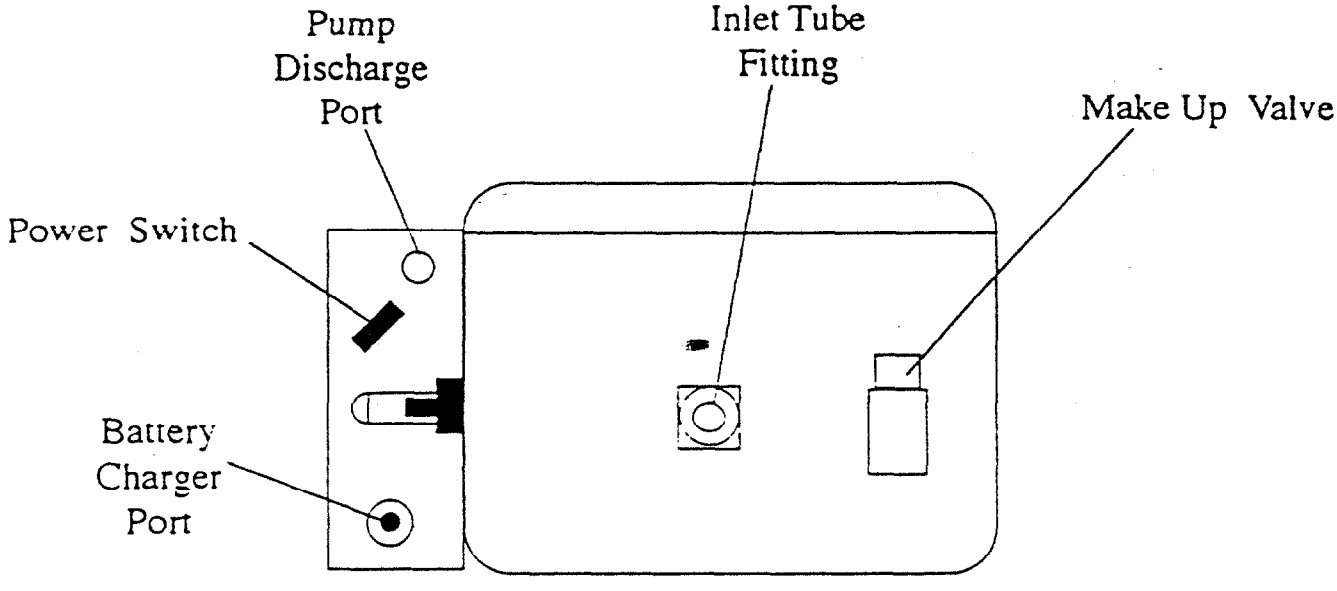
SAMPLE PREPARATION AND COLLECTION:

The principal of operation of this portable sampler is to fill a sample bag by exposing the outside of the sample bag to a vacuum force which causes the bag to fill.

1. Place the sample bag inside sampler.
2. Insert a 6" long piece of 1/4"ODX1/8"ID Tygon© tubing through the Inlet Tube Fitting.
3. Adjust lenght of tubing so half of the tubing is inside the sampler.
4. Tighten the inlet tube fitting just enough to create a seal around the Tygon© tubing.
5. Attach the inside portion of the Tygon© tubing to the inlet valve on the sample bag.
6. Open sample valve on the sample bag and close the lid of the sampler.
7. Make sure the Purge Valve is closed(Closed for fastest fill rate, Open to slow fill rate).Turn on the sample pump.

To ensure proper sample bag preparation, fill & empty the new sample bag with a clean gas. To empty the sample bag using the sampler pump: disconect the tubing at the Outlet Vacuum Port; Attach a short piece of 1/4"ODX1/8"ID Tygon© tubing from the Pump Discharge Port to the Outlet Vacuum Port to create a presure inside the sample chamber. Fill pre purged sample bag for analysis. Turn off sample pump, open Purge Valve, open sampler lid; CLOSE SAMPLE BAG VALVE and remove sample bag from inlet tubing.

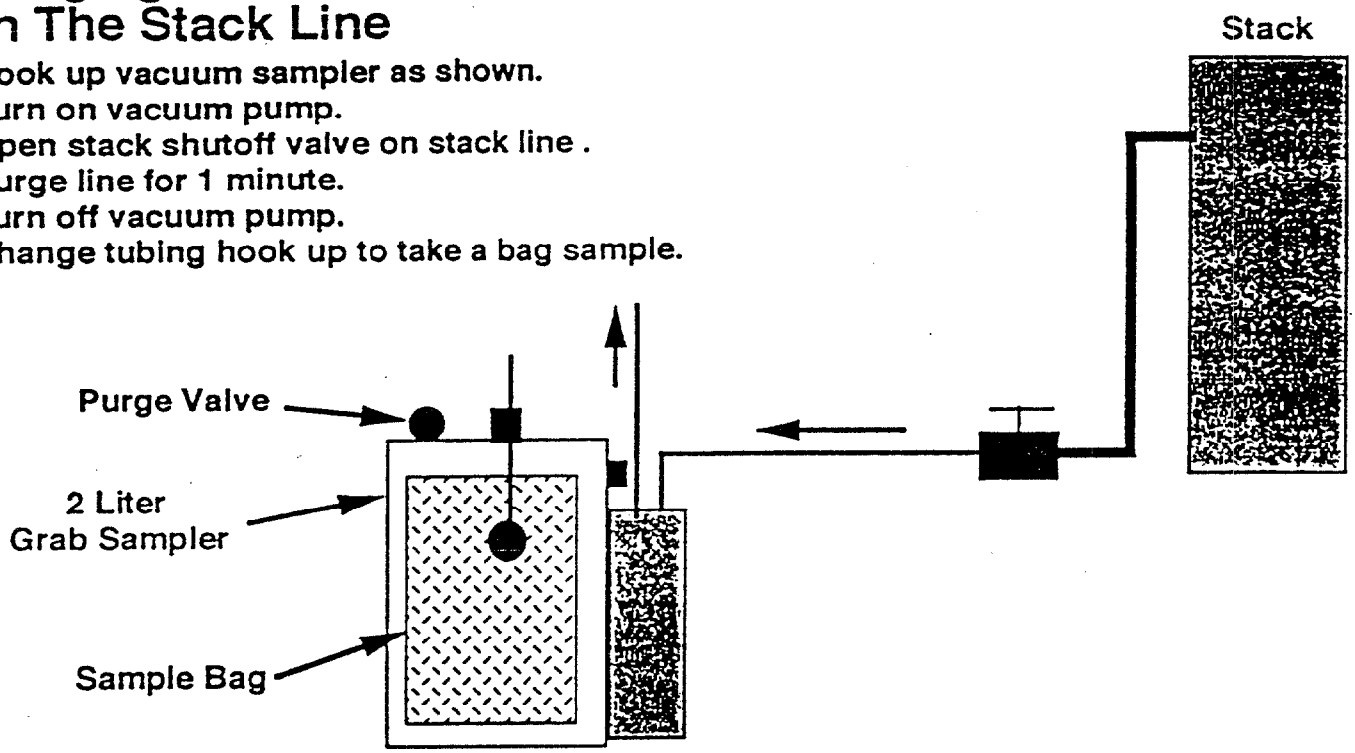
CAUTION: It is recommended that you give the battery an overnight charge after six hours of use.



Stack Sampling

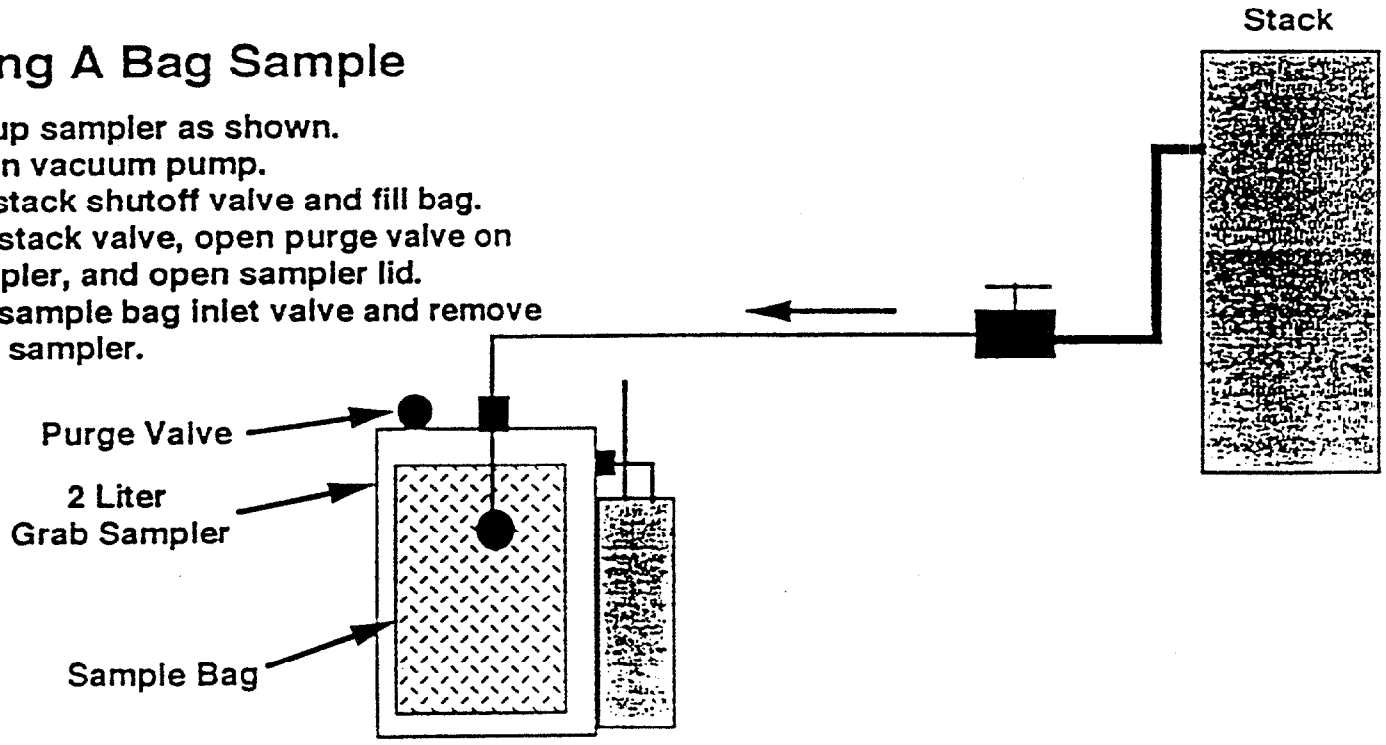
Purging The Dead Volume In The Stack Line

Hook up vacuum sampler as shown.
Turn on vacuum pump.
Open stack shutoff valve on stack line .
Purge line for 1 minute.
Turn off vacuum pump.
Change tubing hook up to take a bag sample.



Taking A Bag Sample

Hook up sampler as shown.
Turn on vacuum pump.
Open stack shutoff valve and fill bag.
Close stack valve, open purge valve on sampler, and open sampler lid.
Close sample bag inlet valve and remove from sampler.



2-N-1 VALVE - OPERATING INSTRUCTIONS

NOTE: Valve stem outer diameter is 3/16" and is suitable for use with 3/16" ID tubing. Bags are supplied with the valve in the CLOSED position.

FIRST: Lay bag flat on a clean, hard surface with valve stem facing upward.

TO OPEN VALVE: PUSH stem into the valve body until it stops. The valve is now OPEN. Bags are supplied with the valve stem in the CLOSED (PULLED OUT) position.

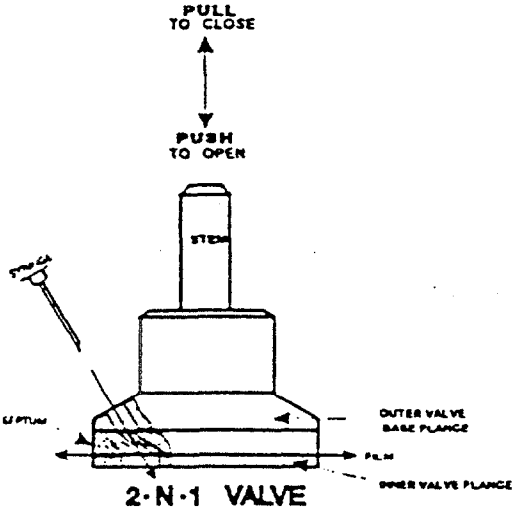
TO CONNECT TUBING: Support bag on a clean, flat surface. Place 3/16" ID tubing over end of stem and push tubing onto stem to appropriate overlap distance (1/8" to 1/4").

TO CLOSE VALVE: PULL stem outward until it stops. Stem will remain in the closed position unless force is applied to push the stem in. The valve is now CLOSED.

TO DISCONNECT TUBING: Pull tubing upward off stem or cut off tubing just above stem.

TO PREVENT ACCIDENTAL SAMPLE LOSS: Make sure objects do not push stem inward during shipment.

SYRINGE SAMPLING: Insert end of needle through small hole in Outer Valve Base Flange at an angle perpendicular to its SLOPED wall (see drawing below). Penetrate PTFE/silicone septum, allowing needle to enter bag through larger hole in Inner Valve Flange. Visual inspection of both the Outer and Inner Flange before inserting the needle will insure proper alignment of the needle. Take care to not puncture the opposite wall of the bag when inserting the needle.



2-N-1 VALVE

ENVIRONMENTAL PROTECTION PLAN
FOR
CONSTRUCTION AND OPERATION OF PHASE I INTERIM AIR SPARGING REMEDIATION SYSTEM AT OPERABLE UNIT 10, SITE 35 MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Atlantic Division
Naval Facilities Engineering Command
6500 Hampton Boulevard
Building A (South East Wing) 3rd Floor
Norfolk, VA 23508

Prepared by:

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Program Manager

October 1997
Delivery Order 083
OHM Project No. 17536

OHM Remediation Services Corp.

TABLE OF CONTENTS

1.0 INTRODUCTION

This Environmental Protection Plan (EPP) has been prepared in accordance with standard OHM policies and procedures. The EPP provides specific information relating to the scope of work under Delivery Order No. 0083 Interim Remedial Action at Operable Unit (O.U.) No 10, Site 35, MCB Camp Lejeune, North Carolina. The plan will provide site-specific information for:

- Land resources management
- Water resources management
- Air and noise pollution control
- Non-compliance/corrective action
- Post-excavation cleanup

The control of environmental pollution will consider air, water and land impacts, as well as noise and solid waste management. The land resources within the property of Camp Geiger Area Fuel Farm, MCB Camp Lejeune, but outside the limits of permanent work, will be preserved in their condition or restored to a condition that does not detract from the appearance of the area after completion of construction. As much as is practical, construction activities will be limited to areas defined by the plans and specifications.

2.0 HISTORICAL AND ARCHAEOLOGICAL FINDS

Although the presence of historical artifacts is not anticipated, if a historical artifact is encountered during field operations, OHM will stop work and notify the Navy Technical Representative (NTR). The NTR will be responsible for contacting federal, state, and local authorities to determine if the site may contain other important historical artifacts, and whether this site qualifies for possible placement on the National Registrar of Historical Places. Field operations will not resume until the NTR issues a written authorization to proceed.

3.0 TEMPORARY CONSTRUCTION ROADS

If required, the construction of any temporary construction roads in and around the project site will be performed in a manner as to minimize the impact to the natural environment. Water will be used for dust control, as necessary.

4.0 PROTECTION OF TREES AND SHRUBS

Prudent steps will be taken to protect trees and shrubs outside of the excavation zone as necessary. The trees and shrubs within the excavation zone will be removed by OHM. All trees and shrubs removed as a result of the construction activities will be cut into manageable pieces and moved from the project site so as not to interfere with operations. Precautions will be taken to minimize the construction activities' impact on existing vegetation and will include but not be limited to:

- Utilization of existing or temporary construction roads only
- Closely supervised equipment operators with an emphasis placed on preservation of vegetation in non-work areas
- Proper guidance of heavy equipment and truck operators by site personnel to minimize damage to adjacent vegetation not directly affected by construction activities
- Utilization of equipment appropriately designed and sized for precise excavation

5.0 RESTORATION

Upon completion of the field construction activities, disturbed areas will be compacted and graded to the original contour. The ground surface will be restored to original conditions.

6.0 WATER RESOURCES PROTECTION

The precipitation at the site drains into Brinson Creek approximately 500 feet northeast of the site. Brinson Creek could possibly be impacted by construction activities if proper sediment and erosion protection measures are not taken. To protect against damage, stormwater surface run-off leaving the site will be controlled by temporary erosion/sediment control techniques such as berms, silt fencing and grading. The area of bare soil exposed at any one time by construction activities will be minimized.

6.1 EROSION SEDIMENT CONTROL

Prior to disturbance of native vegetation and soils, temporary erosion/sediment control will be established on the down gradient side of each excavation. Control techniques to be utilized will involve silt fencing.

Silt fencing will be installed with the fabric a minimum of 6 inches below grade and extending 36 inches above grade and fastened to posts no more than 6 feet apart. The posts will be installed with a minimum of 24 inches below grade and extend a minimum of 36 inches above grade. Fabric will be attached to the up-slope side of the posts using 1-inch staples or tie wires. Silt fences will be inspected after every rain and daily during extended rain fall. Accumulated sediment will be removed before the depth reaches 12 inches.

6.2 SPILL CONTROL

Measures will be taken to prevent chemicals, fuels, oils, greases, bituminous materials and contaminated materials from entering streams, rivers or lakes. Absorbents will be available to solidify any leaks outside containment and any soil contaminated with fuel spills will be immediately removed and placed into appropriate containers and sampled to determine proper disposition.

7.0 DUST AND AIR POLLUTION CONTROL

7.1 AIR AND NOISE MONITORING

Personnel and ambient air monitoring will be conducted as necessary in order to determine airborne dust and contaminant levels. Ambient air monitoring will be conducted at working locations and on occasion at the perimeter of the project site. This ensures that respiratory protection is adequate to protect personnel against the contaminants that are encountered as well as ensuring that harmful levels of airborne contaminants are not leaving the site.

OHM will only perform operations of heavy equipment during daylight hours to minimize the impact of off-site noise pollution. Noise exposure to off-site residents or personnel is expected to be minimal. Hearing protection for on-site workers will be implemented if necessary as specified in the SHSP.

7.2 PARTICULATE EMISSION CONTROLS

Specific measures to be taken to minimize particle emissions for major activities during site construction include the following:

Soil Excavation, Handling, Site Grading, and Transportation

- Apply water to work and traffic areas as necessary to minimize dust emissions
- Cover stockpiles with sheeting to minimize wind and/or stormwater erosion
- Move and load soil for transport within the site that limits free fall of material and is least likely to generate dust emissions
- Halt dust-generating work when on-site wind conditions exceed 35 miles per hour

Movement of Equipment

- Water traffic areas as required to minimize dust emissions
- Designate equipment traffic patterns to minimize travel distance and vehicular dust emissions
- Limit vehicle speed to minimize dust emissions

7.3 BURNING

No burning will be performed on-site. In the event of an un-expected fire on-site, work will stop immediately and the MCB Camp Lejeune fire department will be notified.

8.0 POST-EXCAVATION CLEANUP

All excavation equipment that performed within areas of contaminated soil will be decontaminated prior to working in non-contaminated areas or demobilizing from the site. Decontamination will consist of scraping and pressure-washing to remove visible soil and debris from tires and undercarriage of vehicles and heavy equipment. Decontamination fluids will be containerized and samples procured and analysis prior to disposal.

Prepared by: Les Pettit
Date: 10/01/97
Project: DO 083, OU No. 10, Site 35, Interim Remedial Action
Camp Lejeune, N.C.

Calc. Pressure at horizontal well 37-feet below the surface of the watter

Pressure @ 37'H20 head =	16.0284	psi
Min Press. Drop thru well screen =	1	psi (min)
Total Pressure Drop =	**17.0**	**psi**

Convert SCFM to ACFM in well screen 17 psi in header pipe is maintained.

SCFM @ Blower	150	SCFM
Gage Pressure @ top well riser =	17.0	psig
Assume Temp in Pipe	60	degree F
Assume RH =	0.56	

ACFM = SCFM x (Ps -(RHs xPVs))/(Pb -(RHa xPVa)) x (Ta/Ts) x (Pb/Pa)

ACFM=	Actual Flow		unknown	acfm
SCFM=	Flow at standard conditions		150	scfm
Ps = Standard pressure (PSIA)			14.7	psia
Pb= Atmospheric pressure - barometer (PSIA)			14.7	psia
Pa= Actual pressure (Pb+ Loss), Blower/pipe/equip. loss=		17.0	31.7284	psia
RHs = Standard relative humidity			0.56	
RHa = Actual relative humidity			0.56	
PVs=Satur vapor press of H20 @ std temp. (PSI) See pg 13			0.3391	psia
PVa=Satur vapor press of H20 @ act temp. (PSI) See pg 13			0.573	psia
Ts = Standard temperature (degree R= deg. F + 460)		68 F =	528	deg. R
Ta = Actual temperature (deg F +460)		80 F =	540	deg. R

RH Correction Factor =	1.0091093
Temp. Correct. Factor =	1.0227273
Press. Correct. Factor=	0.4633073

ACFM = SCFMxCorrection Factors=	**71.72**	acfm in piping
No. of well per unit	1	
Total flow for wells, one unit =	72	acfm @ in header pipe 17 psi

Air Sparging Air Compressor Sizing Calculations

Site Name:	Camp Geiger Fuel Farm	Date Calculated:	10/01/97
Address:	OU 10, Site 35	Date Checked:	
City, State:	Camp Lejeune, North Carolina	By:	Les Pettit
Job No.:	17536	Checked By:	

Introduction:

The pipe frictional losses for the air sparging system are estimated using the Darcy-Weisback friction factor equation given below:

h = f x (L/D) x V□dP□

where, h = frictional losses in the pipe, in w.g.
f = friction factor, dimensionless
L = piping length, ft
d = pipe diameter, ft
V□dP□ = air flow velocity pressure, in w.g.

The friction factor, f, is found using the Churchill correlation. The correlation is given below:

f = 8 x [(8□u12□/R□de□) + (A + B)□u-1.5□]□u1/12□

where, A = -2.457 x Ln[(7□u.9□/R□de□) + k/3.7d]
B = 37,530□u16□
k = Surface roughness of the pipe, ft
R□de□ = pdV/u

where, p = air density, lb/ft□u3□
u = viscosity, lb/ft-sec

Additional losses must also be calculated for any fittings. Fitting losses are estimated from loss coefficients (K) multiplied by the piping air flow velocity pressure, V□dP□. The relevant equation is:

h = K x V□dp□

Values of K are found in literature.

Properties of Air:	
Temp =	70 □uo□F
Density =	0.075 lb/ft□u3□
Viscosity =	0.0000124 lb/ft-s

The air compressor will be sized based on the friction losses associated with the piping connected to AS-1c since it is furthest from the treatment compound. Wells AS-1a through AS-1c are connected to the treatment compound using a common header. For the purposes of this calculation conservatively assume valve at top of riser AS-1b is closed, such that 50% of air goes to riser AS-1c and 50% of the air goes to riser AS-1a.

Flowrate @ inlet air compressor=	150 scfm
Header Pipe Pressure =	17 psi
Flowrate, compound header pipe=	72 psi
Flowrate @ Well Head=	36 cfm @ 17 psi

Head Loss in Well Screen				
Vapor Flowrate =	36 CFM			
Pipe Diameter =	1.5 In =		0.125 Ft	
Pipe Area =	1.77 In□u2□ =		0.0123 Ft□u2□	
Air Velocity, V =	2933.55 Ft/Min =		48.89 Ft/Sec	
Velocity Pressure =	p x (V/1096)□u2□ =		0.5373 in w.g.	
Pipe Length =	50 Ft			
Fitting Losses:				
Fitting	No.	K	dTOTAL□	
90□u0□ Elbow	1	0.45	0.45	
60□uo□ Elbow	0	0.30	0.00	
45□uo□ Elbow	0	0.23	0.00	
Reducer	0	0.45	0.00	
Valves	1	1.00	1.00	
Total Fitting Loss Factor =			1.45	
Total Fittings Loss =			**0.78**	**in w.g.**
Pipe Losses:				
R□de□ = 36965.05	k = 0.0005 Ft (From Literature for PVC)			
A = 1.723E+19	B = 1.2746654			
f = 0.0315183				
Total Pipe Loss =			**6.77**	**in w.g.**
Total Losses =			**7.6**	**in w.g.**

Head Loss in Well Riser Pipe		
Vapor Flowrate =	36 CFM	
Pipe Diameter =	1.5 In =	0.125 Ft
Pipe Area =	1.77 In□u2□ =	0.0123 Ft□u2□
Air Velocity, V =	2933.55 Ft/Min =	48.89 Ft/Sec
Velocity Pressure =	p x (V/1096)□u2□ =	0.5373 in w.g.
Pipe Length =	45 Ft	

Fitting Losses:

Fitting	No.	K	dTOTAL□	
90□u0□ Elbow	2	0.45	0.90	
60□uo□ Elbow	0	0.30	0.00	
45□uo□ Elbow	0	0.23	0.00	
4 in x 3 in Reducer	0	0.45	0.00	
3 in x 2 in Reducer	2	0.35	0.70	
Valves	2	1.00	2.00	
Total Fitting Loss Factor =			3.60	
Total Fittings Loss =			**1.93**	**in w.g.**

Pipe Losses:

R□de□ =	36965.05	k = 0.0005 Ft (From Literature for PVC)	
A =	1.723E+19	B = 1.2746654	
f =	0.0315183		
Total Pipe Loss =		**6.10**	**in w.g.**
Total Losses =		**8.0**	**in w.g.**

Head Loss from AIS Header, AS-1a to AS-1c				
Vapor Flowrate =	36 CFM			
Pipe Diameter =	1.5 In =		0.125 Ft	
Pipe Area =	1.77 In□u2□ =		0.0123 Ft□u2□	
Air Velocity, V =	2933.55 Ft/Min =		48.89 Ft/Sec	
Velocity Pressure =	p x (V/1096)□u2□ =		0.5373 in w.g.	
Pipe Length =	100 Ft			
Fitting Losses:				
Fitting	No.	K	dTOTAL□	
90□u0□ Elbow	3	0.45	1.35	
60□uo□ Elbow	0	0.30	0.00	
45□uo□ Elbow	0	0.23	0.00	
4 in x 3 in Reducer	0	0.45	0.00	
3 in x 2 in Reducer	0	0.35	0.00	
Valves	1	1.00	1.00	
Total Fitting Loss Factor =			2.35	
Total Fittings Loss =			**1.26 in w.g.**	
Pipe Losses:				
R□de□ = 36965.05	k = 0.0005 Ft (From Literature for PVC)			
A = 1.723E+19	B = 1.2746654			
f = 0.0315183				
Total Pipe Loss =			**13.55 in w.g.**	
Total Losses =			**14.8 in w.g.**	

Head Loss from Header, AS-1c to treatment compound		
Vapor Flowrate =	72 CFM	
Pipe Diameter =	1.5 In =	0.125 Ft
Pipe Area =	1.77 In□u2□ =	0.0123 Ft□u2□
Air Velocity, V =	5867.09 Ft/Min =	97.78 Ft/Sec
Velocity Pressure =	p x (V/1096)□u2□ =	2.1492 in w.g.
Pipe Length =	50 Ft	

Fitting Losses:

Fitting	No.	K	dTOTAL□	
90□u0□ Elbow	4	0.45	1.80	
60□uo□ Elbow	0	0.30	0.00	
45□uo□ Elbow	1	0.23	0.23	
4 in x 3 in Reducer	0	0.45	0.00	
3 in x 2 in Reducer	0	0.35	0.00	
Valves	1	1.00	1.00	
Total Fitting Loss Factor =			3.03	
Total Fittings Loss =			**6.51**	**in w.g.**

Pipe Losses:

R□de□ =	73930.101	k =	0.0005 Ft (From Literature for PVC)
A =	2.458E+19	B =	1.945E-05
f =	0.030148		
Total Pipe Loss =		**25.92**	**in w.g.**
Total Losses =		**32.4**	**in w.g.**

Summary Head Loss AIS Wells, AS-1a thru AS-1c

Total Losses (Pipe and Fittings) =	62.8	in w.g.
Wellhead Pressure= 17 psi=	470.9	in w.g.
Equipment Losses (Estimated) =	10.0	in w.g.
Total =	543.7	in w.g.
or	20	psig
Number Wells =	1	well
Total Flow per well @ well head 17 psig=	72	CFM
Total Flowrate @ well head 17 psig =	72	CFM