04.05-07/01/95-01480

OHM Remediation
Services Corp.

WORK PLAN
FOR
SOIL REMEDIATION AT
OPERABLE UNIT 10, SITE 35
MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Delivery Order 0044

Prepared by:

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May 1995
Revised July 1995

OHM Project No. 16487

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04.05/07/01/95-01480

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APPENDICES
Appendix A Sampling and Analysis Plan (SAP)
Appendix B Site-Specific Health and Safety Plan (SHSP)

1.0 INTRODUCTION

This Work Plan (WP) presents OHM Remediation Services Corp.'s (OHM's) approach for soil remediation at Operable Unit (OU) No. 10, Site 35 Camp Geiger Area Fuel Farm, Marine Corps Base (MCB), Camp Lejeune, North Carolina. It has been prepared for presentation to the Department of the Navy, Naval Facilities Engineering Command, Atlantic Division (LANTDIV) under Remedial Action Contract (RAC) Contract Number N 62470-93-D-3032. This document has been prepared in accordance with the following documents:

- Basic Contract
- NAVFAC Specification No. 05-94-4833, "Soil Remediation at Operable Unit No. 10, Site 35, Marine Corps Base Camp Lejeune, North Carolina" dated December 21, 1994
- "Final Basis of Design, Soil Remediation at Operable Unit No. 10, Site 35, Marine Corps Base Camp Lejeune, North Carolina" by Baker Environmental, Inc. dated December 21, 1994
- Project Drawings which are referred to as Project Documents.

Additional detail, methods, or information needed to enact this plan are covered in the Project Documents.

Several other plans have been developed by OHM for this delivery order and are to be considered as integral components to this work plan. As such, they have been appended to this plan.

- Site Specific Health and Safety Plan (SHSP)
- Sampling and Analysis Plan (SAP)

This WP identifies and describes how OHM will implement the major tasks encompassing the soil remediation for OU No. 10 in conformance with the contract requirements. It includes the following sections:

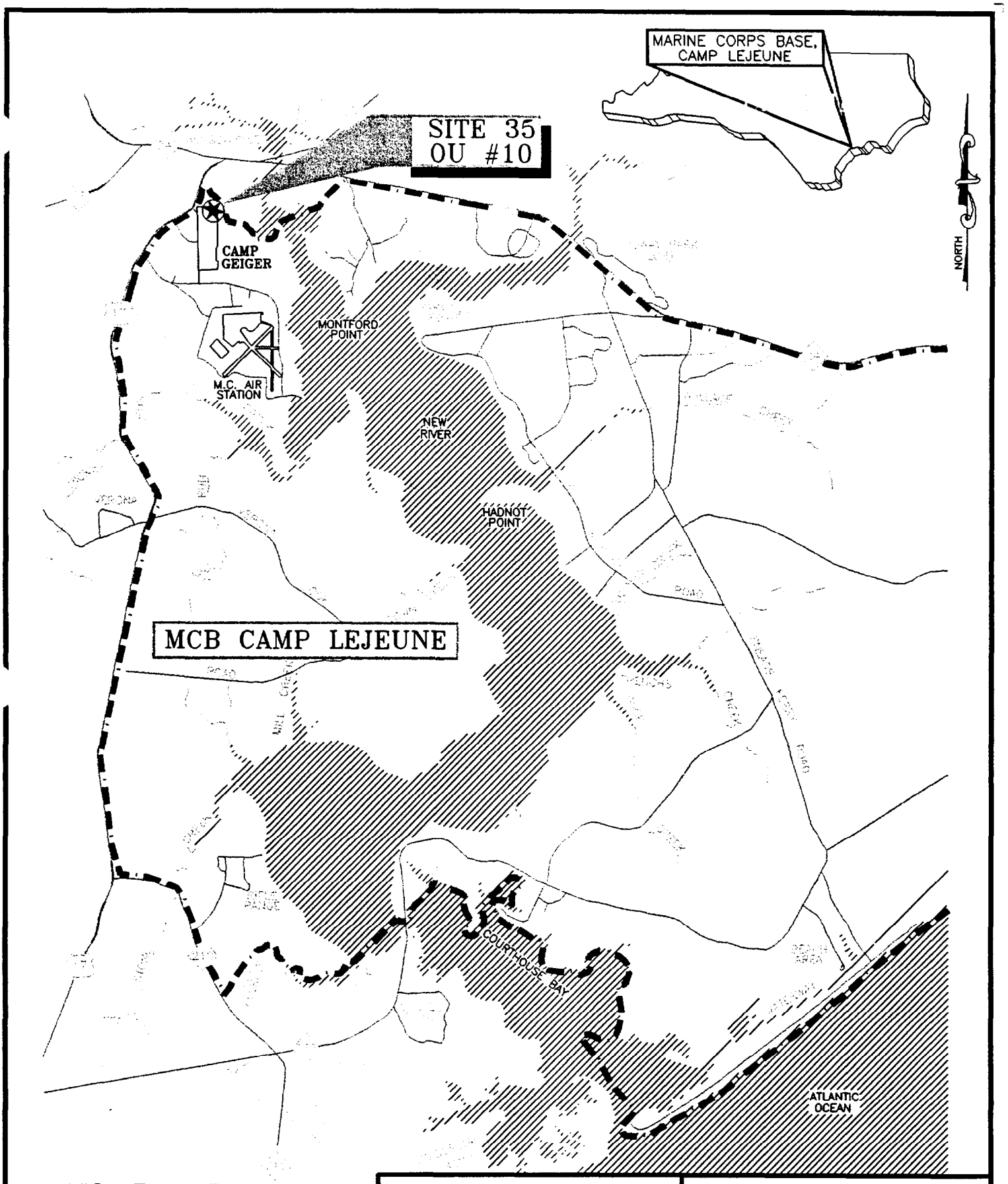
- Section 2.0 Site Background
- Section 3.0 Site Description
- Section 4.0 Site Preparation and Mobilization
- Section 5.0 Site Control Plans
- Section 6.0 Site Work
- Section 7.0 Site Restoration and Demobilization
- Section 8.0 Reporting
- Section 9.0 Project Schedule

The purpose of this document is to enable the implementation of remediation of Operable Unit No. 10, Site 35, the Camp Geiger Area Fuel Farm, under the Installation Restoration Program using a Remedial Action Contract (RAC). The goal of this removal action is to remediate the contaminated soil with concentrations of total petroleum hydrocarbons (TPH) in excess of 40 mg/kg (milligrams per kilogram) as measured by EPA Method 5030/8015 (Low Boiling Point Hydrocarbons) and 160 mg/kg as measured by EPA Method 3550/8015 (High Boiling Point Hydrocarbons). For the purpose of this project, any soil which exceeds these criteria will be identified as contaminated soil.

2.0 SITE BACKGROUND

MCB Camp Lejeune is a training base for the U.S. Marine Corps, located in Onslow County, North Carolina as shown in Figure 1. The base covers approximately 236 square miles and includes 14 miles of coastline. MCB Camp Lejeune is bounded to the southeast by the Atlantic Ocean, to the northeast by State Route 24, and to the west by U.S. Route 17. The town of Jacksonville, North Carolina is located north of the base.

Camp Geiger is located at the extreme northwest corner of MCB Camp Lejeune. The main entrance to Camp Geiger is off U.S. Route 17, approximately 3.5 miles southeast of Jacksonville. OU No. 10, Site 35, the Camp Geiger Area Fuel Farm, refers to an area where five, 15,000-gallon aboveground storage tanks (ASTs), a pump house, and a fuel unloading pad were situated within Camp Geiger just north of the intersection of Fourth and "G" Streets. All fueling facilities, tanks, pumps, pipelines and appurtenances have been removed by others and for the purpose of OHM activities Site 35 will consist of four Areas A, B, C and D as shown in Figure 2 that will be remediated in this WP.



VICINITY MAP

2 0 1 2

1 INCH = 2 MILES

OHM Remediation Services Corp.

NORCROSS, GEORGIA

A SUBSIDIARY OF OHM CORPORATION

DRAWN BY	J. COLLINS	5/12/95
CHECKED BY	J. OVERHOLTZER	5/12/95
APPROVED BY	G. GILLES	5/12/95

REV.	SHEET #	PROJECT NO.
0	-	16487

FIGURE 1

VICINITY AND LOCATION MAP

D.O. 44 WORK PLAN
MARINE CORPS BASE CAMP LEJEUNE
N. CAROLINA

01480EE01Z

MOBILE TESTING LAB.
DECON AREA
STOCKPILE AREA
FIRST ST.
SECOND ST.
"D" STREET
"E" STREET
THIRD ST.
FOURTH ST.
FIFTH ST.
SITE 35
OU #10
EXCAVATION AREA B
EXCAVATION AREA A
EXCAVATION AREA C
BRINSON CREEK
CONFIRMATION SAMPLING AREA "D" SEE DETAIL ON FIGURE 5
BLDG. G480
FORMER MESS HALL
FORMER MESS HALL HEATING PLANT
500 – GAL. DIESEL AST (ABANDONED)
NO. 6 FUEL OIL UST (ABANDONED)
WAREHOUSE
FORMER GAS STATION
FORMER ICE HOUSE
500 – GAL. WASTE OIL TANK (ACTIVE)
WAREHOUSE (FORMER VEHICLE MAINTENANCE GARAGE)
PAINT STORAGE
WAREHOUSE
WAREHOUSE
WAREHOUSE
WAREHOUSE
FORMER WAREHOUSE
BARRACKS
FOOTBALL FIELD
PARKING AREA
NORTH

LEGEND

LIMITS OF EXCAVATION AREA
HAUL ROUTE
TEMPORARY SAFETY FENCING

200 0 100 200
1 INCH = 200 FEET

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CADD FILE: FIGURE2a.DWG
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REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

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ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
LANTDIV RAC CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO. 0044
OPERABLE UNIT NO. 2 — MARINE CORPS BASE, CAMP LEJEUNE, N.C.

FIGURE 2
SITE LAYOUT
D.O. 44 WORK PLAN

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DATE: 5/12/95

3.0 SITE DESCRIPTION

The surface topography at Site 35 is generally flat to the south and west of the fueling area. The ground surface dips rapidly to the north and east in the direction of Brinson Creek. Surface water runoffs flows toward Brinson Creek.

The shallow soil stratigraphy at Site 35 consists of fine to medium-grained sands (15 to 30 feet thick), which in turn is underlain by oolitic, fossilferrous limestone (6 to 20 feet thick), which is underlain by a unit of silty sand.

Shallow groundwater flow direction is generally west to east across the site in the direction of Brinson Creek. The top of groundwater is encountered roughly 8 to 10 feet below the ground surface across the flat portion of the site and at lesser depths as the surface topography converges with Brinson Creek.

Analytical data generated as part of Interim Remedial Action/Feasibility Study in December of 1993 combined with data obtained during previous investigations conducted at Site 35 identified the presence of petroleum contaminated soil in the vicinity of the former Fuel Farm ASTs and to the north and northwest in a broad area extending from the former UST adjacent to Building G480 to the vicinity of monitoring well MW-25. In general, the analytical data suggests that the majority of the contaminated soil is present within a narrow zone that begins just above the top of the shallow groundwater table.

Three areas of soil contamination requiring remediation have been identified as depicted on Figure 2. The first area, C, is located in the vicinity of the previously existing Fuel Farms ASTs. The two other areas are located north of the Fuel Farm. The larger of these two areas, A, is located along "F" Street in the vicinity of monitoring well MW-11; the smaller area, B, is in the area of monitoring well MW-25. Based on the limits of excavation identified on Drawings C-1, C-2, and C-3 of the drawings included in NAVFAC Specification No. 05-94-4833, and "The Final Basis of Design," it is estimated that 3,600 cubic yards of contaminated soil and 5,500 cubic yards of uncontaminated soil will be excavated for a total of 9,100 cubic yards of soil removed from the excavations. The uncontaminated soil that will be excavated must be excavated in order to reach the contaminated soil and will, upon confirmation as uncontaminated through analytical testing, subsequently be used as backfill. Any additional backfill required will be imported from the base borrow area located near Hadnot Point. Area D is also shown on the site layout. Area D, north of Building G480 is designated for confirmation sampling. Four soil borings are proposed in this area (Figure 3). Specific tasks are provided in the SAP.

01480EE022

PARKING AREA

EXCAVATION AREA C

EXCAVATION AREA C

NORTH

E STREET

F STREET

GATE

SB-03

EDGE OF ASPHALT PATCH

SB-02

SB-01

SB-04

15'

BOLLARDS

EXISTING AST

15'

15'

BLDG. G480

FENCE

FOURTH ST.

FORMER ICE HOUSE

FORMER GAS STATION

LEGEND

LIMITS OF EXCAVATION AREA

SB-03 SOIL BORING LOCATION

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FIGURE 3

SOIL BORING LOCATIONS NEAR BLDG. G480-SITE 35

D.O. 44 WORK PLAN

DRAWING NUMBER:

SHEET NUMBER: _ of

DATE: 5/12/95

4.0 SITE PREPARATION AND MOBILIZATION

An initial sampling event will be conducted during early June and prior to project mobilization. The purpose of this event is two-fold and includes:

- Procure samples for waste characterization
- Perform pilot bench testing for three different immunoassay kits and correlate results to laboratory test results.

The pilot/bench testing program will also enable determination of testing times for each of the kits. The testing time will be utilized to evaluate the effective cost of each kit which when coupled with the data correlation will aid in selection of the most cost-effective field test kit.

OHM will mobilize personnel and equipment from its Southern Region offices. 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 all activities and the plan by signing an approved acceptance form.

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

- **Site Survey** - A professional licensed surveyor will be subcontracted to provide the initial limits of excavation for each area and location of other features such as construction roads and equipment laydown areas.
- **Temporary Facilities Installation** - OHM will install a mobile testing laboratory adjacent to the decontamination area.
- **Delivery of Equipment** - OHM will deliver all equipment necessary to perform the work. The heavy equipment will consist of trackhoe, dump trucks, bull dozers, and compactors. Light weight equipment will consist of all sampling equipment, decontamination equipment, health and safety equipment, water tanks, and general supplies.
- **Temporary Office** - OHM will utilize the project office at OHM's existing office trailer in Lot 203.
- **Clearing and Grubbing** - Trees located within the excavation zones will be cut and staged in a convenient location for pickup by the Forestry Service.

- **Erosion and Sedimentation Control** - OHM will establish controls to prevent erosion and sedimentation through the use of sediment fencing. Section 4.1 of this WP details the erosion and sedimentation control measures required by the State of North Carolina.

- **Install Safety Fencing** - OHM personnel will erect safety fencing around excavations A, B, and C. Fencing will be 4 feet high, bright orange, polyethylene, mesh fence to prevent personnel from accidentally entering the open excavations.

- **Decontamination Areas** - 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.

- **Stockpile Area Preparation** - The designated stockpile area will be cleared of debris and plastic sheeting will be spread on the asphalt pavement to temporarily store and separate the soil being excavated.

- **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 contamination reduction zone (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 delineated by orange safety fencing. OHM health and safety personnel will provide site air monitoring as specified in the SHSP and will adjust work zone boundaries as appropriate.

- **Waste Characterization and Disposal Authorization** - OHM will collect samples from each of the three areas for disposal characterization. A disposal/treatment facility (or facilities) will then be identified for the acceptance of the contaminated soil which will be removed. All disposal documentation necessary will be prepared and will be provided to the NTR for approval and authorization as described in Section 6.4.

- **Common Fill Identification** – A borrow area will be identified for the supply of common fill for site restoration. Geotechnical samples will be collected and forwarded to the respective laboratories.

- **Monitor Well Abandonment** – Monitor wells within the remediation area that are to be removed will be identified. They will be abandoned in accordance with State of North Carolina regulations.

- **Site Fence Installation** – Since the project will be conducted on a secure military facility, only temporary orange plastic safety fencing will only be installed around areas where open excavations are present.

5.0 SITE CONTROL PLANS

OHM will implement site control plans to prevent negatively impacting the surrounding environment while performing remediation activities. Three specific plans that are discussed in the following section are the following:

- Erosion and Sedimentation Plan
- Spill Prevention and Control Plan
- Stormwater Management Plan

Portions of these plans will be implemented immediately once OHM mobilizes to the site, while other activities will be implemented as necessary. The following sections describe the activities for each of these plans.

5.1 EROSION AND SEDIMENTATION CONTROL PLAN

The Erosion and Sedimentation Control Plan (ESCP) has been prepared to provide measures to protect nearby surface waters that could be negatively impacted by construction activities if proper sediment and erosion protection measures are not taken within this area having easily erodible sandy surface soils. To protect against damage, storm water surface run-off leaving the site will be controlled by temporary erosion/sediment control techniques such as berms, silt fencing and grading as shown in Figures 4 and 5. Open excavations or stockpiled soil vulnerable to creating erosion problems during construction activities will be held to a minimum.

Silt fencing will be constructed around all high activity construction areas or excavation areas where off-site migration of soil may occur. Locations that will be protected downgradient include monitoring well locations, the two drainage ditches and Brinson Creek.

Mulch will be placed over and around natural and wooded areas that are disturbed during excavation activities. Areas which are not expected to be reclaimed by natural vegetation will be seeded and mulched, sodded, and/or covered with seeded, biodegradable erosion control matting.

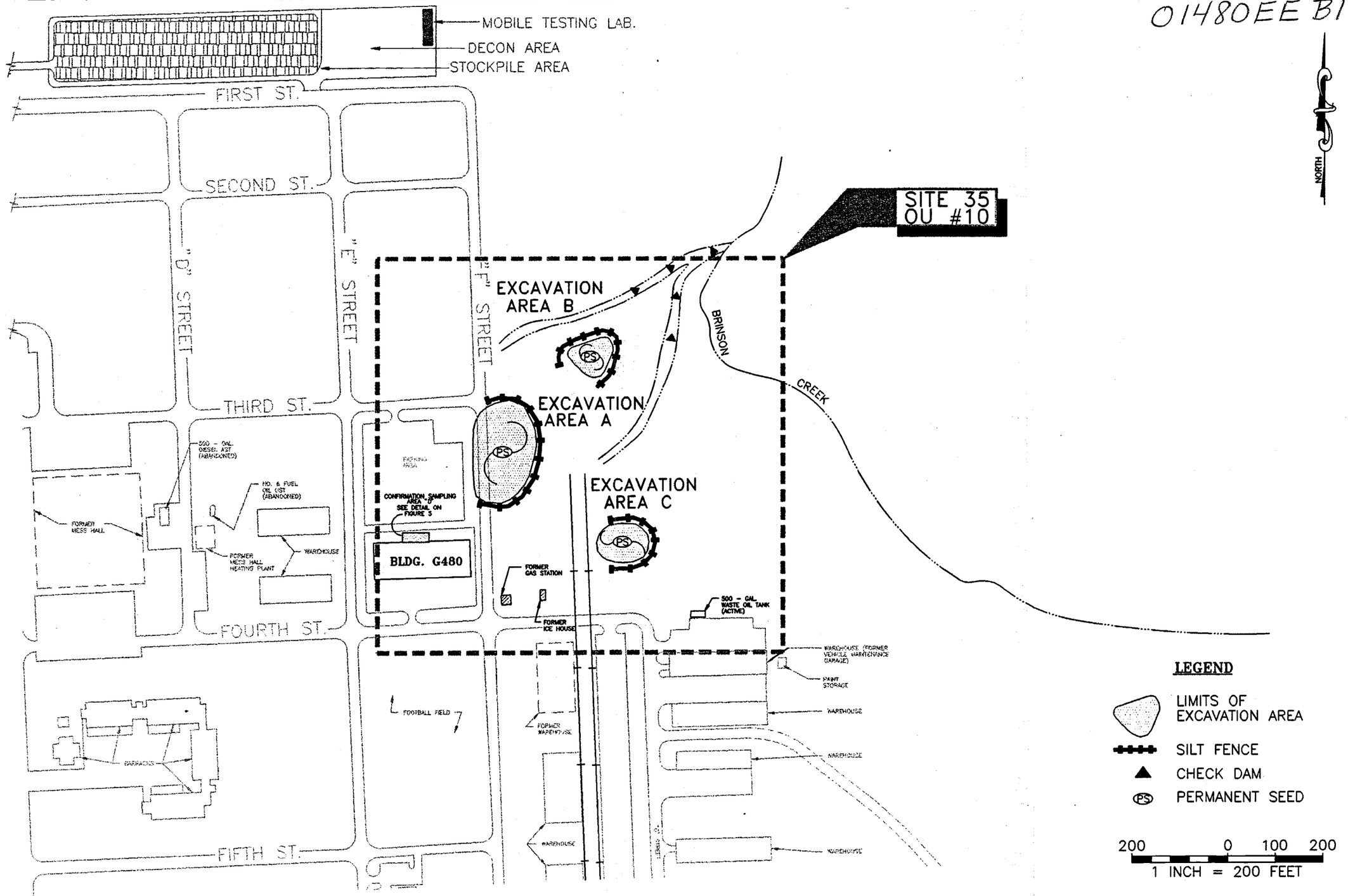
Upon completion of backfilling and compaction activities, permanent seeding will be performed over the affected areas, and any other areas where natural revegetation will not occur or will not occur quickly.

5.1.1 Construction Specifications

1. Silt Fencing – Construction Specifications

- Construct sediment fence as shown on drawings to prevent sediment from being washed into the drainage system.

01480EE BIZ



LEGEND

- LIMITS OF EXCAVATION AREA
- SILT FENCE
- CHECK DAM
- PS PERMANENT SEED

200 0 100 200
1 INCH = 200 FEET

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FIGURE 4

EROSION AND SEDIMENTATION CONTROL

D.O. 44 WORK PLAN

DRAWING NUMBER:

SHEET NUMBER: _ of

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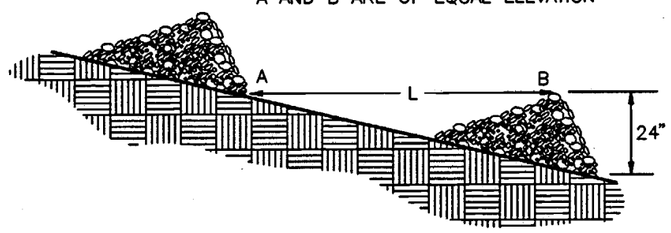
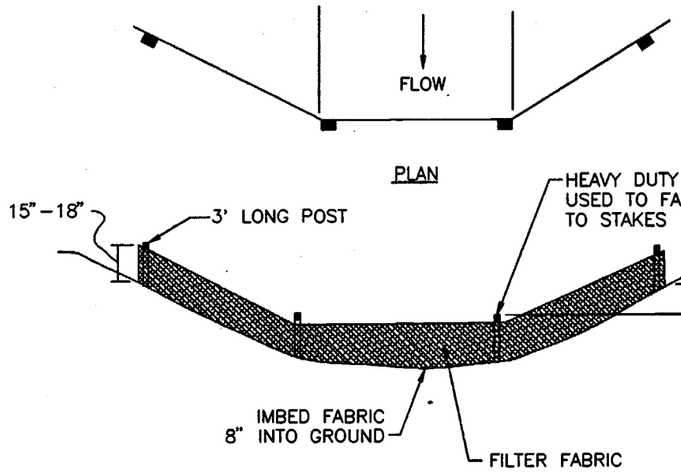
L= THE DISTANCE SUCH THAT POINT A AND B ARE OF EQUAL ELEVATION



DETAIL– CHECK DAM

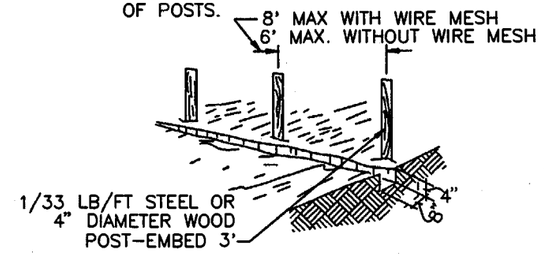
NOT TO SCALE



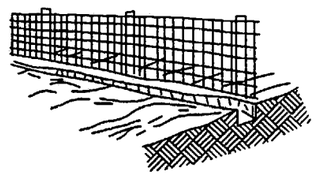
SILT FENCE CONSTRUCTION

NOT TO SCALE

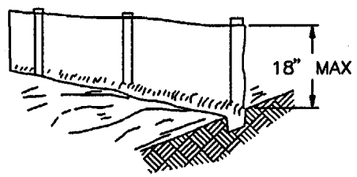
1. SET POSTS AND EXCAVATE A 8" X 4" TRENCH UPSLOPE ALONG THE LINE OF POSTS.



2. STAPLE OR ATTACH FENCING TO THE UPSLOPE SIDE OF POSTS. EXTEND WIRE 6" INTO TRENCH.

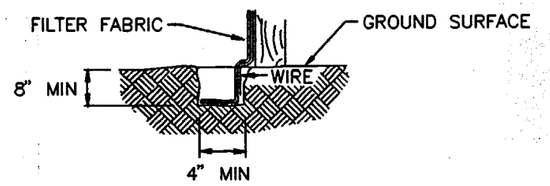


3. ATTACH THE FILTER FABRIC TO UPHILL SIDE OFTHE WIRE FENCE AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.

EXTENSION OF FABRIC AND WIRE INTO THE TRENCH.



DETAIL – SILT FENCE

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ATLANTIC DIVISION

NAVAL STATION — NORFOLK, VIRGINIA

LANTDIV RAC CONTRACT N62470–93–D–3032 — DELIVERY ORDER NO. 0044

OPERABLE UNIT NO. 2 — MARINE CORPS BASE, CAMP LEJEUNE, N.C.

FIGURE 5

SILT FENCE DETAILS

D.O. 44 WORK PLAN

DRAWING NUMBER:

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- Locate posts downslope of fabric to help support fencing.
- Bury toe of fence a minimum of 8 inches deep to prevent undercutting.
- When joints in fabric are necessary, securely fasten the fabric at a support post with overlap to the next post.
- Filter fabric to be of nylon, polyester, propylene or ethylene yarn with extra strength – 50 pounds/lin. inches (minimum) – and with a flow rate of at least 0.3 gallon/square feet/minute. Fabric should contain ultraviolet ray inhibitors and stabilizers.
- Post to be 4 inches diameter pine or suitable equivalent with a minimum length of 4 feet.

2. Seed Bed Preparation

- Scarify existing subgrade. Seed will match existing vegetation and will be spread at 5 pounds per 1,000 square feet. A CID A-A-1909, Type I, Class 2, 10-10-10 analysis fertilizer will be spread at 25 pounds per 1,000 square feet. A grain straw mulch will then be applied at 100 pounds per 1,000 square feet.

5.1.2 Construction Schedule

1. Obtain plan approval and other applicable permits.
2. Hold preconstruction conference at least one week prior to starting construction.
3. Flag work limits, mark any trees to remain, and create buffer area for protection.
4. Install silt fence around site at the locations on Figure 3.
5. Clear debris from site and start excavation and removal of soil.
6. Backfill excavations with uncontaminated soil or borrow material.
7. Identify any areas or locations that require additional erosion control devices.
8. Place mulch on all disturbed areas outside of the excavation limits.
9. All erosion and sediment control practices will be inspected weekly and after rainfall events. Needed repairs will be made immediately.

10. After site is stabilized and permanent vegetation has been established, all erosion and sediment control structures may be removed.

5.1.3 Maintenance Plan

1. All erosion and sediment control practices will be checked by OHM personnel for stability and operation following every run-off producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed.

2. Sediment will be removed from behind sediment fence when it becomes greater than 1 foot deep at the fence. The sediment fence will be repaired as necessary to maintain a barrier.

3. All seeded areas will be fertilized, reseeded as necessary, mulched and mowed according to specifications to maintain a vigorous, dense vegetation cover.

4. Inspect check dams and channels for damage after run-off event.

5. Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam. Correct all damage immediately. If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel.

6. Remove sediment accumulated behind the dams as needed to prevent damage to channel vegetation, allow the channel to drain through the stone check dam, and prevent large flows from carrying sediment over the dam. Add stones to dams as needed to maintain design height and cross section. Gravel will be cleaned or replaced when the check dam no longer drains properly.

5.2 STORMWATER MANAGEMENT PLAN

The primary objective of the Stormwater Management Plan is to prevent the free and uncontrolled flow of water across the Exclusion Zone and contaminated stockpiles. Diversions and controls will prevent clean water from becoming contaminated and incurring additional cost and effort to dispose (Figure 4). Clean water can be discharged to ditches. The secondary objective of the management is to identify what will be done with rainwater that enters the excavation.

The excavation will be controlled to prevent the flow of stormwater runoff from adjacent areas into the excavation. This will be accomplished by the placement of berms and/or trenches around the perimeter of the excavation and stockpiles that will divert surface flows off site and

away from the work area. The drainage paths will be constructed to assure that contaminated soil is not carried off site or onto uncontaminated areas.

To control erosion and cross contamination in the excavated areas and stockpiles, polyethylene sheeting will be used. Migration of contaminated soil from stockpiles onto uncontaminated soil areas will be controlled by covering contaminated soil stockpiles with polyethylene sheet. If large volumes of water are collected that have come in contact with the contaminated soil face, that water will be contained and sampled for laboratory analysis in accordance with Section 01430 of the specifications. The water will be analyzed in accordance with the SAP. Upon receipt of the chemical analytical data, a choice will be made for the appropriate disposal method.

5.3 SPILL PREVENTION AND CONTROL PLAN

The Spill Prevention and Control Plan will address two categories of spills that may occur in association with the work: on site and off site. The type of spill most likely to be encountered is the release of soil from trucks.

Various methods will be employed during different project activities to prevent spills of contaminated soil. Prevention methods that will be enforced on site will be the control of the Exclusion Area. All personnel and equipment leaving this area will be decontaminated. During loading of trucks destined for a disposal/treatment facility, a technician will monitor the loading of trucks for spillage, firm loading foundation, tight gate seals, and tarping. Truck drivers will be under OHM supervision and will not be allowed to congest the area thus preventing accidents. Finally, drivers will be instructed to travel directly to the disposal facility, shortening time for opportunities for accidents while loaded.

Should a spill of contaminated soil occur, a response will be made as soon as possible to collect and remove the spill. If the spill occurs on site, OHM will respond immediately to contain and return the contaminated soil to a stockpile or truck that is secure. The cause of the spill will be determined and corrective action will be taken if necessary. Should the spill occur off site, the truck driver will immediately contact the OHM site supervisor so that the proper notifications may be made.

The site supervisor will carry a pager so that the truck dispatcher may contact him at any time. A special emergency code will be provided so that the site manager will be immediately alerted of the urgency to respond to the page. Action will be taken immediately to contain and recover material. Spills which occur on clean soil will be over excavated to verify that all contaminated soil is removed. Spills occurring on concrete will be swept with brooms or vacuumed to ensure that all contaminated soil is collected.

A report of all spills or leaks, regardless of their quantity, will be made to the NTR immediately following their discovery. A written follow up will be submitted after the initial report.

6.0 SITE WORK

The field activities for this project consist predominantly of the removal, identification, and handling of soil contaminated by petroleum hydrocarbons. The areas impacted by these contaminants are identified in Figure 2 and Drawings T-1, C-1, C-2, and C-3 accompanying NAVFAC Specification No. 05-94-4833. The soil that is impacted is identified as containing total petroleum hydrocarbons in excess of the following two criteria.

- 40 mg/kg per EPA Method 5030/8015
- 160 mg/kg per EPA Method 3550/8015

The following sections describe the various activities that will be conducted to remove and dispose of petroleum hydrocarbon contaminated soil and remove and replace uncontaminated soil.

6.1 SOIL EXCAVATION

As discussed in Section 4.0, all preparatory activities will have been performed so that excavation can be conducted safely, efficiently and with minimum environmental impact. All areas to be excavated will be field checked to verify that the surveyor's stakes conform to the locations shown on Drawings C-2 and C-3. If necessary, off-set stakes will be installed for boundary stakes that may be displaced.

Prior to any excavation, all utilities will be located, verified with base personnel and flagged to prevent damage. The name of an emergency contact person and a telephone number will be kept on site by the site superintendent for all utilities that are identified in the area. All utilities and pipe lines that remain in an excavation area during soil removal will be flagged and supports will be provided to prevent sagging that may cause breakage or leakage.

A trackhoe will carefully excavate soil from the Areas A, B, and C. All soil identified in Drawings C-2 and C-3 of NAVFAC Specification No. 05-94-4833 will be excavated to the vertical and horizontal limits. Top-loading of dump trucks directly from the excavation will minimize earthmoving equipment tracking through contaminated soil. The excavation will also start at Area C and proceed toward the stockpile area, thus preventing trucks from driving through and around contaminated soil. During excavation and loading, the operator will carefully and smoothly load the trucks to prevent spillage. Trucks will not be loaded such that soil pours over the edges of the dump bed and is spread along the haul route.

During the excavation of soil, a field chemist will take soil samples and conduct an analysis of the soil removed. They will visually inspect the soil for stains or discoloration and will perform field screening with a rapid immuno assay test for petroleum hydrocarbons. Based on this information, the chemist will instruct the truck driver whether to dump the soil in a

contaminated or uncontaminated stockpile. The method and frequency of rapid immuno assay testing is described in the SAP.

The excavation process will continue until the predetermined limits are encountered in all directions or until groundwater is encountered. No excavation will be performed into the groundwater table. If visual and/or field screening indicate that contaminated soil is present beyond the predetermined areas, OHM will consult the NTR for guidance. OHM will not excavate any soil beyond those shown in Drawings C-2 and C-3 of the specifications without written authorization from the NTR.

The results of the immuno assay testing will direct the excavation activities. Samples will be taken of the walls of the excavations in accordance with the SAP. All methods frequencies, documentation and tests for the confirmation screening of the walls are described in the SAP. Should the screening results indicate soils are below the TPH action levels, confirmation samples will be collected for off-site analyses as described in the SAP. If the indicated soils are above the TPH action limits, then excavation will continue as authorized by the NTR.

Because the removal of contaminated soil may create an excavation greater than 4 feet deep, the slopes of the excavation will be observed for stability and fulfillment of OSHA regulations. They will sloped to an angle of no less than 1.5 horizontal:1 vertical preventing the need for bracing and shoring.

6.2 TRANSPORT TO STOCKPILE AND STOCKPILING

All trucks used for transporting contaminated soil and uncontaminated soil within the exclusion zone will be decontaminated before leaving the exclusion zone. The loaded trucks will transport all soil to the stockpile area along the route shown in Figure 2 and Drawing C-2 of the design drawings. The entire route is paved and the drivers will be instructed not to deviate from the haul route preventing the accidental spreading of contaminated soil. Should dust become a concern, the route will be dampened with water or deposits will be brushed or shoveled from the route. The trucks will deposit their loads of soil in the stockpiles as instructed by the technicians who performed the petroleum hydrocarbon screening. To minimize cross-contamination, the trackhoe will attempt to handle only contaminated or uncontaminated soil for extended periods of operation. Also, if it becomes necessary trucks can be dedicated to hauling just one type of payload.

The stockpile area shown on Figure 2 and Drawing C-2 of the design drawings is a paved area which will be covered with polyethylene to prevent contact with clean pavement and ease removal when loading for disposal or treatment. The stockpiles will be clearly labeled with signs and flagging. Contaminated soil areas will be flagged with red tape and uncontaminated soil areas will be flagged with yellow tape. Both contaminated and uncontaminated soil

stockpiles will be composed of approximately 200 cubic yards of soil and will be physically separated by plastic sheeting or an open area from the adjacent stockpile. Separate areas for contaminated and uncontaminated soil will be demarcated at extreme ends of the stockpile area to prevent any mixing of soil. All stockpiles will be covered with polyethylene sheeting to prevent excessive precipitation from saturating the soil, reduce potential odors from the stockpile area, and prevent unauthorized personnel access to contaminated soil stockpiles.

To verify the disposition of the soil stockpiles, waste characterization samples will be collected for laboratory analysis. Both contaminated and uncontaminated soil stockpiles will be sampled. The specific methods, frequencies, documentation, and tests are described in the SAP. If the results of the tests show TPH above the criteria, then the stockpile should be scheduled for shipment to a disposal/treatment facility. If the results show TPH levels below the threshold, then the stockpile should be considered a candidate for use as backfill. Geotechnical data should be acquired for the soil and all laboratory analysis should be assembled for submittal to the NTR as discussed in Section 7.0.

6.3 LOAD-OUT AND TRANSPORT

Once laboratory chemical analyses indicate which soil stockpiles are contaminated, the contaminated soil stockpiles will be scheduled for removal from the site. Trucks will be mobilized to the site where they will be loaded with contaminated soil for transport to a treatment disposal facility. All waste destined for off-site disposal/treatment will be transported by a licensed hauler in accordance with North Carolina regulations.

Temporary loading areas will be demarcated using flagging and will be near the contaminated soil stockpiles. During loading, a technician will be on hand to aid loading, verify proper procedures are followed, inspect the vehicles for adherence to regulations such as tarping, tailgate seals, stop lights, etc. Additionally, the technician will brush soil from the outside of trucks and monitor loading to minimize spillage. If necessary, a pressure washer can be used to remove contamination. All water from decontamination operations will be collected for appropriate disposal. Finally, prior to the truck leaving the site, the technician will verify that the driver is in possession of all proper documentation. These activities will be recorded on a shipping log detailing information such as truck number, bill of lading number, tarping, cleanliness of vehicle, estimated or actual tonnage shipped, time of entry to area, time of exit from site, etc. Transport vehicles will be given directions and instructed to proceed directly to the treatment/disposal facility and dispose of the contaminated soil. Once at the treatment/disposal facility the drivers will submit all necessary documentation for disposal of their load.

6.4 DISPOSAL

Analytical data obtained during previous investigations at Site 35 indicated the presence of petroleum hydrocarbon contaminated soil around the former fuel farm ASTs and former USTs adjacent to Building G480. Based on the limits of excavation identified on Drawings C-1, C-2, and C-3 of the drawings including in NAVFAC Specification No. 05-94-4833, and "The Final Basis of Design," it has been estimated that 3,600 cubic yards of contaminated soil and 5,500 cubic yards of uncontaminated soil will be excavated for a total of 9,100 cubic yards of soil removed from the excavations.

6.4.1 Characterization of Wastestreams

Based on the information provided to OHM in the Basis of Design prepared by Baker Environmental, No. 6 fuel oil, unleaded gasoline, diesel fuel, and kerosene are the contaminants of concern. All excavated soil will be characterized by TPH (5030/8015) and TPH (3550/8015) to determine if soils will be used as backfill or routed to an off-site thermal treatment facility.

The NTR will have the ultimate approval to route the soil based on the remedial goals and recommendations from OHM.

Each 200-yard stockpile will be analyzed. If analytical results show TPH (5030/8015) greater than 40 mg/kg and TPH (3550/8015) greater than 160 mg/kg and TCLP regulatory limits are not exceeded, material will be disposed off-site at an appropriate thermal treatment/recycling facility. If the TCLP limits are exceeded, the material will have to be handled by a permitted hazardous waste facility. Soils that are confirmed to have less than 40 mg/kg TPH (5030/8015) and less than 160 mg/kg TPH (3550/8015) and all TCLP data is below regulatory limits, may be used as backfill with NTR approval.

6.4.2 Waste Disposal Approval

OHM will assign a Transportation and Disposal (T&D) Coordinator to this project acting 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 North Carolina regulations relating to hazardous and solid waste handling, treatment, storage, disposal, and transportation. This individual will review the analytical data reported by Baker Environmental and by OHM and obtain pre-approval from the appropriate disposal facilities to allow direct load out of excavated soils. The T&D Coordinator will also be responsible for preparing waste profiles to the selected disposal facilities and coordinating disposal approvals.

Based on the materials identified that will require off-site disposal, the T&D Coordinator, in consultation with the project management and procurement personnel, has reviewed potential vendors to prequalify transportation and disposal vendors based on:

- Notice of Violation (NOV) status
- Ability to handle the wastes identified
- Cost effectiveness of the available transportation and disposal options
- Past experience
- SB and SDB contract goals

At this time OHM has identified the following qualified vendors to provide transportation and disposal of wastes from this site:

Disposal

- Cherokee Environmental Group
  Sanford, NC
- Soil Reclaiming (Lee Brick)
  Sanford, NC
- Terradyne
  Fayetteville, NC
- Cunningham Brick
  Thomasville, NC

Transportation

- Hilco Transport, Inc. (SB, WBE)
  Wilmington, NC
- Terra First
  St. George, SC
- Wills Trucking, Inc.
  Columbia, SC
- Robbie D. Woods
  Demopolis, AL

All bids will be obtained based on a written solicitation and all bid responses will be in writing. All bids will be made in conjunction with OHM's procurement department. A condition of OHM's purchase order will be that the selected vendors must provide OHM with addresses, the name of a single point of contact, EPA ID numbers, permit verification, insurance verification, NOV status, and any other qualifying data necessary. OHM has determined that the transportation portion of the T&D work is well suited as a task that can be performed by a small business or small disadvantaged business.

6.4.3 Waste Packaging

Soil will be stored into approximately 200-cubic yard stockpiles, lined and covered with polyethylene sheeting to prevent precipitation from saturating soils and cross-contamination. All temporary storage will be in compliance with 40 CFR 262.34 and the applicable North Carolina regulations.

Any drummed waste (if required) will be collected in 55-gallon (17-H open-top) steel drums. These drums will be labeled and logged using OHM's standard drum inventory procedures (see attached Drum Inventory Log and Drum Labeling Instruction) OHM will maintain these

drums logs and a database summary of the type and quantity of wastes generated. Appropriate measures will be taken to keep off-site back-up copies of these data as well.

6.4.4 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 petroleum hydrocarbon contaminated soil data profiles, and all other shipping paperwork. The selected vendor(s) will be required to provide all shipping paperwork. A completed example of these forms 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 shipping paperwork will be received by OHM's on-site personnel at least 24 hours in advance of the scheduled start of shipments.

Written verification that the proposed disposal sites are permitted to accept the contaminated materials specified is required for the disposal vendors with their approvals. A written verification that wastes were actually delivered to the disposal site will be provided within seven days of receipt of waste materials. A certificate of treatment will be provided within seven days of the date of actual waste disposal and for final payment of all invoices.

6.4.5 Transportation and Disposal

The T&D Coordinator will contact the selected vendor and together with the Site Supervisor schedule soil load-out in a timely manner to coordinate with the project schedule. Prior to shipment of wastes, OHM's on-site personnel, in conjunction with the T&D coordinator, will complete a checklist for each waste shipment leaving the site.

OHM will maintain chronological organized files of weight tickets, manifest copies, LDR forms and other shipping paperwork for each shipment. OHM will also maintain a database of all pertinent information regarding each off-site shipment. Copies of the manifest file and database printouts will be provided to the LANTDIV and Camp Lejeune representatives upon request and at the completion of the project.

7.0 SITE RESTORATION AND DEMOBILIZATION

Once all removal activities of contaminated soil are complete, restoration of the site will be performed with demobilization of OHM personnel and equipment. Those activities described in this section consist of the 1) supply and placement of common fill, 2) supply and placement of pavement, 3) grassing and seeding and 4) demobilization.

Upon removal of all contaminated soil from the excavations or at the earliest time possible, all chemical analytical and geotechnical laboratory data required by the NAVFAC Specification No. 05-94-4833 will be assembled for the soil that will be used to backfill the excavations. This data will be for both the uncontaminated soil and common fill acquired from another location. The SAP describes the methods and tests that will be implemented for chemical analysis. The geotechnical testing is discussed in Section 02200 of the specifications. This information will be submitted to the NTR for review. He will then issue authorization to OHM prior to the use of any fill materials.

OHM will then load and transport all uncontaminated soil and common fill necessary to raise the site to the grades shown in Drawings C-4 and C-5 of the design drawings. The soil will be delivered by dump trucks and spread by a bulldozer in loose lifts no greater than 10 inches thick. If necessary, a bridging lift greater than 10 inches thick is allowed for the first lift placed in each excavation to prevent piercing the compacted common fill with the earthmoving equipment. The soil will then be compacted by tracking construction equipment to attain a dry density of 90 percent per ASTM D 1557.

OHM will confirm that the compaction criteria are fulfilled by *in situ* soil density testing at a frequency of no less than 1 test per 2,000 square feet per lift of fill placement. The testing procedures will conform to those stated in Section 02200 of the specifications.

When the area encompassing F Street is brought up to grade, an aggregate base and asphalt cement concrete surface will be placed for the restoration of this street as shown in NAVFAC Specification No. 05-94-4833, Drawing C-6. Any streets that may have been damaged will also be reconstructed. For areas B and C and the area surrounding the road in area A that will not receive pavement, a layer of topsoil will be placed. This will then be seeded to produce grass similar to that existing in the surrounding area as described in Section 5.1 of this WP and Section 02200 of the specification. A final survey as-built will then be performed. This as-built survey will be included in the Contractor's Closeout Report.

When all work associated with site restoration has been completed, OHM will demobilize from the site. All equipment and material that was mobilized to the site will be removed. All project related debris, trash, and incidental waste, will be disposed appropriately. The disposal of incidental waste will include any required analysis per Specification Section 01430. Prior to complete demobilization, the NTR or delegate will be requested to perform a site walk to inspect the site and approve substantial completion.

8.0 REPORTING

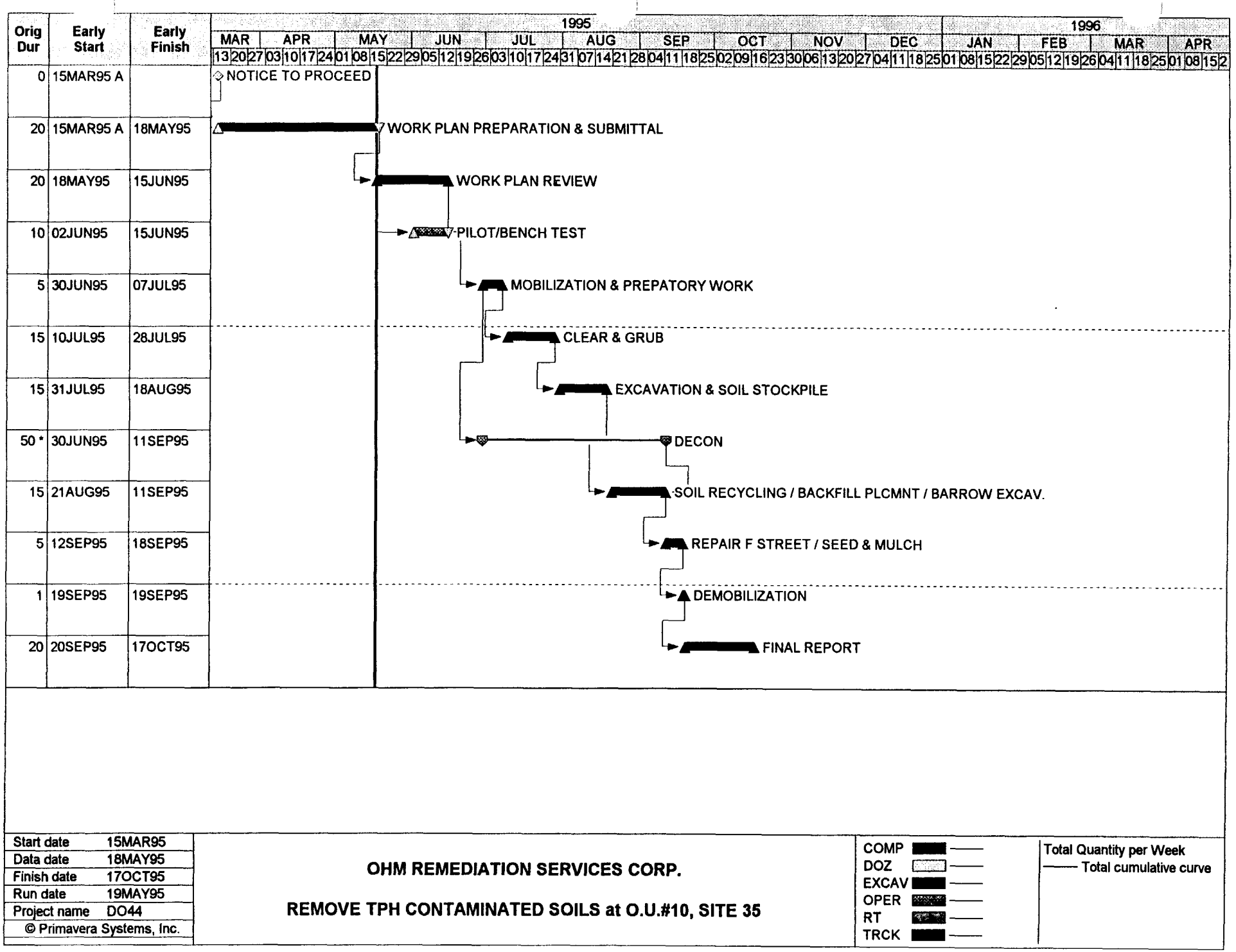
During the course of the project OHM will monitor and track project activities. This information will be reported to the appropriate parties during meetings or in submittals, permits, and periodic reports. These various documents are listed in the Submittal Register contained in Section 01010 of the NAVFAC Specifications No. 05-94-4833.

When all documents, reports, and certificates have been received, OHM will prepare for issuance to the NTR a Contractor's Closeout Report for OU 10 in accordance with Section 1.3.1.10 of the project specifications. This document will constitute a certification of completion of the project and will include the following information.

- Summary of Activities
- Health and Safety Report
- Chemical Analysis Reports
- Geotechnical Data
- Disposal Documentation
- Contract Changes and Modifications
- Survey of the site prior to remediation
- As-built survey of the site after restoration indicating any modifications to the original plan.

9.0 PROJECT SCHEDULE

The project schedule, outlining the major activities, is attached as Figure 6. It begins with receipt of notice to proceed (NTP) from LANTDIV and identifies the sequence and durations of the major tasks. Work progress will be tracked daily against this schedule in order to prevent delays in the overall duration.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20 15MAR95 A 18MAY95 WORK PLAN PREPARATION & SUBMITTAL
20 18MAY95 15JUN95 WORK PLAN REVIEW
10 02JUN95 15JUN95 PILOT/BENCH TEST
5 30JUN95 07JUL95 MOBILIZATION & PREPATORY WORK
15 10JUL95 28JUL95 CLEAR & GRUB
15 31JUL95 18AUG95 EXCAVATION & SOIL STOCKPILE
50 * 30JUN95 11SEP95 DECON
15 21AUG95 11SEP95 SOIL RECYCLING / BACKFILL PLCMNT / BARROW EXCAV.
5 12SEP95 18SEP95 REPAIR F STREET / SEED & MULCH
1 19SEP95 19SEP95 DEMOBILIZATION
20 20SEP95 17OCT95 FINAL REPORT
Start date 15MAR95
Data date 18MAY95
Finish date 17OCT95
Run date 19MAY95
Project name DO44
© Primavera Systems, Inc.
OHM REMEDIATION SERVICES CORP.
REMOVE TPH CONTAMINATED SOILS at O.U.#10, SITE 35
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Total cumulative curve

OHM Remediation
Services Corp.

SAMPLING AND ANALYSIS PLAN
FOR
SOIL REMEDIATION
OPERABLE UNIT 10, SITE 35
MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Delivery Order 0044

Prepared by

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May 1995
Revised July 1995

OHM Project No. 16487

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) presents, in specific terms, the policies, organization, functions, and QA/QC requirements designed to achieve the data quality goals for the Camp Geiger site, Delivery Order 0044 under the contract N62470-93-D-3032 for the Navy Atlantic Division (LANTDIV) at the Marine Corps Base (MCB), Camp Lejeune, Jacksonville, North Carolina. This SAP integrates the required components of a quality assurance project plan (QAPP) and a field sampling plan.

This document shall be read, understood, and implemented by the Project Manager, Site Supervisor, Project QC Manager, Project Chemist, Field Chemist/Scientist, and Sample Technicians. Any field changes shall be approved by the Navy's Technical Representative (NTR), Project Manager, and 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 Background

The objective of this project is to remove, transport, and dispose of contaminated soils located in 3 areas of Operable Unit (OU) No. 10, Site 35 - Camp Geiger Area Fuel Farm, which is at the extreme northwest corner of MCB Camp Lejeune. OU No. 10, Site 35, refers primarily to five 15,000 aboveground storage tanks (ASTs), a pump house, and a fuel unloading pad situated within Camp Geiger. Originally, the ASTs were used for the storage of No. 6 fuel oil, but were later converted for storage of other petroleum products including unleaded gasoline, diesel fuel, and kerosene.

Soil contaminated with petroleum hydrocarbons has been identified Site 35 in three areas within a zone located between the ground surface and the top of the seasonal high shallow groundwater surface. Metals were detected in one or more samples throughout the Site 35 study area, but concentration of these analytes (except arsenic) fall within the base-wide MCB Camp Lejeune background ranges and the range of element concentrations detected in eastern United States soils and surficial materials. No other organic compounds were identified in Site 35 soil as contaminants of concern requiring remediation.

2.2 Project Task Descriptions

The project tasks applicable to the SAP are the following:

- Excavate to the limits specified in the SOW
- Monitor field activities for vapor emissions and personnel health and safety using direct-reading instruments
- Sample and screen the excavated soils using visual inspection and TPH immunoassay kits in order to separate the waste into "contaminated" and "uncontaminated" piles
- Sample and analyze the "contaminated" soil piles for disposal
- Sample and analyze the "uncontaminated" soil piles to confirm that they are indeed "clean" and viable for use as backfill
- Sample and screen the excavation sidewalls using visual inspection and TPH immunoassay kits in order to delineate the limits of excavation
- Sample and analyze the excavation sidewalls following TPH screening to confirm that the soils remaining are indeed "clean"

- Sample and analyze backfill sample(s) from the base borrow pit
- Sample and analyze water from decon operations, stormwater runoff, dewatering operations, etc.
- Sample and analyze "incidental waste" generated from site activities, such as debris and PPE
- Transport and dispose of "contaminated" soils at a soil recycling facility
- Dispose of water and "incidental waste"
- Backfill excavations
- Perform subsurface investigations of Area D
- Perform surveillances and technical audits of site sampling activities

In the event that drums or potentially off-spec soils are encountered during the course of these tasks, the Navy Technical Representative (NTR) will be informed and consulted for further actions.

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 and other members of the project staff. An organizational chart of the project team is shown on Figure 2.1.

The responsibilities of the key members in the project organization are:

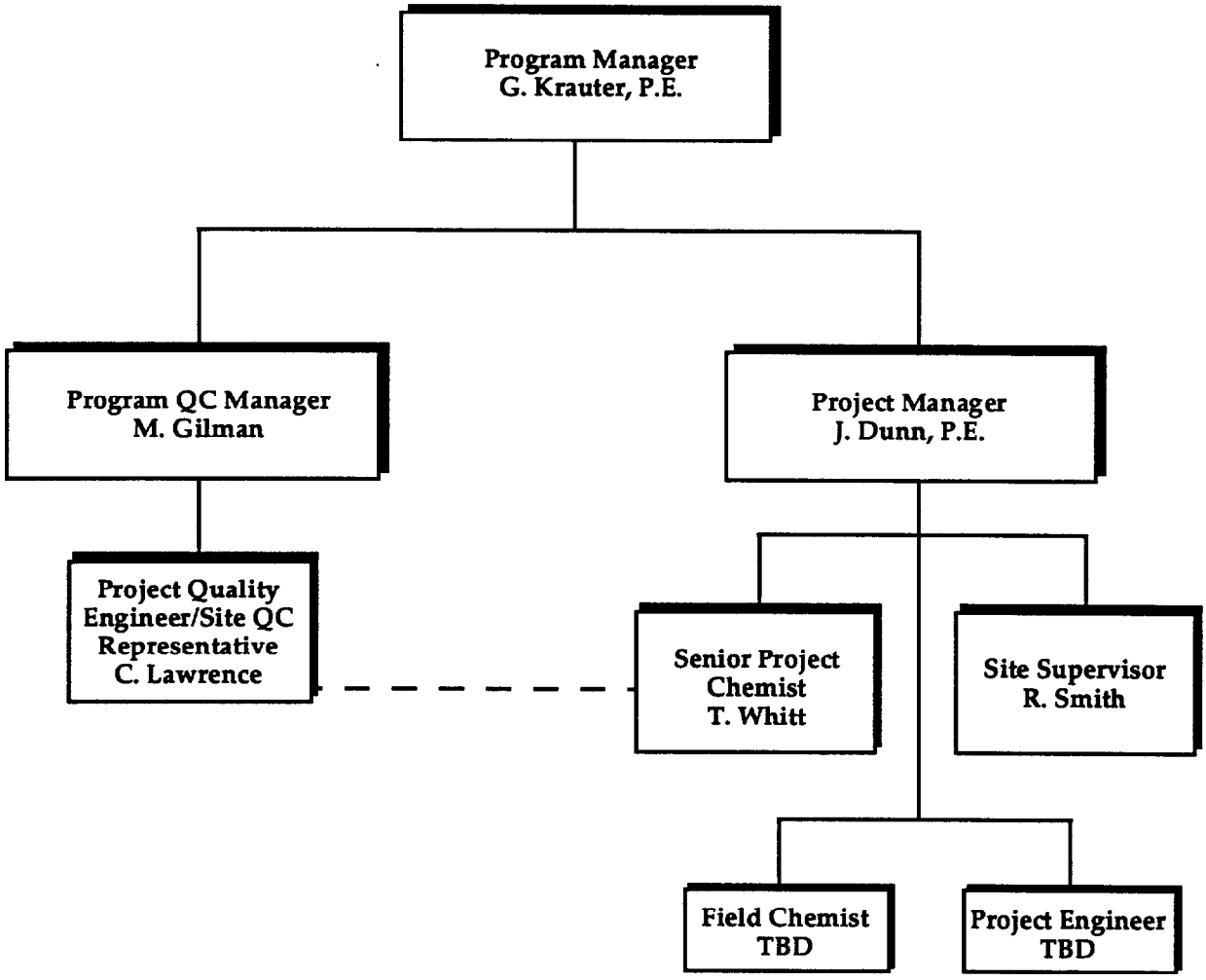


Figure 2.1
QC Organization Chart

Project Manager - James A. Dunn, Jr., P.E.
The project manager is responsible for the overall direction of this project executed under his/her 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
- Supervision of preparation and approval of project-specific procedures, work plans, and QA project plans
- Approval of project design basis, design parameters, drawings, and reports
- Approval of project remedial action/construction methodologies
- Dissemination of project-related information from the client such as design basis, 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

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 E. Smith or Designee
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 day-to-day site activities in accordance with project and program requirements
- Preparing the Contractor Production Report
- Initiating corrective actions for non-conformance identified on-site

Project Chemical QA/QC Officer - Theresa D. Rojas
The chemical QA/QC 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:

- Determining if the project and data quality objectives are being met
- 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 non-conformances, identifying appropriate corrective actions, and performing follow-up audits to ensure that the corrective actions were successful

Project Chemist - Terence A. Whitt
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. He is also responsible for informing the chemical QA officer of any site-specific problems and for coordination QA efforts with the contracted laboratory. His specific responsibilities include, but is not limited to, the following:

- Evaluating chemical data for technical validity and ensuring adherence to published guidelines
- Analyze and interpret 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

Field Chemist - To Be Determined
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
- 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 is supplied with the required field QC samples (i.e., trip blanks, rinsate blanks, etc.)

Sample Technician - To Be Determined
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

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 that are listed in Table 2.1. The criteria by which these decisions will be based and the persons responsible for making the decisions are also listed. Project-specific quality objectives are listed in Appendix A, Table A-2. These include the quantitation, action, accuracy, precision, and completeness limits by which the data will be evaluated.

A NEESA-certified laboratory will be used for all soil and waste 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.

Samples collected for the on-site immunoassay screening will meet, at a minimum, the requirements of USEPA QA/QC Level 2. Due to the prohibitive cost, the low probability of litigation, and the disposal facilities not requiring more stringent QC, all disposal samples such as the "contaminated" soils and incidental wastes (decon water, surface water, stormwater

Table 2.1
Action Items

Project Task	Decision-Maker	Criteria	Decision
Segregation of the excavated soils	Site Chemist	If: Soil is stained or discolored, or immunoassay results greater than 100 mg/kg	Then: The soil will be considered "contaminated" Otherwise, the soil will be considered "clean"
Screening of excavation walls	NTR	If: Soil is stained or discolored, or immunoassay results are greater than 100 mg/kg	Then: NTR will determine action based on recommendations from Project Manager Otherwise: Collect samples for off-site confirmation
Confirmation of excavation walls	NTR	If: All off-site analytical results show: TPH (5030/ 8015) greater than 40 mg/kg or TPH (3550/8015) greater than 160 mg/kg and all QC criteria are met	Then: NTR will determine action based on recommendations from Project Manager Otherwise: The excavation may be backfilled with the approval of the NTR
Characterization of "clean" soils	Chemist/T&D Coordinator, NTR	If: All off-site analytical results show: TPH (5030/ 8015) less than 40 mg/kg or TPH (3550/8015) less than 160 mg/kg and TCLP limits are not exceeded and all QC criteria are met	Then: The soils may be used for backfill, with the approval of the NTR Otherwise: The soils will be disposed off-site at an appropriate TSDF
Characterization of "contaminated" soils for disposal	Chemist/T&D Coordinator	If: All off-site analytical results show: TPH (5030/8015) greater than 40 mg/kg or TPH (3550/8015) greater than 160 mg/kg and TCLP limits are not exceeded and all QC criteria are met	Then: The soils will be routed to the off-site recycling facility for thermal treatment However, if TCLP limits are exceeded or PCBs are detected, then disposal will have to be handled by a hazardous waste facility.

runoff, PPE, and disposal sampling equipment) will meet, at a minimum, NEESA 20.2-047B QA/QC Level E requirements, as directed by the ROICC. All other samples such as the "clean" soils and confirmation samples will meet, at a minimum, NEESA 20.2-047B QA/QC Level C requirements. 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.

An independent firm will be subcontracted to perform data validation on samples collected using Level C QA/QC. The subcontracted firm's statement of qualifications is kept on file in the Norcross office and available upon request. Data review procedures specified by NEESA 20.2-047B and the National Functional Guidelines for validation of organics and inorganics will be followed to ensure that raw data are not altered and that an audit trail is developed for those data which require reduction. Data validation results will be provided in the project closeout report.

3.0 SAMPLING

3.1 Sampling Methods and Procedures

Table A-1 "Sampling Summary" in Appendix A summarizes the sampling locations, frequencies, samples matrices, and measurement parameters of interest. Any changes or variances to these specifications and procedures must be documented, approved, and submitted as an addendum to this SAP.

A pilot study will be performed prior to full mobilization of the project crew in order to accomplish the following:

- Determine the correlation between screening methods and off-site methods
- Evaluate and validate the screening methods
- Obtain profiles of the waste for evaluating disposal options

At each site (Area A, Area B and Area C), samples will be collected and split between the on-site and off-site laboratories. During collection of these samples, an OVA headspace reading will be obtained and recorded. The split samples given to the on-site laboratory will be screened using immunoassay kits for PAH, BTEX and TPHs. Manufacturers to be tested include Ensys, D-Tech and Dexsel. Tests will be performed by the Project Chemist. The split samples sent to the off-site laboratory will be analyzed for the methods listed in Appendix A for confirmation samples. Upon completion of the evaluation, a brief report will be submitted to the Project Manager and the ROICC. Results from this study should enable the project team (Project Manager and Project Chemist) to make informed decisions from delineation study and confirmation screen results.

In addition to validating screening methods, off-site split samples will be used for characterizing the waste material to be disposed off-site. Results from the waste profiles will aid in providing disposal options and allow for informed decisions. Disposal services could be set up and procured to further aid in meeting schedule milestones.

Samples will be collected from each of the three areas: Area A, Area B and Area C. Each samples will be a composite of five random grab samples collected from areas of suspected contamination, discolored soils, and OVA readings. Each grab samples will be collected using stainless steel shovel, spoon, and/or auger, as necessary. The grab sample will be collected using stainless steel bowl and homogenized prior to filling the appropriate sample containers. Enough sample volume should be collected to fill containers for both the on-site and the off-site laboratories.

All containers will be properly packaged, sealed and sent to the appropriate laboratories. Custody, packaging, handling, and shipping procedures described in this Sampling and Analysis Plan will be followed.

Samples will be logged in and screened upon arrival at the on-site laboratory. Manufacturer's instructions will be followed for each kit. Detection and quantitation limits, accuracy, and precision studies will also be performed for each kit. Results will be recorded in the laboratory notebook and submitted in the pilot study report. Time required for testing will be carefully monitored and recorded.

Samples will be analyzed at an off-site laboratory for the parameters listed in Appendix A. Laboratory services will be procured on a competitive bid basis.

Results from both on-site and off-site laboratories will be reviewed, summarized and evaluated by the Regional Senior Project Chemist and Regional Chemical QA/QC Coordinator. Each screening method and kit will be evaluated based on criteria such as the correlation to standard method results, sensitivity, selectivity, possible matrix interferences, performance, time and cost. Recommendations will be made as to the use and validity of each screening technique.

Results from the off-site laboratory will also be evaluated by the Regional Transportation and Disposal Coordinator for disposal options.

3.1.1 Segregation of Excavated Soils

As excavation is being performed and each truck loaded with approximately 17 cubic yards of soil, a composite sample consisting of 5 grabs will be collected. These 5 grab samples will be collected as the truck is being loaded, using a clean SS spoon. The grab samples will be collected in a clean SS bowl or bucket and homogenized. A composite sample will be prepared and placed into the appropriate containers as listed in Appendix A, Table A-1.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between truckloads to minimize the potential for cross-contamination.

The sample will be screened using a TPH immunoassay field-screening kit. If TPH is greater than 100 mg/kg, the truckload of soil will be taken to a lined holding area designated as "contaminated". If TPH is less than 100 mg/kg, the truckload of soil will be taken to a lined holding area designated as "clean".

3.1.2 Characterization of the "Contaminated" Soil Piles

One composite sample of all "contaminated " soil piles will be collected and sent to the off-site laboratory for the analyses listed in Appendix A, Table A-1. The composite sample will be prepared by collecting 6 random grab samples from the surface, middle and center of all the soil piles using a clean SS spoon. The grabs are then collected into a clean SS bowl or bucket

thoroughly mixed to obtain a relatively homogeneous mixture. A composite sample will be placed into the appropriate containers and sent for off-site analyses. For volatile samples, a representative aliquot of each of the grab samples will be placed directly into the sample container.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

3.1.3 Disposal Sampling of "Contaminated" Soil Piles

One composite sample per 200 cubic yards (every 30 truckloads, assuming 17 cubic yards per truckload) of "contaminated " soil will be collected and sent to the off-site laboratory for the analyses listed in Appendix A, Table A-1. The composite sample will be prepared by collecting 6 grab samples from the surface, middle and center of the pile using a clean SS spoon. The grabs are then collected into a clean SS bowl or bucket thoroughly mixed to obtain a relatively homogeneous mixture. A composite sample will be placed into the appropriate containers and sent for off-site analyses. For volatile samples, a representative aliquot of each of the grab samples will be placed directly into the sample container.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

3.1.4 Characterization of the "Clean" Soil Piles

After each lot of 12 truckloads are placed on the "clean" soil pile, one composite sample will be collected and sent to the off-site laboratory for the analyses listed in Appendix A, Table A-1. The composite sample will be prepared by collecting 6 random grab samples from the surface, middle and center of the pile using a clean SS spoon. The grabs are then collected into a clean SS bowl or bucket thoroughly mixed to obtain a relatively homogeneous mixture. A composite sample will be placed into the appropriate containers and sent for off-site analyses. For volatile samples, a representative aliquot of each of the grab samples will be placed directly into the sample container.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

3.1.5 Field Screening of the Excavation Walls

Following excavation of soils down to the seasonal high level of the surficial aquifer, grab samples will be collected every 50 linear feet of each sidewall for field screening. The walls of the excavation will be sloped and will therefore be accessible for sampling within in the hole. The first few inches within the walls will be discarded prior to collecting each grab sample using a clean SS spoon and placing enough volume of material into a clean SS bowl or bucket. The sample must be thoroughly mixed to obtain a relatively homogeneous mixture prior to filling the appropriate sample containers as specified in Appendix A, Table A-1.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

The sample will be screened using a TPH immunoassay field-screening kit. If TPH is less than 100 mg/kg, a confirmation sample will be collected for off-site analysis. If TPH is greater than 100 mg/kg, the NTR will be informed by the Project Manager to determine the additional soil volumes to be excavated. Contaminated soils will be removed until groundwater level is reached.

3.1.6 Confirmation Sampling of the Excavation Walls

Following attainment of negative results on the immunoassay field screening tests, confirmation grab samples will be collected every 50 linear feet of each sidewall for off-site analysis of the parameters listed in Appendix A, Table A-1. The walls of the excavation will be sloped and will be accessible for sampling within in the hole. The first few inches within the walls will be discarded prior to collecting each grab sample using a clean SS spoon and placing enough volume of material into a clean SS bowl or bucket. The sample must be thoroughly mixed to obtain a relatively homogeneous mixture prior to filling the appropriate sample containers as specified in Appendix A, Table A-1. For volatile samples, a representative grab sample will be placed directly into the sample container.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

3.1.7 Confirmation Sampling of Area D

Subsurface Soil Investigation

In January, 1994, a former fuel oil UST located along the north side of Building G480 was excavated and removed. Available records indicate that an undetermined volume of fuel contaminated soil was encountered and excavated along with the UST. No documentation

exists regarding the final disposition of the contaminated soil. Confirmation sampling will be conducted in the vicinity of the former UST where a new aboveground storage tank (AST) is presently located. Four hand auger soil borings will be advanced including one boring directly within the area of the UST excavation and three other borings outside the perimeter of the excavation. The area of excavation can be readily delineated since it was covered with an asphalt patch that is clearly visible. The locations of the proposed borings (SB01 through SB04) are depicted on Figure 3.1.

Soil boring SB01 will be advanced adjacent to the existing AST. This boring will provide data regarding the presence or absence of fuel contaminants in the soil used to backfill the excavation. The remaining three borings are to be advanced 15 feet from the AST in the three accessible directions (i.e., the southerly direction is inaccessible due to the presence of Building G480). Available data indicates that the groundwater in this area is contaminated with fuel byproducts. Therefore, it is anticipated that soil contamination will be encountered beginning at the top of the seasonal high groundwater elevation. However, insufficient data has been obtained to date to determine the elevation of the top of the seasonal high groundwater table. Therefore, two soil samples will be obtained from each boring and analyzed for Total Petroleum Hydrocarbons (TPH) by EPA Methods 5030/8015 and 3550/8015. One sample will be obtained from just above the current groundwater/soil interface (previously recorded at just under 6 feet below the ground surface). The second sample will be obtained from an interval located approximately 3 feet below the ground surface. If the groundwater is encountered at 3 to 4 feet below the ground surface, then only one sample from the groundwater/soil interface will be obtained from each soil boring.

3.1.8 Sampling of Water from "Incidental Wastes"

One grab sample per tanker or one composite sample per 10 drums will be collected from water generated during the remedial action including, but not limited to, water from decontamination of personnel and equipment, existing surface water impounded near Area B, and rainfall and surface water runoff accumulated in the open excavations.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

Sampling will be performed by using either clean or disposable dip tubes or bailers. The appropriate sample containers will be filled and the samples sent off-site for analyses as specified in Appendix A, Table A-1. Because the sample represents water for disposal, no preservatives should be added in the field.

01480EE032

PARKING AREA

EXCAVATION AREA C

EXCAVATION AREA C

NORTH

E STREET

F STREET

GATE

SB-03

EDGE OF ASPHALT PATCH

SB-02

SB-01

SB-04

15'

BOLLARDS

EXISTING AST

15'

15'

BLDG. G480

FENCE

FOURTH ST.

FORMER ICE HOUSE

FORMER GAS STATION

LEGEND

LIMITS OF EXCAVATION AREA

SB-03 SOIL BORING LOCATION

NOT TO SCALE

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: FIGURE4.DWG
DRAWN: J. COLLINS
DESIGNED: J. OVERHOLTZER
CHECKED: G. GILLES
CHECKED: _____

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
LANTDIV RAC CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO. 0044
OPERABLE UNIT NO. 2 — MARINE CORPS BASE, CAMP LEJEUNE, N.C.

FIGURE 3.1
SAMPLING AND ANALYSIS PLAN
D.O. 44 WORK PLAN

DRAWING NUMBER:
SHEET NUMBER: _ of
DATE: 5/12/95

3.1.9 Sampling of Other "Incidental Wastes"

Other "incidental wastes" such as PPE, disposable sampling materials, etc. will be sampled and sent off-site for disposal analyses as specified in Appendix A, Table A-1. Pieces of the waste will be obtained using clean scissors or knives and collected into the appropriate sample containers.

Sampling equipment will be thoroughly cleaned between samples using decontamination procedures described in section 3.5. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

3.2 Sample Identification

All samples collected on-site will be provided with a unique sample designation. The number will serve to identify the site, location, and specific sample number. The sample designation format will appear as follows:

CLJXX-YY-NNN

Where:

CLJ = Camp Lejeune

XX = D.O. for the project (44)

YY = Sample Task:
Characterization Screening (CS)
Characterization "Uncontaminated" (CU)
Characterization "Contaminated" (CC)
Disposal "Contaminated" (DC)
Field Screening (FS)
Confirmation Sampling (CS)
Incidental Water (IW)
Incidental Other (IO)
Soil Boring (SB)

NNN = Sequential number starting at 001

If the sample is a field QC sample, add the appropriate designations listed below to the end of the sample number.

FB = Field Blank

TB = Trip Blank
RB = Equipment Rinsate Blank
DP = Field Duplicate/Replicate

Additional information may be required in the sample identification (ID) column. This will include operable unit, site designation, truck or pile number, and any grid coordinates or location designations associated with the sample.

3.3 Sample Preservation and Holding Times

When samples are collected for off-site analyses, they 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 of collection in the field.

All environmental samples, as well as QA/QC samples, will be preserved to a temperature of 4°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 NEESA 20.2-047B 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 – Field blanks consist of the source water used in decontamination and steam cleaning. At a minimum, one field blank from each sampling event and each source of water will be collected and analyzed for the same parameters and at the same QC levels as the related samples.

- Equipment Rinsate Blank – Equipment rinsate blanks are the final analyte-free water rinse from equipment cleaning collected daily during a sampling event. One equipment rinsate blank will be collected daily for NFESC Level C and E reporting. However, only samples from every other day are analyzed. The laboratory will be informed as to which rinsate blanks will be analyzed. The remaining rinsate blanks are to be held by the laboratory and analyzed only if evidence of contamination exists.

- 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 will be collected simultaneously. Field duplicates will be collected at a frequency of 10% per sample matrix for Level C reporting and at a frequency of 5% per sample matrix for Level E reporting. All the duplicates will be sent to the primary laboratory responsible for analysis, along with the samples. The field duplicates will be used by the laboratory to prepare the laboratory duplicate or matrix spikes and designated on the COC as such.

- 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 will accompany each cooler containing volatiles, stored at the laboratory with the samples, and analyzed by the laboratory. Trip blanks are only analyzed for volatile organic compounds.

Note: A sampling event is considered to be from the time the sampling personnel arrive at the site until these personnel leave for more than a day.

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 are described below.

1) Remove gross contamination by scraping or brushing

2) Clean with tap water and phosphate-free laboratory detergent (liquinox or alconox), using a stiff brush to remove all surface contaminants

3) Rinse thoroughly with tap water

4) Rinse thoroughly with deionized/distilled water

5) Rinse twice with reagent grade isopropanol or methanol

6) Rinse thoroughly with organic-free (ASTM Type II reagent grade) 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.)

7) Wrap equipment with aluminum foil prior to storage or transportation to sample locations

Decontamination fluids will be collected in properly labelled 55-gallon drums, and staged in a secure area until final disposal.

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 walk across a contaminated area and then take a surface soil sample where he has just stepped.

- 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 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 sample.

- 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	PAHs
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 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 will be knowledgeable about these activities and record pertinent details.

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, COC and airbill numbers, preservatives, and date samples were sent
- Name of laboratories and contacts to which the samples were sent, 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 obtaining 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 party
- Details of QC samples obtained

These notes will be dated and signed (each page) for validity in a court of law. All logbooks will be bound and prenumbered. 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 into the database program that has been prepared for this site. It will be entered daily by the field chemist or sample tech. This person will be the point of contact for all sampling and analytical information. Report outputs from the database are acceptable substitutes for the sample log book.

3.8 Sample Labels

Any samples placed into a sample container will be identified by a sample label. Included on the label are the following information:

1) JOB 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 REQUESTED -- see Appendix A, Table A-1

The information described above will 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 included 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 jars. They will be signed and dated by the sampler and placed from one side, across the top, and to the other side of the sample bottle or across the openings of the sample transport containers. An example custody seal is included in Appendix B.

3.10 Chain-of-Custody Procedures

Because of the evidentiary nature of 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.

A copy of a COC form is included in Appendix B. The following information is required on the COC:

1) Project Name

2) Project Location -- City and State in which the project 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 given (Project Manager, Site Supervisor, or Project Chemist)

5) Site Telephone Number -- Telephone 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/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 parameters, method numbers, and specific compounds of interest, if applicable.

13) Airbill Number

14) Laboratory -- Laboratory where samples are to be sent

15) Laboratory Phone -- Telephone number of laboratory

16) Laboratory Contact -- Contact 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). An example COC is included in Appendix D.

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°C will be shipped insulated containers with either freezer forms or ice. If ice is used, it will be placed in a container such as a trash bag and sealed so that water will not fill the shipping container as the ice melts.

Samples will be shipped via Federal Express 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 papers are included in Appendix B. These instructions are for shipping samples with unknown or limited hazards. NO CHANGES OR SUBSTITUTIONS TO THESE INSTRUCTIONS ARE ALLOWED – NO MATTER HOW INSIGNIFICANT THEY MAY SEEM. 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.

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 will be met as specified in the individual methods. In addition, the laboratory will meet the specification and requirements as described in the NEESA 20.2-047B 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, at 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.

TPH immunoassay kit instructions will be followed as to the frequency and kind of calibration. Monitoring instruments, such as the OVA or PID, O2/LEL meter, Monitox, etc. will be calibrated as specified in 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 all calibrations to ensure support of data
- All QA/QC checks are supportive of data
- All documentation is complete and accurate in respective log books
- All chromatograms and strip chart recordings are labeled with data, instrument number, run parameters and analyst

5.2 Laboratory Data Validation

All data generated within the laboratory will be extensively checked for accuracy, precision completion. 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 accuracy and completion of the data. All data generated and reduced follows 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 SOPs have been followed
- Analytical results are correct and complete

- QC samples are within established control limits
- Blanks are within appropriate QC limits
- Special sample preparation and analytical 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 samples 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)

The report from the laboratory will also include a copy of the original COC for the samples analyzed.

5.3 Project Data Review

5.3.1 Field Chemist Data Review Responsibilities

The field 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 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 gross contamination
- Reviewing field quality control results for gross inconsistencies

The field chemist is then responsible for informing the Project Manager and Project QA/QC Officer of any laboratory and/or sampling deficiencies or issues. The field chemist alone should not make decisions on the acceptability of the data. These issues and subsequent decisions will be documented on a weekly report to the Regional QA/QC Director and Project Manager.

5.3.2 Project QC Engineer Data Review Responsibilities

The Project QC Officer 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 Project Data Validation

Data validation is an extensive review of the data for technical and legal validity. This procedure will be performed by an independent third-party subcontractor. The guidelines to be used for data validation will be the USEPA National Functional Guidelines for Data Validation of Organics and Inorganics. The subcontractor's qualifications and experience will be kept in the files in the Norcross office and are available for LANTDIV's, the NTR's or any regulatory agency's review. Only data that have undergone NEESA Level C quality control will be validated by the subcontractor. Data results in the NEESA Level E packages will undergo the review process described in sections 5.1-5.3.

5.5 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 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.

When the hard and final copy is received, a copy of the level C data packages will be sent to the data validation subcontractor. All data packages will also be reviewed by the project chemist and assessed against the project goals and 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 validation has been completed, the project manager may release the data to the client and/or regulating agencies.

5.6 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 the project objectives have been met, all file documents are reviewed and submitted to the general 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
   - Intra-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. Depending on the level of certification 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 are 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 must be accuracy samples. The accuracy samples must be 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:

$$\text{Upper control limit} = p + 3SD$$
$$\text{Lower control limit} = p - 3SD$$

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 will be 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 must be 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 must have at least one recovery check for each type.

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. The mean is the centerline of the control chart. Data from each sample set are pooled with the previous sample sets to generate control and warning limits for the next set. Warning and control 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.

Present practice is to include MS and MSD samples on a per batch basis or a minimum frequency of 5 percent. 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 is responsible for ensuring that all field instrumentation and equipment are functioning properly and calibrated according to set procedures, and that all data are recorded accurately and legibly. In addition, 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) will 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 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 or CDAP
- 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 in coordination with the NTR, 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 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

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 CDAP
- 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 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 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, as well as monthly written QA reports to OHM QA management. The Regional QA/QC Director will be responsible for

reviewing and approving 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 Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Backfill	Soil	Once	1	Composite of 6 random grabs	SS bucket auger, SS bucket or bowl	(2) 4 oz glass with teflon-lined lids (2) 16 oz glass with teflon-lined lids	Cool to approx 4°C	14 days	NFESC Level E	TPH-GRO (Volatiles)	5030/8015	10 days
										TPH-DRO	3550/8015	Extract within 10 days, analyze within 40 days
										TCLP Metals	1311/ 6010, 7060,7740 7470	180 days to TCLP extr; 180 days after extr; Mercury-28 days to TCLP extr; 28 days after extr.
										TCLP Volatiles	1311/8240	14 days to TCLP extr; 14 days after extr.
										TCLP Semi-Volatiles	1311/8270	14 days to TCLP extr; 40 days after prep. extr.
										RCRA Hazardous Waste Char	1010 or 1020A, 9045A, sec 7.3	Cyanide--14 days

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Field Blank	Water	1 per source per event for all levels and all analytes	Minimum 1, and as required	Prepared by field team	N/A	(2) 40 ml glass vial with teflon-lined septum (6) 1 liter glass bottles with teflon-lined lids	Cool to approx 4°C	14 days	NFESC Level C	TPH-GRO (Volatiles)	5030/8015	10 days
										TPH-DRO	3550/8015	Extract within 10 days, analyze within 40 days
										TCLP Metals	1311/ 6010, 7060,7740 7470	6 months except Mercury--26 days
										TCLP Semi-Volatiles	8270--1311 semi-volatile constituents	Extract within 10 days, analyze within 40 days
										RCRA Hazardous Waste Char	1010 or 1020A, 9045A, sec 7.3	Cyanide--14 days
										Oil and Grease	9071	Not specified
										Volatiles	8240	10 days
										PCBs	8080	Extract within 5 days, analyze within 40 days
										Total Lead	6010	6 months
Characterization (on-site screening)	Soil	1 per truckload	819 + 41 dups (5%)	1 Composite of 5 grabs per truckload	SS spoon or shovel, SS bucket or bowl	(1) 4 oz glass with teflon-lined lids	Cool to approx 4°C	24 hours	Screen only	TPH (immuno-assay field screening tests)	Proposed Method 4030	10 days

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Characterization (Contaminated)	Soil	Determined by soil recycling facility or TSDF + 5% dups	Min of 1	Composite of 6 random grabs	SS spoon or shovel, SS bucket or bowl	(2) 4 oz glass with teflon-lined lids (2) 8 oz glass with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level E	TPH-GRO (Volatiles)	5030/8015	10 days
										TPH-DRO	3550/8015	Extract within 10 days, analyze within 40 days
										TCLP Metals	1311/ 6010, 7060,7740 7470	180 days to TCLP extr; 180 days after extr; Mercury-28 days to TCLP extr; 28 days after extr.
										TCLP Volatiles	1311/8240	14 days to TCLP extr; 14 days after extr.
										TCLP Semi-Volatiles	1311/8270	14 days to TCLP extr; 40 days after prep. extr.
										RCRA Hazardous Waste Char	1010 or 1020A, 9045A, sec 7.3	Cyanide--14 days
Disposal (Soil Recycling Facility)	Soil	1 per 500 cubic yards	7 +1 dup (5%)	Composite of 6 random grabs	SS spoon or shovel, SS bucket or bow	(2) 4 oz glass with teflon-lined lids (2) 8 oz glass with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level E	TPH-GRO (Volatiles)	5030/8015	10 days
										TPH-DRO	3550/8015	Extract within 10 days, analyze within 40 days
										Oil and Grease	9071	Not specified
										Volatiles+ BTEX	8240	10 days
										PCBs	8080	Extract within 5 days, analyze within 40 days
										Total Lead	6010	6 months

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Characterization (Contaminated) Trip Blanks	Water	1 per cooler	Minimum 1, and as required	Prepared by lab	N/A	(1) 40 ml glass vial with teflon-lined septum	Cool to approx 4°C,	7 days	NFESC Level E	TPH-GRO (Volatiles) Volatiles	5030/8015 8240	10 days 10 days
Characterization (Contaminated) Equipment Rinseate Blanks	Water	1 per day[5]	Minimum 1, and as required	Prepared by field team by collecting decon final rinse water	N/A	(2) 40 ml glass vial with teflon-lined septum (3) 1 liter glass bottles with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level E	TPH-GRO (Volatiles) TPH-DRO TCLP Metals TCLP Semi-Volatiles RCRA Hazardous Waste Char Volatiles	5030/8015 3550/8015 1311/ 6010, 7060,7740 7470 8270--1311 semi-volatile constituents only 1010 or 1020A, 9045A, sec 7.3 8240	10 days Extract within 10 days, analyze within 40 days 6 months, except for Mercury--26 days Extract within 10 days, analyze within 40 days Cyanide--14 days 10 days

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Characterization (Uncontaminated)	Soil	1 per 200 cubic yards	28 + 3 dups or (10%)	Composite of 6 random grabs	SS spoon or shovel, SS bucket	(2) 4 oz glass with teflon-lined lids (2) 8 oz glass with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level C	TPH-GRO (Volatiles)	5030/8015	10 days
										TPH-DRO	3550/8015	Extract within 10 days, analyze within 40 days
										TCLP Metals	1311/ 6010, 7060,7740 7470	180 days to TCLP extr; 180 days after extr; Mercury-28 days to TCLP extr; 28 days after extr.
										TCLP Volatiles	1311/8240	14 days to TCLP extr; 14 days after extr.
										TCLP Semi-Volatiles	1311/8270	14 days to TCLP extr; 40 days after prep. extr.
										RCRA Hazardous Waste Char	1010 or 1020A, 9045A, sec 7.3	Cyanide--14 days
Characterization (Uncontaminated) Trip Blanks	Water	1 per cooler	Minimum 1, and as required	Prepared by lab	N/A	(1) 40 ml glass vial with teflon-lined septum	Cool to approx 4°C,	7 days	NFESC Level C	TPH-GRO (Volatiles)	5030/8015	10 days
										TCLP Volatiles	8240--1311 volatile constituents only	10 days

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Characterization (Uncontaminated) Equipment Rinseate Blanks	Water	1 per day[5]	Minimum 1, and as required	Prepared by field team by collecting decon final rinse water	N/A	(2) 40 ml glass vial with teflon-lined septum (3) 1 liter glass bottles with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level C	TPH-GRO (Volatiles)	5030/8015	10 days
										TPH-DRO	3550/8015	Extract within 10 days, analyze within 40 days
										TCLP Metals	1311/ 6010, 7060,7740 7470	6 months, except for Mercury--26 days
										TCLP Volatiles	8240--1311 volatile constituents only	10 days
										TCLP Semi-Volatiles	8270--1311 semi-volatile constituents only	Extract within 10 days, analyze within 40 days
										RCRA Hazardous Waste Char	1010 or 1020A, 9045A, sec 7.3	Cyanide--14 days
Confirmation--On-site Screening (Limits of Excavation)	Soil	One per 50 linear feet along each wall of the excavation	As required for screening purposes + 5% dups	Grab	SS spoons or shovel, SS bowl or bucket	4 oz glass	Cool to approx 4°C	24 hours	Screen only	TPH (immuno-assay field screening tests)	Proposed Method 4030	10 days

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Confirmation--Off-site (Closure)	Soil	One per 50 linear feet along each wall of the excavation, after field screening	Area A: 13 + 1 dup[4] or (10%) Area B: 7 + 1 dup[4] or (10%) Area C: 10 + 1 dup[4] or (10%)	Grab	SS spoons or shovel, SS bowl or bucket	(1) 4 oz glass with teflon-lined lid (1) 8 oz glass with teflon-lined lid	Cool to approx 4°C	3 days	NFESC Level C	TPH-GRO (Volatiles) TPH-DRO	5030/8015 3550/8015	10 days Extract within 10 days, analyze within 40 days
Confirmation--Off-site Trip Blanks	Water	1 per cooler	Minimum 1, and as required	Prepared by lab	N/A	(1) 40 ml glass vial with teflon-lined septum	Cool to approx 4°C	3 days	NFESC Level C	TPH-GRO (Volatiles)	5030/8015	10 days
Confirmation--Off-site Equipment Rinseate Blanks	Water	1 per day[5]	Minimum 1, and as required	Prepared by field team by collecting decon final rinse water	N/A	(2) 40 ml glass vial with teflon-lined septum (1) 1 liter glass bottles with teflon-lined lids	Cool to approx 4°C	3 days	NFESC Level C	TPH-GRO (Volatiles) TPH-DRO	5030/8015 3550/8015	10 days Extract within 5 days, analyze within 40 days

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Incidental Wastes	Water	1 composite sample per tanker or 1 composite sample per 10 drums + 5% dup	Minimum 1, and as required	Grab	N/A	(2) 40 ml glass vial with teflon-lined septum (2) 1 liter glass bottles with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level E	TCLP Metals	1311/ 6010, 7060,7740 7470	6 months, except for Mercury--26 days
										TCLP Volatiles	8240--1311 volatile constituents only	10 days
										TCLP Semi-Volatiles	8270--1311 semi-volatile constituents only	Extract within 10 days, analyze within 40 days
Incidental Wastes	PPE, Debris	As required by the disposal facility	Minimum 1, and as required	Composite of waste	N/A	(2) 16 oz glass with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level E	TCLP Metals	1311/ 6010, 7060,7740 7470	180 days to TCLP extr; 180 days after extr; Mercury-28 days to TCLP extr; 28 days after extr.
										TCLP Volatiles	1311/8240	14 days to TCLP extr; 14 days after extr.
										TCLP Semi-Volatiles	1311/8270	14 days to TCLP extr; 40 days after prep. extr.
Incidental Wastes Trip Blanks	Water	1 per cooler	Minimum 1, and as required	Prepared by lab	N/A	(1) 40 ml glass vial with teflon-lined septum	Cool to approx 4°C,	7 days	NFESC Level E	TCLP Volatiles	8240--1311 volatile constituents only	10 days

Table A-1
Sampling Summary

Sample Type	Matrix	Sample Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preserv-atives	TAT[3]	QC Level	Required Analysis	Analytical Method[1]	Holding Time[2]
Incidental Wastes Equipment Rinseate Blanks	Water	1 per day[5]	Minimum 1, and as required	Prepared by field team by collecting decon final rinse water	N/A	(2) 40 ml glass vial with teflon-lined septum (1) 1 liter glass bottles with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level E	TCLP Metals TCLP Volatiles TCLP Semi-Volatiles	1311/ 6010, 7060,7740 7470 8240--1311 volatile constituents only 8270--1311 semi-volatile constituents only	6 months, except for Mercury--26 days 10 days Extract within 10 days, analyze within 40 days
Subsurface Soil Investigation SB-01 and Perimeter sampling	Soil	Once	4 soil borings-- 2 samples from each boring-- 1 at 3-4 feet below the ground surface, and the other above the groundwater/ soil interface	Hand auger to 1 foot and collect the sample adjacent to existing AST	Hand auger, SS spoons or shovel	(1) 4 oz glass with teflon-lined lid (1) 8 oz glass with teflon-lined lid	Cool to approx 4°C	7 days	NFESC Level C	TPH-GRO (volatiles) TPH-DRO	5030/8015 3550/8015	10 days Extract within 10 days, analyze within 40 days
Subsurface Soil Investigation Trip Blanks	Water	1 per cooler	Minimum 1, and as required	Prepared by lab	N/A	(1) 40 ml glass vial with teflon-lined septum	Cool to approx 4°C	7 days	NFESC Level C	TPH-GRO (Volatiles)	5030/8015	10 days

Table A-1
Sampling Summary

Subsurface Soil Investigation Equipment Rinseate Blanks	Water	1 per day[5]	Minimum 1, and as required	Prepared by field team by collecting decon final rinse water	N/A	(2) 40 ml glass vial with teflon-lined septum (1) 1 liter glass bottles with teflon-lined lids	Cool to approx 4°C	7 days	NFESC Level C	TPH-GRO (Volatiles) TPH-DRO	5030/8015 3550/8015	10 days Extract within 5 days, analyze within 40 days

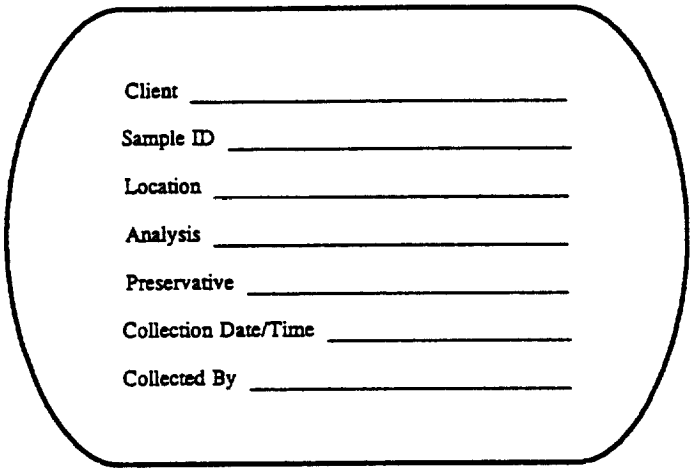
Notes:

1) USEPA SW-846 Methods unless otherwise specified
2) Begins from the date of collection in the field
3) Calendar days
4) Field duplicates shall be used by the laboratory for preparation of the matrix spikes and matrix spike duplicates
5) Samples are collected daily; however, only samples from every other day are analyzed. Other samples are held and analyzed only if evidence of contamination exists.

Appendix B

Sample Label
Custody Seal
Chain-of-Custody Record
OHM Shipping Label
Shipping Instructions for Sending Samples to the Laboratory
Shipping Instructions for Treatability Study Samples

Sample Label



Custody Seal

CUSTODY SEAL

Sample Collector's Signature _____ Sample No. _____

Date Collected _____ Time Collected _____

LAB COPY

OHM Corporation

CHAIN-OF-CUSTODY RECORD

Form 0019
Field Technical Services
Rev. 08/89

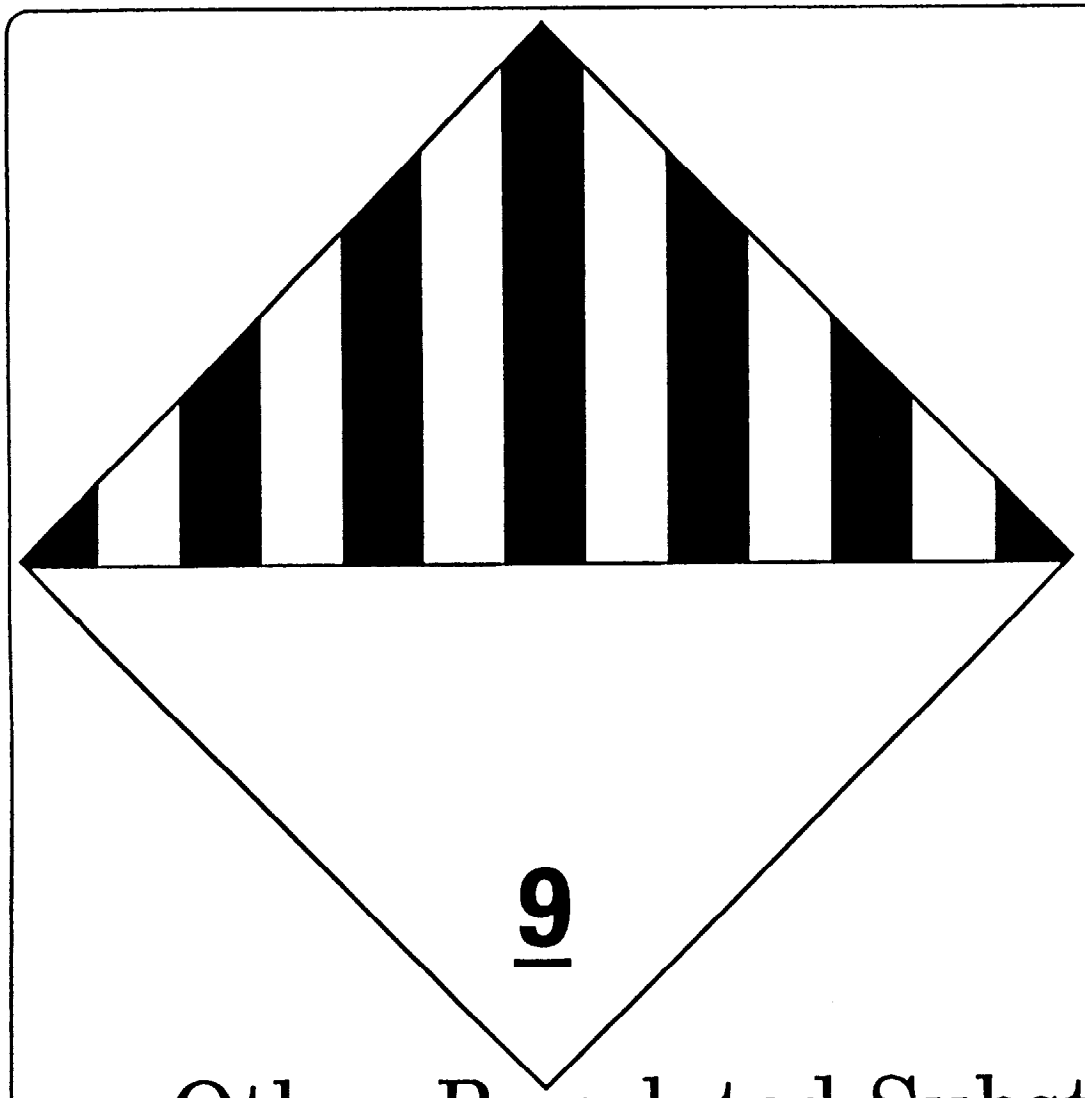
135218

O.H. MATERIALS CORP. • P.O. BOX 551 • FINDLAY, OH 45839-0551 • 419-423-3526

PROJECT NAME	PROJECT LOCATION	
PROJ. NO.	PROJECT CONTACT	PROJECT TELEPHONE NO.
CLIENT'S REPRESENTATIVE	PROJECT MANAGER/SUPERVISOR	

ITEM NO.	SAMPLE NUMBER	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION (INCLUDE MATRIX AND POINT OF SAMPLE)	NUMBER OF CONTAINERS	ANALYSIS DESIRED (INDICATE SEPARATE CONTAINERS)	REMARKS
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME	REMARKS
1						
2						
3						
4						SAMPLER'S SIGNATURE



OHM Corporation

From:

Phone:

To:

Phone:

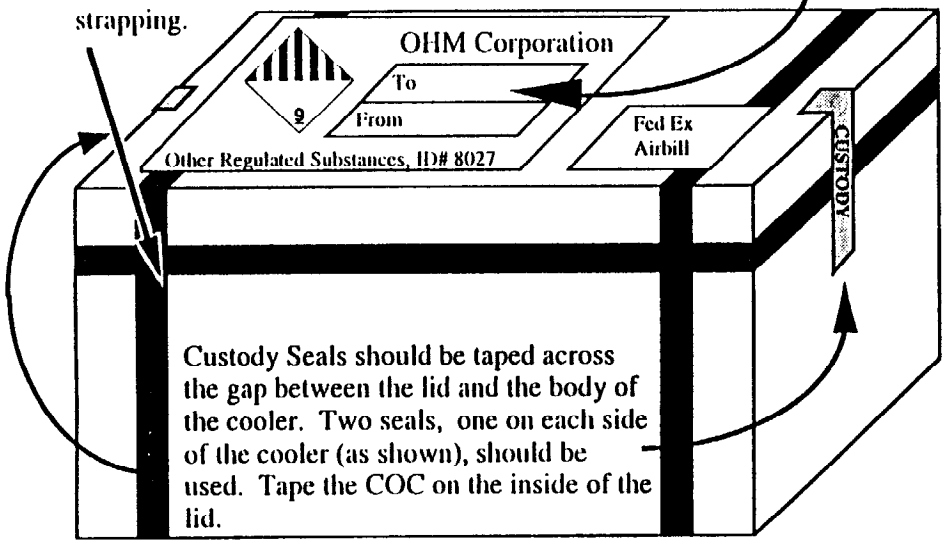
Other Regulated Substances, ID# 8027

OHM Remediation rvices Corp — Shipping Instructions for Sending Samples to the L

NOTE: These procedures are ONLY for shipping unknown wastes, sludge, soil, or water samples for laboratory analysis and ' tification; Materials which are known to be explosive, compressed , flammable, oxidizers, poisons, radioactive, or corrosive cannot be shipped by this method. Call the Regional T&D Coordinator for help in that case.

Cooler lid is taped closed and additional tape should be used around the outside to act as strapping.

OHM custom sample shipping label



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.

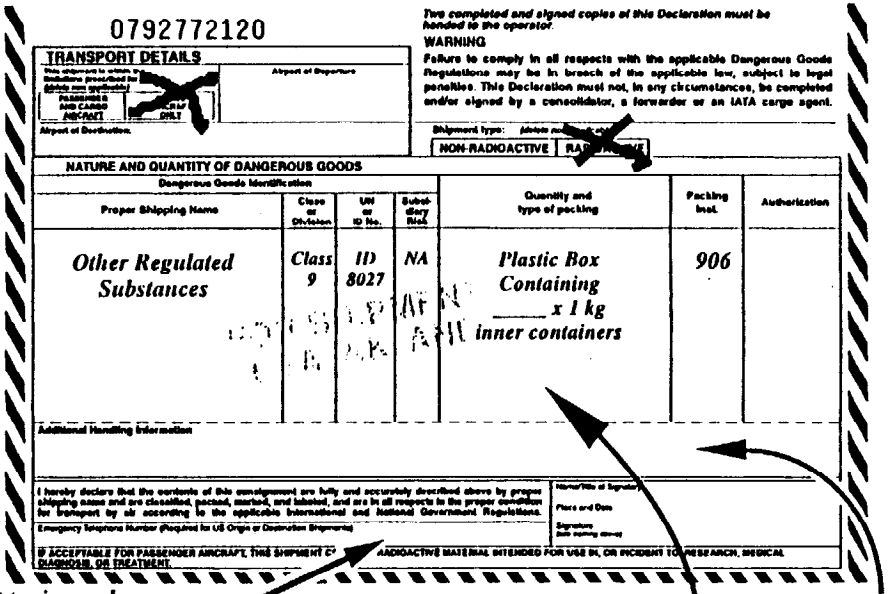
4) Coolers must be packed with absorbent material (vermiculite or kitty litter) which will absorb any spills or leaks, not react with the sample contents, and which will minimize the chance that inner containers will break. The coolers should also be fastened shut securely using tape or strapping.

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) 238-5355 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.

Lower Portion of Fed-Ex DANGEROUS GOODS airbill


0792772120

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING

Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

TRANSPORT DETAILS

Airport of Departure

Airport of Destination

Shipment type: NON-RADIOACTIVE

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification

Proper Shipping Name	Class or Division	UN or ID No.	Subsidiary Risk	Quantity and type of packing	Packing Inst.	Authorization
Other Regulated Substances	*Class 9*	*ID 8027*	*NA*	*Plastic Box Containing ____ x 1 kg inner containers*	*906*	

Additional Handling Information

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in the proper condition for transport by air according to the applicable International and National Government Regulations.

Emergency Telephone Number (Required for US Origin or Destination Shipments)

Name/Title of Signatory

Place and Date

Signature (See warning above)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT C... RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.

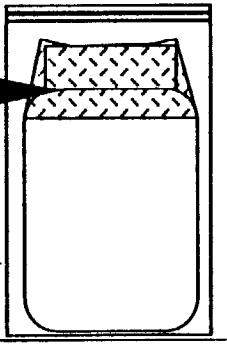
Don't forget to sign and include the 24-hr Emergency Response Phone number. Check with the Regional T&D Coordinator for this number

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

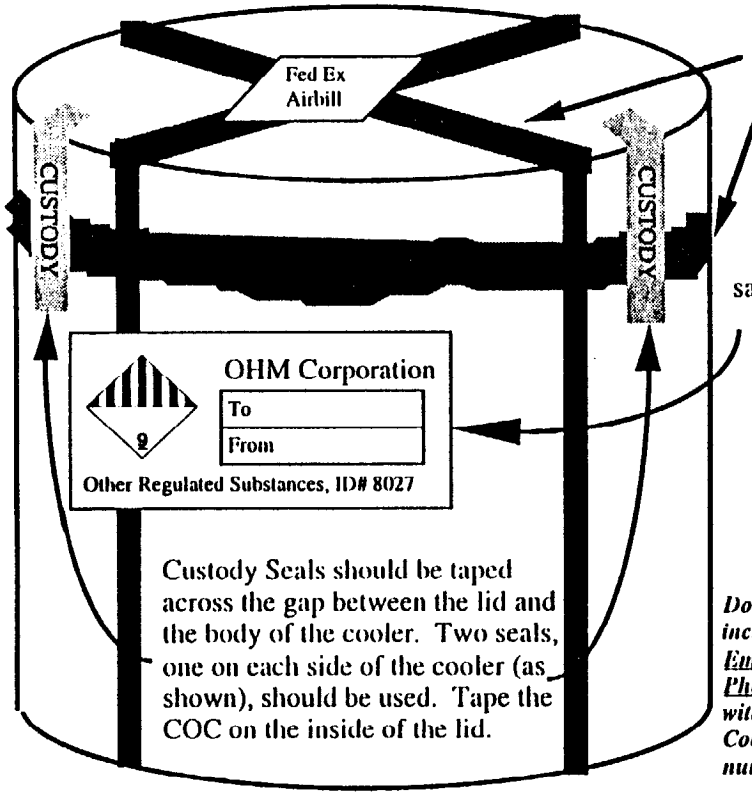


Lids are taped to prevent leaks or loosening. Entire jar is sealed in a zip-lock baggie

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 Remediation rvices Corp — Shipping Instructions for Treatability Study Sampl

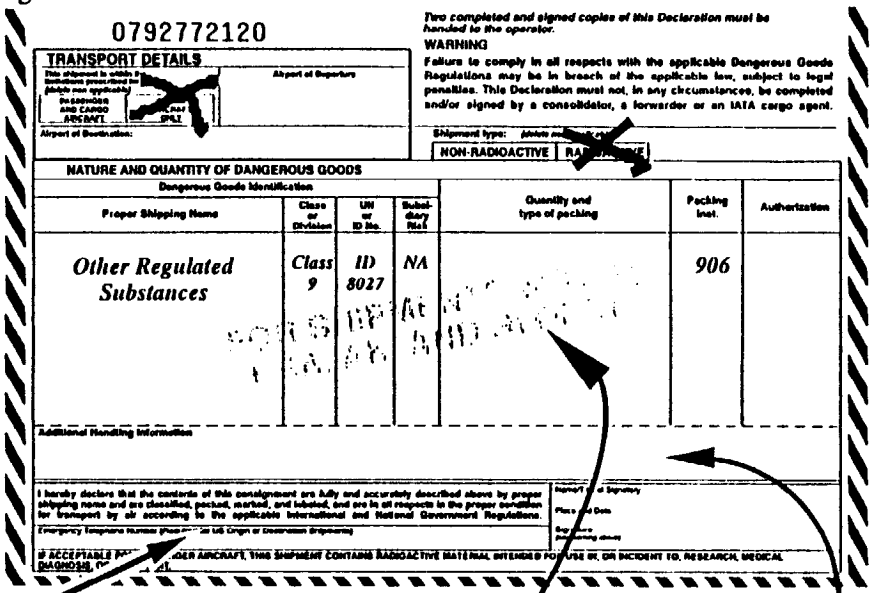
NOTE: These procedures are ONLY for shipping unknown wastes, sludge, soil, or water samples for laboratory analysis and id ification; Materials which are known to be explosive, compressed ga lammable, oxidizers, poisons, radioactive, or corrosive cannot be shipped by this method. Call the Regional T&D Coordinator for help in that case.



Tape the lid on tightly, use tape from top to bottom on the pail as strapping.

OHM custom sample shipping label

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 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

Fill in this blank with either:

Steel Drum containing ____ kg

or

Plastic Drum containing ____ kg

You will have to weigh the pail before shipping and fill in the weight in the blanks above. To convert from pounds to kilograms multiply by 2.2.

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.

1) Samples must be shipped in "Strong outer packaging". Fed-Ex stated that a rigid plastic pail or steel pail with a secure lid is acceptable. Pails which meet the UN 1A1, 1A2, 1H1, or 1H2 specifications would be best.

2) Use one of OHM's custom sample shipping labels and a Fed-Ex dangerous goods airbill. The To/From address portion of the label should be filled out completely including phone numbers. The airbill and OHM label should be placed on last and cannot be covered by tape or each other. The airbill should go on top and the OHM label on the side.

3) Materials which are known to be explosive, compressed gases, flammable, oxidizers, poisons, radioactive, or corrosive cannot be shipped by this method. You should call the Regional T&D Coordinator for assistance with these materials.

4) 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) 238-5355 for more instructions on filling out this form. Be sure to put your name, title, and office number at the bottom!

OHM Remediation
Services Corp.

SITE-SPECIFIC HEALTH AND SAFETY PLAN
FOR
SOIL REMEDIATION
OPERABLE UNIT NO. 10, SITE 35
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Delivery Order 0044

Prepared by

OHM Remediation Services Corp.
Norcross, Georgia

George E. Krauter, P.E.
Program Manager

James Dunn, P.E.
Project Manager

J. Angelo Liberatore, CIH
Southern Region Health and Safety Director

July 1995

OHM Project No. 16487

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed for United States Navy, LANTDIV, Delivery Order No. 44 entitled, Soil Remediation at the MCB Camp Lejeune Operable Unit No. 10, Site 35. 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 0062, 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, October 1992).

1.1 SITE HISTORY

Camp Lejeune is a training base for the U.S. Marine Corps, located in Onslow County, North Carolina. The base covers approximately 236 square miles and includes 14 miles of coast line. MCB Camp Lejeune is bounded to the southeast by the Atlantic Ocean, to the northeast by State Route 24, and to the west by U.S. Route 17. The town of Jacksonville, North Carolina is located north of the Base.

Camp Geiger is located at the extreme northwest corner of MCB Camp Lejeune. The main entrance to Camp Geiger is off U.S. Route 17, approximately 3.5 miles southeast of Jacksonville. OU No. 10, Site 35, the Camp Geiger Area Fuel Farm, refers to an area where five, 15,000-gallon aboveground storage tanks (ASTs), a pump house, and a fuel unloading pad were situated within Camp Geiger just north of the intersection of Fourth and "G" Streets. All fueling facilities, tanks, pumps, pipelines and appurtenances have been removed by others and for the purpose of OHM activities Site 35 will consist of three Areas A,B, and C as shown in Figure 2 that will be remediated in this SOW.

1.2 SITE DESCRIPTION

The surface topography at Site 35 is generally flat to the south and west of the fueling area. The ground surface dips rapidly to the north and east in the direction of Brinson Creek. Surface water runoffs flows toward Brinson Creek.

The shallow soil stratigraphy at Site 35 consists of fine to medium-grained sands (15 to 30 feet thick), which in turn is underlain by a unit of silty sand.

Shallow groundwater flow direction is generally west to east across the site in the direction of Brinson Creek. The top of groundwater is encountered roughly 8 to 10 feet below the ground surface across the flat portion of the site and at lesser depths as the surface topography converges with Brinson Creek.

Analytical data generated as part of Interim Remedial Action/Feasibility Study in December of 1993 combined with data obtained during previous investigations conducted at Site 35 identified the presence of petroleum contaminated soil in the vicinity of the former Fuel Farm ASTs and to the north and northwest in a broad area extending from the former UST adjacent to Building G480 to the vicinity of monitoring well MW-25. In general, the analytical data suggests that the majority of the contaminated soil is present within a narrow zone that begins just above the top of the shallow groundwater table.

Three areas of soil contamination requiring remediation have been identified as depicted in the Work Plan. The first area, C, is located in the vicinity of the previously existing Fuel Farms ASTs. The two other areas are located north of the Fuel Farm. The larger of these two areas, A, is located along "F" Street in the vicinity of monitoring well MW-11; the smaller area, B, is in the area of monitoring well MW-25. Approximately 3,600 cubic yards (4,900 tons) of contaminated soil is estimated to be present in these three areas.

1.3 SCOPE OF WORK

Upon completion of the Remedial Action Work Plan (RAWP), OHM will implement the plan through performance of the following major tasks:

- **Mobilization and Site Preparation** which will include construction and installation of an office facility and personnel and equipment decontamination facilities; utilities installation; access road construction and grading; establishment of erosion control and installation of berms; installation of fencing; delineation of work zones; and clearing and grubbing.

- **Perform Site Survey** to establish excavation limits.

- **Contaminated Soil Excavation** as identified in the project drawings will be performed and soil screened in accordance with the SAP and Work Plan. Soil will be segregated and stockpiled in a staging area while awaiting analytical data to identify the presence of contaminants as specified in the SAP.

- **Verification and Confirmation Sampling** will be performed prior to backfilling each excavation.

- **Backfill and Compaction** of each excavation will be performed once analytical data is received from confirmation sampling as stated in the SAP.

- **Load-out and Transportation** of contaminated soil will be performed once laboratory analysis indicating that soil is contaminated is received. Transport vehicles will be loaded in the stockpile area and decontaminated prior to departure from the site.

- **Heavy Equipment Decontamination** will be performed at the heavy equipment decontamination station using high pressure washing and manual scraping methods.

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	James Dunn (404)453-8072 (office)
Site Supervisor	Randy E. Smith (910) 451-1809
Site Safety Officer	Steven K. Grant (910) 451-1809
Program Manager for LANTDIV	George Krauter, P.E. (609) 588-6477 (office)
SR Health and Safety Director/Project CIH	J. Angelo Liberatore, CIH (404) 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

Chemical Hazards			
Chemical	**Exposure Routes**	**PEL/TLV**	**Symptoms of Overexposure**
Fuel Oil No. 6	Inhalation, ingestion and dermal contact	None established	Skin irritation, acne-like rash; Increased respiration, respiratory irritation, CNS depression; Nausea, vomiting
Gasoline	Inhalation, ingestion, and dermal contact	300 ppm	Intense burning in throat and lungs; CNS depression; Pulmonary edema; Headache, mental confusion, dizziness; Nausea, vomiting
Diesel Fuel	Inhalation, ingestion, and dermal contact	None established; Mineral oil mist – 5 mg/m^3	Skin irritation; CNS depression; Respiratory tract irritation; Headache, dizziness, nausea and vomiting
Kerosene	Inhalation, ingestion, and dermal contact	None established	Mucous membrane irritation, headache, and drowsiness; Defatting of the skin; Dermatitis

Construction of Camp Geiger was completed in 1945, four years after construction of MCB Camp Lejeune was initiated. Originally, the ASTs on-site were used for the storage of No. 6 fuel oil, but were later converted for storage of other petroleum products including unleaded gasoline, diesel fuel, and kerosene. The date of their conversion is not known. The ASTs currently in use at the site are reported to be the original tanks.

Routinely, the ASTs at Site 35 supply fuel to an adjacent dispensing pump. A leak in the underground line from the ASTs to the dispensing island was reportedly responsible for the loss of roughly 30 gallons per day of gasoline over an unspecified period. The leaking line was subsequently sealed and replaced.

The ASTs at Site 35 are currently used to dispense gasoline, diesel and kerosene to government vehicles and to supply USTs in use at Camp Geiger and the nearby New River Marine Corps Air Station. The ASTs are supplied by commercial carrier trucks which deliver product to fill ports located on the fuel unloading pad at the southern end of the facility. Six,

short-run (120 feet maximum), underground fuel lines are currently utilized to distribute the product from the unloading pad to the ASTs and visa versa.

Reports of a release from an underground distribution line near one of the ASTs date back to 1957-58. 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 cannot be located. The fuel reportedly migrated to the east and northeast toward Brinson Creek along the top of shallow groundwater. Shallow groundwater interceptor trenches were reportedly excavated to capture the fuel which was then ignited and burned.

Another abandoned underground distribution line extended west from the ASTs to the former Mess Hall Heating Plant, located adjacent to "D" Street, between Third and Fourth Streets. This underground line dispensed No. 6 fuel to an underground storage tank (UST) which fueled the Mess Hall boiler. The Mess Hall, located across "D" Street to the west, was demolished along with its Heating Plant in the 1960s.

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

Review of available soil analytical data indicates that site soils contain petroleum hydrocarbons at levels as low as below the quantification limits to as high as 22,000 ppm in samples collected in 1992. Real-time air monitoring instruments will be used in conjunction with soil screening procedures in order to further evaluate the area and extent of suspected contamination.

Personnel will be removed from the work site and placed under observation immediately if the following symptoms occur:

- Dizziness or stupor
- Nausea, headaches, or cramps
- Irritation of the eyes, nose, or throat
- Euphoria
- Chest pains and coughing
- Rashes or burns

3.2 PHYSICAL HAZARDS

To minimize physical hazards, OHM has developed standard safety protocols which will be followed at all times. These protocols are contained in the Health and Safety Procedures Manual currently on file with LANTDIV. 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 trailer as a reference document.

The physical hazards posed by planned LANTDIV Camp Lejeune project activities include safety hazards, heat stress, and noise. There are numerous physical/safety hazards associated with this project which, if not identified and addressed, could present operational problems as well as accidents and personal injury to the work force. In order to minimize physical hazards, OHM has developed a Health and Safety Procedures Manual which outlines the minimum health and safety requirements for LANTDIV Camp Lejeune project sites to be followed at all times. Failure to follow safety protocols or continued negligence of these policies will result in expulsion of a crew member from the site as well as possible termination of employment.

The OHM SOPs will be on site located in the project trailer.

Safety Hazards

All OHM Team personnel will become familiar with the field activities which will be conducted at the site. All OHM personnel are trained to work safely under various field conditions. In addition, the PS will observe the general work practices of each crew member and equipment operator, and enforce safe procedures to minimize safety hazards. Procedures from the OHM Health and Safety Procedures Manual that specifically apply to planned project activities will be incorporated into this plan by reference. The following sections are typical safety hazards that may occur at USACE Fort Sill project sites along with relevant hazard control procedures.

1. 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 are 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. Employees will make certain the load can be safely handled by considering the size, weight, and shape of the load. No loads over 60 pounds will be lifted. Proper lifting techniques will be utilized: feet will be shoulder width apart, one foot will be placed along side the load, bend at knees, maintain arch in back, keep the load close to the body, lift with legs not the back.

2. Explosion Hazard - Flammable materials in confined spaces (i.e., excavation areas) can produce an explosive atmosphere which can be triggered by a spark or other energy source. To prevent this type of accident, the concentration of flammable material in air will be carefully monitored, and confined space entry procedures will be followed. See Section 8.2 for air monitoring and Section 4.2.1 for safety hazard.

3. Hoisting Accidents - Employees can have suspended loads dropped on them, be caught behind a load and a stationary object, or be crushed or struck by the counterweight. All hoisting will be done by qualified personnel only after safety checks are made of chokes and cables. In addition, no hoisting will take place without a designated signal man present.

4. Heavy Equipment Operation and Inspection - Heavy construction equipment operators present construction safety hazards to operating and ground personnel. OHM has safe operating procedures (SOP) for the use of heavy construction equipment. Only trained and qualified operators are authorized to operate heavy construction equipment.

   The operators are responsible for performing daily equipment inspections on their equipment to identify, take out of service, and correct any equipment defects of non-functioning safety devices that would render the equipment unsafe to operate. Standard safety devices and equipment required to be inspected and functional during use includes the following:

   - Seat belts
   - Safety glass in enclosed cab
   - Braking system
   - Back-up alarms
   - Portable fire extinguisher
   - Horn
   - Tires
   - Steering and hydraulic systems

Operators are required to wear seat belts when operating equipment and are responsible for the location of ground personnel in their work area. The turning radius of trackhoes is guarded to prevent contact between the equipment counterweight and ground personnel.

5. Bulk Fuel Storage - The bulk fuel storage will be 110 gallon tank located on the pickup. At least one 20-pound dry chemical, ABC-type fire extinguisher will be positioned in this area.

6. 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, it will be performed by OHM SOP on site according to the Hot Work Procedure. This procedure requires a hot work permit and will be inspected by the PSO or PS prior to commencing hot work. All combustible materials will be removed from the area before any not work is started. A fire watch will be posted and the atmosphere will be tested for combustible gases. The hot work permit will be completed by the PSO or PS . The permit will indicate the area, the employees involved, air monitoring results, fire protection systems, and fire department number.

7. 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.

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

9. Electrical Hazards - Overhead power lines, downed electrical wires, and buried cables 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 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.

Electrical work will only be performed by approved electricians. No electrical work should be done on an energized circuit. Single phase electrical hand tools must be approved by a recognized testing agency and all exposed non-current carrying metal parts must be grounded or double insulated. Electrical equipment cannot be used if there are deficiencies in the appliance, cord, and plug.

10. 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.

11. 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.

12. Excavations and Trenching - Excavations and trenching present a special risk to workers due to the hazard of trench wall collapse. If OHM personnel must enter excavations five feet or greater in depth, the sides of the excavation will be sloped 1-1/2:1 (horizontal:vertical) or shored in accordance with 29 CFR 1926.650 through 652.

    All surface encumbrances will be located and those that may create a hazard and remove or support. All underground installations, utilities, sewer, telephone, fuel, electric, and water lines will be located and marked prior to opening excavation. Structural ramps for equipment or personnel must be designed by a qualified individual. Employees will not be permitted underneath loads handled by lifting equipment.

    A warning system such as barricades, hand or mechanical signals, or stop logs shall be used to warn mobile equipment operators does not have a clear view of the excavation's edge. Excavations which have a potential for hazardous atmosphere must be tested before entry. Excavations which have hazardous atmospheres must have emergency rescue equipment present before entry. Precautions will be taken to protect employees from water accumulation. Support systems will be provided for buildings, walls, or other structures when their stability is affected by the excavation.

    All materials must be kept two feet from the excavation's edge to protect employees from falling objects. Daily inspection of the excavation by a qualified individual shall be conducted. The excavation soil type will be determined and employee protection systems will be used. The OHM excavation permit will be completed by the OHM competent person when employee exposure can reasonably be anticipated. This is required to document compliance with 29 CFR 1926 Subpart P - Excavations. The excavation permit is required to document inspections by the competent person daily, before work, and as needed throughout the shift

13. Pumping Equipment - Various types of pumps may be used for the removal of materials from ditches, ponds, lagoons, etc. The handling of pressurized hoses that could rupture and violently release liquid materials to the work area will be controlled by inspecting all hose fittings for secure connections [all OPW (camlock) and fittings must be secured with the wire]. All employees must wear splash gear including splash shields when moving or disconnecting pumps and hoses.

14. Drum Handling and Opening - No unknown drums are anticipated.

15. 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.

16. 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 PSO will ensure that an adequate area is clear of personnel while the equipment is in operation.

17. Heavy Equipment and Vehicle Traffic - The use of heavy equipment for debris removal, excavation, and lifting presents the greatest potential for injury to personnel. In order to minimize these hazards, designated routes will be established for mobilization through the facility, and specific traffic patterns will be established. All trucks will have spotters for backing maneuvers. Those crew members directly involved with spotting for the operator will be the only personnel allowed in the vicinity of the heavy equipment. All others will remain a safe distance away from these operations.

    Personnel needing to approach heavy equipment while operating will observe the following protocols:

    1. Make eye contact with the operator (and spotter)
    2. Signal the operator to cease heavy equipment activity
    3. Approach the equipment and inform the operator of intentions

    OHM will follow all traffic rules. Company vehicles will yield to all bikes, pedestrians, and railroad crossings. All vehicles must come to a complete stop at all railroad crossings. All vehicles must be operated in a safe and legal manner. Motor vehicles that are defective or not operating properly must be reported immediately. Seats beats must be worn while driving. Personnel shall drive at posted speed limits or at speeds consistent with prevailing road, traffic, or weather conditions.

18. Confined Space Entry - No confined spaced are anticipated.

19. 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.

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. Remove clothing and apply water while treating for shock during transport or while awaiting competent medical care. 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 or higher
  - 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 Biological Hazards

- *Poison Ivy (Rhus Radicans)*

  Poison Ivy may be found at the site. It is highly recommended that all personnel entering into an area with poison ivy wear a minimum of a tyvek coverall, to avoid skin contact.

  The majority of skin reactions following contact with offending plants are allergic in nature and characterized by:

  - General symptoms of headache and fever
  - Itching
  - Redness
  - A rash

  Some of the most common and most severe allergic reactions result from contact with plants of the poison ivy group, including poison oak and poison sumac. Such plants produce severe rash characterized by redness, blisters, swelling, and intense burning and itching. The victim may develop a high fever and feel very ill. Ordinarily, the rash begins within a few hours after exposure, but may be delayed 24 to 48 hours.

  Distinguishing Features of Poison Ivy Group Plants

  The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each. Both plants have greenish-white flowers and berries that grow in clusters.

  First Aid

  a. Remove contaminated clothing; wash all exposed areas thoroughly with soap and water, followed by rubbing alcohol.
  b. Apply calamine or other soothing lotion if rash is mild.
  c. Seek medical advice if a severe reaction occurs, or if there is a known history of previous sensitivity.

- *Ticks*

  Heavily vegetated areas of a site may have ticks. It is highly recommended that all personnel walking through such areas wear a tyvek coverall and latex boot covers taped at all joints. The ticks will stand out against the light colors. A tick or insect repellent containing DEET is recommended.

  Ticks can transmit several diseases, including Rocky Mountain spotted fever, a disease that occurs in the eastern portion of the United States as well as the western portion, and Lyme disease. Ticks adhere tenaciously to the skin or scalp. There is

some evidence that the longer an infected tick remains attached, the greater is the chance that it will transmit disease.

First Aid

a. Cover the tick with heavy oil (mineral, salad, or machine) to close its breathing pores. The tick may disengage at once; if not, allow oil to remain in place for a half hour. Carefully (slowly and gently) remove the tick with tweezers, taking care that all parts are removed.

b. With soap and water, thoroughly, but gently, scrub the area from which the tick has been removed, because disease germs may be present on the skin; also wipe the bite area with an antiseptic. Although use of tweezers for the removal of the tick and application of heat to the tick's body often have been attempted, these methods may leave tick parts in the wound or may injure the skin.

c. If you have been bitten, place the tick in a jar labeled with the date, location of the bite, and the location acquired. If any symptom appears, such as an expanding red rash, contact a physician immediately.

- *Lyme Disease*

Lyme disease may cause a number of medical conditions, including arthritis, that can be treated if you recognize the symptoms early and see your doctor. Early signs may include a flu-like illness, an expanding skin rash and joint pain. If left untreated, Lyme disease can cause serious nerve and heart problems as well as a disabling type of arthritis.

You are more likely to spot early signs of Lyme disease rather than see the tick or its bite. This is because the tick is so small (about the size of the head of a common pin or a period on this page and a little larger after they fill with blood), you may miss it or signs of a bite. However, it is also easy to miss the early symptoms of Lyme disease.

In its early stage, Lyme disease may be a mild illness with symptoms like the flu. It can include a stiff neck, chills, fever, sore throat, headache, fatigue, and joint pain. But this flu-like illness is usually out of season, commonly happening between May and October when ticks bite.

Most people develop a large, expanding skin rash around the area of the bite. Some people may get more than one rash. The rash may feel hot to the touch and may be painful. Rashes vary in size, shape, and color, but often look like a red ring with a clear center. The outer edges expand in size. Its easy to miss the rash and the

connection between the rash and the tick bite. The rash develops from three days to as long as a month after the tick bite. Almost one third of those with Lyme disease never get the rash.

- *Indigenous Wildlife*
  In addition to the preceding hazards, various native wildlife may be encountered during the performance of remedial activities. Spiders, snake bites, or other wild animal bites will be reported immediately to the Site Safety Officer so that emergency medical treatment may be sought immediately. Do not attempt to capture or restrain any animal, however, a physical description of the snake, spider, or other wild animal will be helpful to the attending physician when administering treatment.

3.3.4 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.

3.3.5 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
Task No. 1: Mobilization and Site Preparation	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 6 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual

Task Breakdown	Potential Hazards	Hazard Control Measures
Task No. 2: Clearing and grubbing Utility verification and site survey operations	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use
	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
	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on exposure hazards present • Review hazardous properties of potential site contaminants with workers before operations begin

Task Breakdown	Potential Hazards	Hazard Control Measures
Task No. 3: Soil excavation/staging	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 • Do not suspend loads over ground personnel
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Barricade excavation perimeter
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking in fuel dispensing area • 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 in fuel dispensing areas and storage • Store combustible materials away from flammables
	Excavation/Cave-in	• Barricade or enclose the work areas • Slope/shore excavations 5 feet deep or greater 1-1/2:1 (horizontal to vertical) where personnel must enter excavations • Excavation must be supervised by OHM competent person • Restrict entry to authorized personnel only during work activities • Wear hard hats, safety glasses with side shields, and steel-toe safety boots
	Insect/Snake Bites	• Review injury potential and types of snakes with workers • Avoid insect nests areas, likely habitats of snakes outside work areas • Use the Buddy System where such injury potential exists • Use insect repellant, wear PPE to protect against sting/bit injuries
	Underground/Overhead Utilities	• Identify all underground utilities around the excavation site before work commences • Cease work immediately if unknown utility markers are uncovered • Maintain a minimum 15-foot buffer between the trackhoe stick and overhead electrical lines or de-energize overhead lines within 15 feet of equipment operations

Task Breakdown	Potential Hazards	Hazard Control Measures
Task No. 4: Soil Sampling Operations	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
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions
	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

Task Breakdown	Potential Hazards	Hazard Control Measures
Task No. 5: Backfill/ compact excavation	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 • Do not suspend loads over ground personnel
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Barricade excavation perimeter
	Excavation/Cave-in	• Barricade or enclose the work areas • Slope/shore excavations 5 feet deep or greater 1-1/2:1 (horizontal to vertical) where personnel must enter excavations • Excavation must be supervised by OHM competent person • Restrict entry to authorized personnel only during work activities • Wear hard hats, safety glasses with side shields, and steel-toe safety boots
	Insect/Snake Bites	• Review injury potential and types of snakes with workers • Avoid insect nests areas, likely habitats of snakes outside work areas • Use the Buddy System where such injury potential exists • Use insect repellant, wear PPE to protect against sting/bit injuries
	Underground/Overhead Utilities	• Identify all underground utilities around the excavation site before work commences • Cease work immediately if unknown utility markers are uncovered • Maintain a minimum 15-foot buffer between the trackhoe stick and overhead electrical lines or de-energize overhead lines within 15 feet of equipment operations

Task Breakdown	Potential Hazards	Hazard Control Measures
Task No. 6: Load-out of contaminated soil	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 • Do not suspend loads over ground personnel
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions • Barricade excavation perimeter
	Fire/Explosion	• Eliminate sources of ignition from the work area • Prohibit smoking in fuel dispensing area • 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 in fuel dispensing areas and storage • Store combustible materials away from flammables

Task Breakdown	Potential Hazards	Hazard Control Measures
Task No. 7: Equipment Decontamination	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 using high pressure washer
	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
	Slips, Trips, Falls	• Clear walkways of equipment, construction debris and other materials • Mark, identify or barricade other obstructions
	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
Task No. 8: 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 6 feet or more above the ground • Use approved ladders in accordance with OHM Health and Safety Procedures Manual

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. The exclusion zone will be clearly demarcated by the use of fluorescent colored banner-guard and/or temporary fencing. Access to this area will be controlled by physical barriers, and through monitoring activities conducted by the SSO.

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	Comments/Modifications
Site Preparation and Mobilization	Level D	
Access Clearance, Utility Verification, Site Survey	Modified Level D/C with tyvek	Level C when working on contaminated surface areas and PID action levels are met.
Soil Excavation	Level C/Modified Level D with tyvek	Potential for downgrade to Modified Level D with adequate air monitoring documentation in accordance with Section 7.0
Confirmation Sampling	Level C with tyvek	Wear Level C protection when sampling in known to be contaminated areas on-site; Downgrade to Modified Level D for background area sampling or for on-site analytical procedures performed under a ventilation hood
Vehicle and Equipment Decontamination	Level C with sarans	Pressure washing requires face shield and hearing protection
Backfill/Compact Excavation	Level C with tyvek/ Modified Level D	First lift – Level C with tyvek; remaining lifts – Modified Level D
Load-out Contaminated Soil	Level C with tyvek/ Modified Level D	Potential for downgrade to Modified Level D with air monitoring documentation in accordance with Section 7.0
Demobilization	Level D	

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 or cut-resistent work 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)

5.3 AIR-PURIFYING RESPIRATORS

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

5.4 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

5.5 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.

5.6 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.

5.7 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.

5.8 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.

5.9 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.

5.10 CONTACT LENSES

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

5.11 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).

5.12 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 first pair sample gloves
8. Remove outer saran or tyvek
9. Remove and wash respirator
10. Rinse respirator and hang to dry
11. 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.

Trucks being directly loaded at the excavation area will be placed on polyethylene (PE) sheeting and draped along the truck sides when loading. Truck tires and wheels will be scraped of any visual contamination and inspected before tarping and leaving the site. The trackhoe will not enter the excavation area and the bucket will be decontaminated using high pressure washing and manual removal methods between excavations and at project demobilization.

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 during soil excavation and direct loadout operations	>10% LEL <20.8% O_2	Evacuate area, ventilate to less than 10% LEL before continuing
PID (Breathing Zone) To be performed during soil excavation, staging and load-out operations	10 ppm for 5 min. >500 ppm for 5 min.	Level C, monitor with benzene drager tubes Stop operations and allow vapors to dissipate to less than 500 ppm before continuing
Benzene Drager Tubes When PID readings are >10 ppm in Breathing Zone	>0.5 ppm >25 ppm	Upgrade to Level C Stop operations and allow vapors to dissipate prior to continuing
Mini-Ram (Breathing Zone) To be performed during soil excavation and direct loadout operations	>2.5 mg/m3 for 5 min. >5.0 mg/m3 for 5 min	Level C Stop operations and institute dust control measures

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. Although organic compounds are not anticipated to be

present at the site, monitoring will be performed to detect the presence of pesticide carrier solvents which may be present in contaminated soils.

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 BENZENE DETECTOR TUBE MONITORING

Benzene detector tubes with Drager pump will be used to monitor personnel breathing zone when the PID/OVA action level of 10 ppm for 10 seconds is exceeded, requiring Level C protection. Should benzene detector tube results exceed 25 ppm, the operations will be shut down and vapors will be allowed to ventilate to less than 25 ppm before operations resume. Benzene detector tubes (Drager benzene tube 0.5 a 67-28561), with a measurement range of 0.5 to 10 ppm benzene, will be used in conjunction with Drager pump at pump strokes from 40 to 2. Benzene detector tubes will be pulled four times daily in personnel breathing zone to determine personnel exposure when 10 ppm PID/OVA readings are obtained.

7.4 REAL-TIME AEROSOL MONITOR (MINIRAM)

A real-time aerosol monitor (miniram) will be used to measure airborne particulate in personnel breathing zones and site work area locations. A breathing zone action level has been specified that requires upgrading to Level C protection based on sustained (5-minute average) miniram results of 2.5 mg/m^3. The miniram will also be used to monitor personnel breathing zone when wearing Modified Level D protection and to determine when an upgrade to Level C is warranted.

7.5 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 Health and Safety Procedures Manual which will be maintained at the project site trailer by the SSO. The log will be signed by the individual conducting the monitoring daily. The Project CIH will periodically review this data

7.6 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, name and signature of person performing the calibration.

7.7 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.

- Incident critiques will be prepared by the Site Supervisor and Site Safety Officer for submission to the OHM Regional Health and Safety Director for review. A "lessons learned" summary of the critique will be distributed to all site personnel within 30 days of the incident closure.

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)
Camp Gieger Fire Station No. 6	(910) 451-0538
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
NOSC Camp Gieger	
Van Marshbern	(910) 451-5006
Project Manager	
James Dunn	(404) 734-8072
Director, Health and Safety, Angelo Liberatore, CIH	(404) 453-7671
OHM Corporation (24 hour)	800-537-9540
Project Office	(910) 451-2599
Note:	
Additional Phone Numbers in Section 2.0 this HASP	

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

Exit Camp Gieger through Main Gate and proceed north on Highway 17 to Western Boulevard.

Proceed west on Western Boulevard for approximately 1.5 miles to Onslow County Memorial Hospital.

Enter Camp Lejeune through Main Gate to Brewster Street and turn right. Hospital is on right.

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
Drager 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 which must be performed.
- 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

8.7.1.3 Directions To Hospital

Written directions to the hospital and a map will be posted in all trailers in the staging area.

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 assigned to this project will receive training on this HASP and other pertinent site-specific information (as determined by the SSO and SS) prior to starting work.

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)

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 Safely 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

SITE MATERIAL SAFETY DATA SHEETS

Site Contaminants
Varsol
Trichloroethylene
Benzene
Ethylbenzene
Xylene
Tetrachloroethylene
Toluene

Hazard Communication Chemicals
Gasoline (Unleaded)
Motor oil
Alconox
Anti-fog
Bleach/detergent
Diesel fuel
Fire extinguishers
Gear lube
Grease
Hand cleaner
Calcium hypochlorite
Liquid detergent
Breathing air
Isobutylene (calibration gas)
Isopropyl alcohol
Oil (hydraulic)
Pentane (calibration gas)
Starting fluid
WD-40

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Material Safety Data Sheets Collection:

Sheet No. 334
Mineral Spirits, Type I

Issued: 7/84 Revision: C, 11/89

Section 1. Material Identification

30

Mineral Spirits, Type I, Description: Used as a diluent in paints, coatings, and waxes; as a dry cleaning agent; as a degreaser and cleaner in mechanical shops; and as an herbicide.
Other Designations: Stoddard solvent; Texsolve S; Varsol 1; white spirits; CAS No. 8052-41-3.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.
Comments: All mineral spirits are refined petroleum distillates Genium divides into types I, II, and III (*MSDS Collection*, Nos. 334, 334A, and 334B, respectively). Types I and II have a standard aromatic content and 100 and 140 °F (37.78 and 60 °C) minimum flash points, respectively; while type III has a high aliphatic content (low or reduced aromatic content), little odor, and a 100 °F minimum flash point. These different types have different applications. Consult your manufacturer or supplier to ascertain the exact information applicable to your purchased mineral spirits.

R 1
I 3
S 2
K 2

Genium

HMIS
H 1
F 2
R 0
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Mineral spirits, type I, ca 100%*

OSHA PEL	ACGIH TLV, 1989-90	NIOSH REL, 1987	Toxicity Data†
TWA-air: 500 ppm, 2900 mg/m³	TLV-TWA: 100 ppm, 525 mg/m³	10-hr TWA: 350 mg/m³ 15-min Ceiling: 1800 mg/m³	Cat, inhalation, LC_{L_o}: 10 g/m³/2.5 hr Human, eye: 470 ppm/15 min

* All mineral spirits are mixtures that typically consist of both straight and branched hydrocarbons, paraffins, naphthenes (cycloparaffins), and aromatic hydrocarbons. However, their physical properties divide them into types I, II, and III. Since these parameters vary among suppliers, the purchaser must determine the mineral spirits' composition based on the supplier's information. Note that the mineral spirits' exact composition can affect disposal, shipping, approved uses, insurance policies, and regulatory liabilities.
† See NIOSH, *RTECS* (WJ8925000), for additional data with references to irritative effects.

Section 3. Physical Data

Boiling Point: 300 to 407 °F (149 to 208 °C)*
Water Solubility: Insoluble
Vapor Pressure: ca 5 torr at 77 °F (25 °C)
Vapor Density (Air = 1): ca 4.8
Molecular Weight: Not applicable (mixture)
Specific Gravity (H_2O = 1 at 39 °F (4 °C)): ca 0.79
% Volatile by Volume: ca 100

Appearance and Odor: A clear, colorless liquid; a kerosene-like odor usually perceptible to humans at about 1-ppm concentration.

* This 300 to 407 °F (149 to 208 °C) distillation range describes a specific cut of petroleum distillates, as well as defines and distinguishes these mineral spirits from many petroleum distillates (petroleum naphtha, petroleum ether, rubber solvent, kerosene, mineral seal oil, and others).

Section 4. Fire and Explosion Data

Flash Point: >100 °F (38 °C) min. TCC	Autoignition Temperature: >450 °F (232 °C)	LEL: ca 1% v/v	UEL: ca 6% v/v

Extinguishing Media: Use water fog, dry chemical, carbon dioxide (CO_2), or foams to put out fires involving this material. Never direct solid streams of water into burning pools of this liquid since this can scatter and spread the flames.
Unusual Fire or Explosion Hazards: During fires, or if heated or misted, this liquid is an explosive, flammable hazard. Finely dispersed mists are a dangerous explosion hazard.
Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

Section 5. Reactivity Data

Stability/Polymerization: Type I mineral spirits are stable at room temperature in closed containers. Hazardous polymerization cannot occur.
Chemical Incompatibilities: As a hydrocarbon mixture, type I can react dangerously with strong oxidizing agents like chlorine and oxygen, as well as with nitric, sulfuric, and phosphoric acids.
Conditions to Avoid: Prevent exposures to heat and ignition sources and incompatible chemicals. Perform processing operations that heat or mist type I in a careful, controlled manner that minimizes exposure of vapors or mists to possible heat or ignition sources such as lighted tobacco products, open flames, or uninsulated heating elements.
Hazardous Products of Decomposition: Thermal oxidative decomposition of type I mineral spirits can produce carbon dioxide and carbon monoxide (CO). Depending on your material's exact composition and its unreported contaminants (benzene, toluene, or other aromatics or aliphatics), degradation products could include unidentified aromatic compounds and organics. When heated to decomposition, this material may explode.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists mineral spirits as a carcinogen.
Summary of Risks: Millions of industrial workers in chemical process and allied industries have been exposed to mineral spirits with minimal serious health effects, aside from the drying, defatting (stripping away of your skin's protective fats and emoilents), and irritant skin effects. However, overexposure can depress the central nervous system (CNS) with these symptoms: headache, dizziness, drowsiness, intoxication with euphoria, and possibly unconsciousness. Prolonged or repeated skin contact can cause dermatitis due to this mineral spirits' defatting effect.
Medical Conditions Aggravated by Long-Term Exposure: None reported. **Target Organs:** Skin, eyes, nose, throat, respiratory system, and CNS. **Primary Entry:** Skin or eye contact with the liquid or inhalation of vapors. **Acute Effects:** Irritation, redness of skin, eyes; narcotic effects like dizziness, slurred speech, or drunkeness. **Chronic Effects:** None reported in humans; animal testing indicates possible liver and kidney damage.
FIRST AID
Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for 15 min. **Skin:** Remove all contaminated clothing to prevent continued exposure. After rinsing affected area with flooding amounts of water, wash it with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Treat as an emergency. Potentially fatal aspiration hazard exists. Keep victim's head down between his knees. Never give anything by mouth to an unconscious or convulsing person. Never induce vomiting unless directed by qualified medical personnel. Even if aspiration into the lungs does not occur, ingestion of 3 to 4 oz. can prove fatal in humans due to the CNS's depressed action.
After first aid, get appropriate in-plant, paramedic, or community medical attention and support.
Physician's Note: Aspiration of even a few milliliters of mineral spirits can be fatal! The resulting diffused chemical irritation of the lungs can progress to fatal pulmonary edema after aspiring (breathing in) liquid mineral spirits. Persons who swallow mineral spirits must be monitored very carefully to prevent aspiration of freshly vomited solvent.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a mineral spirits spill control and countermeasure plan (SCCP).* When a spill occurs, notify safety personnel, eliminate heat and ignition sources, provide optimum explosion-proof ventilation, and implement the SCCP. Cleanup crews must use nonsparking tools and equipment and protective clothing to prevent vapor inhalation or skin contact. Absorb the spilled material with vermiculite or a similiar material and place in appropriate disposal containers.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)
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). **Respirator:** Wear a NIOSH-approved respirator if necessary (see Genium ref. 28 for specific recommendations). Follow OSHA respirator regulations (29 CFR 1910.134). 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 rubber or polyvinyl gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. **Ventilation:** Provide general and local explosion-proof ventilation systems that maintain airborne concentrations below the OSHA PEL standard (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103). **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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment. **Other Equipment:** Use only nonsparking tools and equipment in handling operations in production and storage areas. **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. Never inhale its mists or vapors, especially when processing operations heat or mist this material.

Section 9. Special Precautions and Comments

Storage Requirements: Store this material in a cool, dry, well-ventilated, fireproof area away from heat and ignition sources and oxidizing agents. Protect these containers from physical damage. Store in properly labeled closed metal drums or safety cans.
Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas.
Comments: Shipping regulations vary with your particular mineral spirits' physical properties (flash point, boiling point). The data below represent one of several ways to classify mineral spirits, per the actual entries in the table of regulations. Before shipping mineral spirits, ascertain how the pertinent shipping rules apply to your product.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Petroleum distillate	**IMO Shipping Name:** Petroleum distillates, n.o.s.
DOT Hazard Class: Combustible liquid *or* Flammable liquid	**IMO Hazard Class:** 3.1 *or* 3.2 *or* 3.3
ID No.: UN1268 (Both)	**IMO Label:** Flammable liquid
DOT Label: None *or* Flammable liquid	**IMDG Packaging Group:** II

***MSDS Collection* References:** 1, 6, 7, 84-94, 100, 116, 117, 119, 120, 122
Prepared by: PJ Igoe, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD M3

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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).

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

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.

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/m^3)
15-min STEL: 200 ppm (1080 mg/m^3)

1990 IDLH Level
1000 ppm

1990 NIOSH REL
10-hr TWA: 25 ppm (~135 mg/m^3)

1992-93 ACGIH TLVs
TWA: 50 ppm (269 mg/m^3)
STEL: 200 ppm (1070 mg/m^3)

1990 DFG (Germany) MAK
Ceiling: 50 ppm (270 mg/m^3)
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/ft^3; 1.2 kg/m^3): 0.0956 lbs/ft^3; 1.53 kg/m^3
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 euphoric effect of TCE has led to craving, and habitual sniffing of its vapors.

Continue on next page

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, ...r, kidney, and skin. **Primary Entry Routes:** Inhalation, skin and eye contact, and ingestion (rarely). **Acute Effects:** Vapor inhalation can ...e eye, nose, and throat irritation, nausea, blurred vision, overexcitement, headache, drunkenness, memory loss, irregular heartbeat (resulting in ...den 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
...ted as a SARA Toxic Chemical (40 CFR 372.65)
...ed as a RCRA Hazardous Waste (40 CFR 261.33 & 261.31): No. U228 & F002 (*spent solvent*)
...sted 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
...No.: UN1710
...T Packing Group: III
...OT 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

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 168, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** AC Darlington, MD

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Material Safety Data Sheets Collection:

Sheet No. 316
Benzene

Issued: 11/78 Revision: E, 8/90

Section 1. Material Identification

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Benzene (C_6H_6) Description: Derived by fractional distillation of coal tar, hydrodealkylation of toluene or pyrolysis of gasoline, catalytic reforming of petroleum, and transalkylation of toluene by disproportionation reaction. Used as a fuel; a chemical reagent; a solvent for a large number of materials such as paints, plastics, rubber, inks, oils, and fats; in manufacturing phenol, ethylbenzene (for styrene monomer), nitrobenzene (for aniline), dodecylbenzene (for detergents), cyclohexane (for nylon), chlorobenzene, diphenyl, benzene hexachloride, maleic anhydride, benzene-sulfonic acid, artificial leather, linoleum, oil cloth, varnishes, and lacquers; for printing and lithography; in dry cleaning; in adhesives and coatings; for extraction and rectification; as a degreasing agent; in the tire industry; and in shoe factories. Benzene has been banned as an ingredient in products intended for household use and is no longer used in pesticides.

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

NFPA

HMIS
H 3
F 3
R 0
PPG†
† Sec. 8

Other Designations: CAS No. 0071-43-2, benzol, carbon oil, coal naphtha, cyclohexatriene, mineral naphtha, nitration benzene, phene, phenyl hydride, pyrobenzol.

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

Cautions: Benzene is a confirmed *human carcinogen* by the IARC. *Chronic low-level exposure may cause cancer (leukemia) and bone marrow damage, with injury to blood-forming tissue.* It is also a dangerous fire hazard when exposed to heat or flame.

Section 2. Ingredients and Occupational Exposure Limits

Benzene, ca 100%*

1989 OSHA PELs
(29 CFR 1910.1000, Table Z-1-A)
8-hr TWA: 1 ppm, 3 mg/m³
15-min STEL: 5 ppm, 15 mg/m³

(29 CFR 1910.1000, Table Z-2)
8-hr TWA: 10 ppm
Acceptable Ceiling Concentration: 25 ppm
Acceptable Maximum Peak: 50 ppm (10 min)†

1989-90 ACGIH
TLV-TWA: 10 ppm, 32 mg/m³

1988 NIOSH RELs
TWA: 0.1 ppm, 0.3 mg/m³
Ceiling: 1 ppm, 3 mg/m³

1985-86 Toxicity Data‡
Man, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted
Man, inhalation, TC_{Lo}: 150 ppm inhaled intermittently over 1 yr in a number of discrete, separate doses affects the blood (other changes) and nutritional and gross metabolism (body temperature increase)
Rabbit, eye: 2 mg administered over 24 hr produces severe irritation

* OSHA 29 CFR 1910.1000, Subpart Z, states that the final benzene standard in 29 CFR 1910.1028 applies to all occupational exposures to benzene except in some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.
† Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift.
‡ See NIOSH, *RTECS* (CY1400000), for additional irritative, mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 176 °F (80 °C)
Melting Point: 42 °F (5.5 °C)
Vapor Pressure: 100 mm Hg at 79 °F (26.1 °C)
Vapor Density (Air = 1): 2.7
Evaporation Rate (Ether = 1): 2.8

Molecular Weight: 78.11
Specific Gravity (15 °C/4 °C): 0.8787
Water Solubility: Slightly (0.180 g/100 g of H_2O at 25 °C)
%Volatile by Volume: 100
Viscosity: 0.6468 mPa at 20 °C

Appearance and Odor: A colorless liquid with a characteristic sweet, aromatic odor. The odor recognition threshold (100% of panel) is approximately 5 ppm (unfatigued) in air. Odor *is not* an adequate warning of hazard.

Section 4. Fire and Explosion Data

Flash Point: 12 °F (-11.1 °C), CC	Autoignition Temperature: 928 °F (498 °C)	LEL: 1.3% v/v	UEL: 7.1% v/v

Extinguishing Media: Use dry chemical, foam, or carbon dioxide to extinguish benzene fires. Water may be ineffective as an extinguishing agent since it can scatter and spread the fire. Use water spray to cool fire-exposed containers, flush spills away from exposures, disperse benzene vapor, and protect personnel attempting to stop an unignited benzene leak.

Unusual Fire or Explosion Hazards: Benzene is a Class 1B flammable liquid. A concentration exceeding 3250 ppm is considered a potential fire explosion hazard. Benzene vapor is heavier than air and can collect in low lying areas or travel to an ignition source and flash back. Explosive and flammable benzene vapor-air mixtures can easily form at room temperature. Eliminate all ignition sources where benzene is used, handled, or stored.

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 equipment. Structural firefighter's protective clothing provides limited protection. Stay out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Runoff to sewer can create pollution, fire, and explosion hazard.

Section 5. Reactivity Data

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

Chemical Incompatibilities: Benzene explodes on contact with diborane, permanganic acid, bromine pentafluoride, peroxodisulfuric acid, and peroxomonosulfuric acid. It ignites on contact with dioxygen difluoride, dioxygenyl tetrafluoroborate, iodine heptafluoride, and sodium peroxide + water. Benzene forms sensitive, explosive mixture with iodine pentafluoride, ozone, liquid oxygen, silver perchlorate, nitryl perchlorate, nitric acid, and arsenic pentafluoride + potassium methoxide (explodes above 30 °C). A vigorous or incandescent reaction occurs with bromine trifluoride, uranium hexafluoride, and hydrogen + Raney nickel [above 410 °F (210 °C)]. Benzene is incompatible with oxidizing materials.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of benzene can produce toxic gases and vapors such as carbon monoxide.

Section 6. Health Hazard Data

Carcinogenicity: The ACGIH, OSHA, and IARC list benzene as, respectively, a supected human carcinogen, a cancer hazard, and, based on sufficient human and animal evidence, a human carcinogen (Group 1).
Summary of Risks: Prolonged skin contact or excessive inhalation of benzene vapor may cause headache, weakness, appetite loss, and fatigue. The most important health hazards are cancer (leukemia) and bone marrow damage with injury to blood-forming tissue from chronic low-level exposure. Higher level exposures may irritate the respiratory tract and cause central nervous system (CNS) depression.
Medical Conditions Aggravated by Long-Term Exposure: Exposure may worsen ailments of the heart, lungs, liver, kidneys, blood, and CNS.
Target Organs: Blood, central nervous system, bone marrow, eyes, upper respiratory tract, and skin.
Primary Entry Routes: Inhalation, skin contact.
Acute Effects: Symptoms of acute overexposure include irritation of the eyes, nose, and respiratory tract, breathlessness, euphoria, nausea, drowsiness, headache, dizziness, and intoxication. Severe exposure may lead to convulsions and unconsciousness. Skin contact may cause a drying rash (dermatitis).
Chronic Effects: Long-term chronic exposure may result in many blood disorders ranging from aplastic anemia (an inability to form blood cells) to leukemia.
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. Immediately 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. Emergency personnel should protect against inhalation exposure. Provide CPR to support breathing or circulation as necessary. Keep awake and transport to a medical facility.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* since aspiration may be fatal. Call a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: Evaluate chronic exposure with a CBC, peripheral smear, and reticulocyte count for signs of myelotoxicity. Follow up any early indicators of leukemia with a bone marrow biopsy. Urinary phenol conjugates may be used for biological monitoring of recent exposure. Acute management is primarily supportive for CNS depression.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a benzene spill control and countermeasure plan (SCCP).* Notify safety personnel, evacuate all unnecessary personnel, eliminate all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation, eye contact, and skin absorption. Absorb as much benzene as possible with an inert, noncombustible material. For large spills, dike far ahead of spill and contain liquid. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of confined spaces such as sewers, watersheds, and waterways because of explosion danger. 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), Hazardous Waste No. U019
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1000 lb (454 kg) [* per Clean Water Act, Sec. 307 (a), 311 (b)(4), 112; and per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Tables Z-1-A and Z-2)

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: 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. 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 skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations at least 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: 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, dry, well-ventilated area away from all heat and ignition sources and incompatible materials. *Caution! Benzene vapor may form explosive mixtures in air.* To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. When opening or closing benzene containers, use nonsparking tools. Keep fire extinguishers readily available.
Engineering Controls: Because OSHA specifically regulates benzene (29 CFR 1910.1028), educate workers about its potential hazards and dangers. Minimize all possible exposures to carcinogens. If possible, substitute less toxic solvents for benzene; use this material with extreme caution and only if absolutely essential. 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. Designate regulated areas of benzene use (see legend in the box below) and label benzene containers with "DANGER, CONTAINS BENZENE, CANCER HAZARD."
Other Precautions: Provide preplacement and periodic medical examinations with emphasis on a history of blood disease or previous exposure.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Benzene (*benzol*)
DOT Hazard Class: Flammable liquid
ID No.: UN1114
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Benzene
IMO Hazard Class: 3.2
ID No.: UN1114
IMO Label: Flammable liquid
IMDG Packaging Group: II

DANGER
BENZENE
CANCER HAZARD
FLAMMABLE–NO SMOKING
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

MSDS Collection **References:** 1, 2, 12, 26, 73, 84-94, 100, 101, 103, 109, 124, 126, 127, 132, 134, 136, 138, 139, 143
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 385
Ethylbenzene

Issued: 8/78 Revision: B, 9/92

Section 1. Material Identification

Ethylbenzene ($C_6H_5C_2H_5$) Description: Derived by heating benzene and ethylene in presence of aluminum chloride with subsequent distillation, by fractionation directly from the mixed xylene stream in petroleum refining, or dehydrogenation of naphthenes. Used as a solvent, an antiknock agent in gasoline; and as an intermediate in production of synthetic rubber, styrene, cellulose acetate, diethylbenzene, acetophenone, ethyl anthraquinone, propyl oxide, and α-methylbenzol alcohol.
Other Designations: CAS No. 100-41-4, ethylbenzol, EB, phenylethane, NCI-C56393.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

R 1
I 3
S 2*
K 4
* Skin absorption

NFPA
3
2 0
-

HMIS
H 2†
F 3
R 0
PPE - Sec. 8
† Chronic effects

Cautions: Ethylbenzene is a skin and mucous membrane irritant considered the most irritating of the benzene series. Inhalation causes acute and chronic central nervous system (CNS) effects. It is highly flammable and forms explosive mixtures with air.

Section 2. Ingredients and Occupational Exposure Limits

Ethylbenzene, ca >99.0%. Impurities include ~ 0.1% *meta* & *para* xylene, ~ 0.1% cumene, and ~ 0.1% toluene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m^3)
15-min STEL: 125 ppm (545 mg/m^3)
Action Level: 50 ppm (217 mg/m^3)

1990 IDLH Level
2000 ppm

1990 NIOSH REL
TWA: 100 ppm (435 mg/m^3)
STEL: 125 ppm (545 mg/m^3)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m^3)
STEL: 125 ppm (545 mg/m^3)

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m^3)
Category 1: local irritants
Peak Exposure Limit: 200 ppm, 5 min momentary value, max of 8/shift
Danger of cutaneous absorption

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 100 ppm/8 hr caused eye effects, sleep, and respiratory changes.
Human, lymphocyte: 1 mmol/L induced sister chromatid exchange.
Rat, oral, LD_{50}: 3500 mg/kg; toxic effects not yet reviewed
Rat (female), inhalation, TC_{Lo}: 1000 ppm/7 hr/day, 5 days/wk, for 3 wk prior to mating and daily for 19 days of gestation produced pups with high incidence of extra ribs.[179]

* See NIOSH, *RTECS* (DA0700000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 277 °F (136 °C)
Melting Point: -139 °F (-95 °C)
Surface Tension: 31.5 dyne/cm
Ionization Potential: 8.76 eV
Viscosity: 0.64 cP at 77 °F (25 °C)
Refraction Index: 1.4959 at 68 °F (20 °C)
Relative Evaporation Rate (ether = 1): 0.0106
Bulk Density: 7.21 lb/Gal at 77 °F (25 °C)
Critical Temperature: 651 °F (343.9 °C)
Critical Pressure: 35.6 atm

Molecular Weight: 106.16
Density: 0.863 at 77 °F (25 °C)
Water Solubility: Slightly, 14 mg/100 mL at 59 °F (15 °C)
Other Solubilities: Miscible in alcohol, ether; soluble in carbon tetrachloride, benzene, sulfur dioxide, and many organic solvents; insoluble in ammonia
Odor Threshold: 2.3 ppm
Vapor Pressure: 7.1 mm Hg at 68 °F (20 °C); 10 mmHg at 78.62 °F (25.9 °C); 100 mm Hg 165.38 °F (74.1 °C)
Saturated Vapor Density (Air = 0.075 lb/ft^3 or 1.2 kg/m^3): 0.0768 lb/ft^3 or 1.2298 kg/m^3

Appearance and Odor: Colorless, flammable liquid with a pungent odor.

Section 4. Fire and Explosion Data

Flash Point: 64 °F (18 °C) CC	**Autoignition Temperature:** 810 °F (432 °C)	**LEL:** 1.0% v/v	**UEL:** 6.7% v/v

Extinguishing Media: Class 1B Flammable liquid. For small fires, use dry chemical, carbon dioxide, or 'alcohol-resistant' foam. For large fires, use fog or 'alcohol-resistant' foam. Use water only if other agents are unavailable; EB floats on water and may travel to an ignition source and spread fire. **Unusual Fire or Explosion Hazards:** Burning rate = 5.8 mm/min. Vapors may travel to an ignition source and flash back. Container may explode in heat of fire. EB poses a vapor explosion hazard indoors, outdoors, and in sewers. **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. Cool container sides with water 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 from area and let fire burn. Withdraw immediately if you hear 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: Ethylbenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Reacts vigorously with oxidizers.
Conditions to Avoid: Exposure to heat and oxidizers.
Hazardous Products of Decomposition: Thermal oxidative decomposition of EB can produce acrid smoke and irritating fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list EB as a carcinogen. **Summary of Risks:** Occupational exposure to EB alone is rare since it is usually present together with other solvents. EB is irritating to the eyes, skin, and respiratory tract. Vapor inhalation produces varying degrees of CNS effects depending on concentration. The liquid is absorbed through the skin but vapors are not. 56 to 64% of inhaled ethylbenzene is retained and metabolized. Urinary metabolites following exposure to 23 to 85 ppm for 8 hr are mandelic acid (64%), phenylglyoxylic acid (25%), and methylphenylcarbinol/1-phenyl ethanol (5%). Concurrent exposure to xylene and ethylbenzene causes slower excretion of EB metabolites. Based on the rat LD_{50}, one manufacturer gives 3 to 4 oz. as the lethal dose for a 100 lb person.

Continue on next page

Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Skin and CNS diseases and impaired pulmonary function (especially obstructive airway disease). **Target Organs:** Eyes, respiratory system, skin, CNS, blood. **Primary Entry Routes:** Inhalation, skin and eye contact. **Acute Effects:** Vapor inhalation of 200 ppm caused transient eye irritation; 1000 ppm caused eye irritation with profuse watering (tolerance developed ...idly); 2000 ppm caused severe and immediate eye irritation and watering, nasal irritation, chest constriction, and vertigo; 5000 ppm was ...lerable and caused eye and nose irritation. Inhalation of high concentrations may cause narcosis, cramps, and death due to respiratory paralysis. ...n exposed to pure ethylbenzene for 10 to 15 min absorbed 22 to 33 mg/cm^2/hr. Immersion of hand in solutions of 112 & 156 mg/L for 1 hr absorbed 118 & 215.7 µg/cm^2/hr, respectively. **Chronic Effects:** Repeated skin contact may cause dryness, scaling, and fissuring. Workers chronically exposed to > 100 ppm complained of fatigue, sleepiness, headache, and mild irritation of the eyes and respiratory tract. Repeated vapor inhalation may result in blood disorders, particularly leukopenia (abnormally low level of white blood cells) and lymphocytosis.

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. **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 to dilute. *Do not* induce vomiting! Aspiration of even a small amount of EB in vomitus can cause severe damage since its low viscosity and surface tension will cause it to spread over a large area of the lung tissue.

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

Note to Physicians: BEI = mandelic acid in urine (1.5 g/g of creatinine), sample at end of shift at workweeks end. Since this test is not specific, test for EB in expired air for confirmation.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate and ventilate area, deny entry and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against vapor inhalation and skin/eye contact. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container. Dike far ahead of large spill for later reclamation or disposal. Report any release >1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** If released to soil, EB partially evaporates into the atmosphere, with a half-life of hrs to wks, and some leaches into groundwater, especially in soil with low organic carbon content. Biodegradation occurs with a half-life of 2 days. Some EB may absorb to sediment or bioconcentrate in fish. Evidence points to slow biodegradation in groundwater. In air, it reacts with photochemically produced hydroxyl radicals with a half-life of hrs to 2 days. Additional amounts may be removed by rain. **Ecotoxicity Values:** Shrimp (*Mysidopsis bahia*), LC_{50} = 87.6 mg/L/96 hr; sheepshead minnow (*Cyprinodon variegatus*) LC_{50} = 275 mg/L/96 hr; fathead minnow (*Pimephales promelas*) LC_{50} = 42.3 mg/L/96 hr in hard water & 48.5 mg/L/96 hr in softwater. **Disposal:** A candidate for rotary kiln incineration at 1508 to 2912°F (820 to 1600°C), liquid injection incineration at 1202 to 2912°F (650 to 1600°C), and fluidized bed incineration at 842 to 1796°F (450 to 980°C). 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 261.21): No. D001
...sted as a SARA Toxic Chemical (40 CFR 372.65)
...A Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
...ed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per 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 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 selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use a powered air-purifying respirator with an appropriate organic vapor cartridge, a supplied-air respirator (SAR), SCBA, or chemical cartridge respirator with appropriate organic vapor cartridge. For < 2000 ppm, use a SAR or SCBA with a full facepiece. 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 of Viton or polyvinylchloride to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the 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 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 away from ignition sources and oxidizers. Outside or detatched storage is preferred. If inside, store in a standard flammable liquids cabinet. Containers should have flame-arrester or pressure-vacuum venting. To prevent static sparks, electrically ground and bond all equipment used with ethylbenzene. Install Class 1, Group D electrical equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain levels as low as possible. Purge and ventilate reaction vessels before workers are allowed to enter for maintenance or cleanup. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, skin, blood, and respiratory system.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Ethylbenzene
DOT Hazard Class: 3
ID No.: UN1175
...T Packing Group: II
T Label: Flammable liquid
...pecial 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: 5L
b) Cargo Aircraft Only: 60 L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: —

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 153, 159, 162, 163, 164, 167, 168, 171, 176, 179
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 318
Xylene *(Mixed Isomers)*

Issued: 11/80 Revision: E, 9/92

Section 1. Material Identification

Xylene (Mixed Isomers) (C_8H_{10}) Description: The commercial product is a blend of the three isomers [*ortho*-(*o*-), *meta*-(*m*-), *para*-(*p*-)] with the largest proportion being *m*- xylene. Xylene is obtained from coal tar, toluene by transalkylation, and pseudocumene. Used in the manufacture of dyes, resins, paints, varnishes, and other organics; as a general solvent for adhesives, a cleaning agent in microscope technique; as a solvent for Canada balsam microscopy; as a fuel component; in aviation gasoline, protective coatings, sterilizing catgut, hydrogen peroxide, perfumes, insect repellants, pharmaceuticals, and the leather industry; in the production of phthalic anhydride, isophthalic, and terephthalic acids and their dimethyl esters which are used in the manufacture of polyester fibers; and as an indirect food additive as a component of adhesives. Around the home, xylene is found as vehicles in paints, paint removers, degreasing cleaners, lacquers, glues and cements and as solvent/vehicles for pesticides.

Other Designations: CAS No. 1330-20-7 [95-47-6; 108-38-3; 106-42-3 (*o*-, *m*-, *p*-isomers)], dimethylbenzene, methyltoluene, NCI-C55232, Violet 3, xylol.

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

Cautions: Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

R	1
I	2
S	2
K	3

NFPA

HMIS
H 2†
F 3
R 0
PPE ‡
† Chronic Effects
‡ Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Xylene (mixed isomers): the commercial product generally contains ~ 40% *m*-xylene; 20% each of *o*-xylene, *p*-xylene, and ethylbenzene; and small quantities of toluene. Unpurified xylene may contain pseudocumene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m^3)
15-min STEL: 150 ppm (655 mg/m^3)

1990 IDLH Level
1000 ppm

1990 NIOSH RELs
TWA: 100 ppm (435 mg/m^3)
STEL: 150 ppm (655 mg/m^3)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m^3)
STEL: 150 ppm (651 mg/m^3)
BEI (Biological Exposure Index): Methylhippuric acids in urine at end of shift: 1.5 g/g creatinine

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m^3)
Category II: Substances with systemic effects
Half-life: < 2 hr
Peak Exposure: 200 ppm, 30 min, average value, 4 peaks per shift

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 200 ppm produced olfaction effects, conjunctiva irritation, and other changes involving the lungs, thorax, or respiration.
Man, inhalation, LC_{Lo}: 10000 ppm/6 hr; toxic effects not yet reviewed.
Human, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted.
Rat, oral, LD_{50}: 4300 mg/kg; toxic effect not yet reviewed.
Rat, inhalation, LC_{50}: 5000 ppm/4 hr; toxic effects not yet reviewed.

* See NIOSH, *RTECS* (XE2100000), for additional toxicity data.

Section 3. Physical Data

Boiling Point Range: 279 to 284 °F (137 to 140 °C)*
Boiling Point: *ortho:* 291 °F (144 °C); *meta:* 281.8 °F (138.8 °C); *para:* 281.3 °F (138.5 °C)
Freezing Point/Melting Point: *ortho:* -13 °F (-25 °C); *meta:* -53.3 °F (- 47.4 °C); *para:* 55 to 57 °F (13 to 14 °C)
Vapor Pressure: 6.72 mm Hg at 70 °F (21 °C)
Saturated Vapor Density (Air = 1.2 kg/m^3): 1.23 kg/m^3, 0.077 lbs/ft^3

Appearance and Odor: Clear, sweet-smelling liquid.

* Materials with wider and narrower boiling ranges are commercially available.

Molecular Weight: 106.16
Specific Gravity: 0.864 at 20 °C/4 °C
Water Solubility: Practically insoluble
Other Solubilities: Miscible with absolute alcohol, ether, and many other organic liquids.
Octanol/Water Partition Coefficient: logKow = 3.12-3.20
Odor Threshold: 1 ppm
Viscosity: <32.6 SUS

Section 4. Fire and Explosion Data

Flash Point: 63 to 77 °F (17 to 25 °C) CC	**Autoignition Temperature:** 982 °F (527 °C) (*m*-)	**LEL:** 1.1 (*m*-, *p*-); 0.9 (*o*-)	**UEL:** 7.0 (*m*-, *p*-); 6.7 (*o*-)

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), water spray or regular foam. For large fires, use water spray, fog or regular foam. Water may be ineffective. Use water spray to cool fire-exposed containers. **Unusual Fire or Explosion Hazards:** Xylene vapors or liquid (which floats on water) may travel to an ignition source and flash back. The heat of fire may cause containers to explode and/or produce irritating or poisonous decomposition products. Xylene may present a vapor explosion hazard indoors, outdoors, or in sewers. Accumulated static electricity may occur from vapor or liquid flow sufficient to cause ignition. **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 firefighter's protective clothing will provide limited protection. If feasible and without risk, move containers from fire area. Otherwise, cool fire-exposed containers until well after fire is extinguished. Stay clear of tank ends. Use unmanned hose holder or monitor nozzles for massive cargo fires. If impossible, withdraw from area and let fire burn. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Xylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Xylene is easily chlorinated, sulfonated, or nitrated. **Chemical Incompatibilities:** Incompatibilities include strong acids and oxidizers and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin). Xylene attacks some forms of plastics, rubber, and coatings. **Conditions to Avoid:** Avoid heat and ignition sources and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of xylene can produce carbon dioxide, carbon monoxide, and various hydrocarbon products.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list xylene as a carcinogen. **Summary of Risks:** Xylene is an eye, mucous membrane, and respiratory tract irritant. Irritation starts at 200 ppm; severe breathing difficulties which may be delayed in onset can occur at high concentrations. It is a central nervous system (CNS) depressant and at high concentrations can cause coma. Kidney and liver damage can occur with xylene exposure. With prolonged or repeated cutaneous exposure, xylene produces a defatting dermatitis. Chronic toxicity is not well defined, but it is less toxic than benzene. Prior to the 1950s, benzene was often found as a contaminant of xylene and the effects attributed to xylene such as blood dyscrasias are questionable. Since the late 1950s, xylenes have been virtually benzene-free and blood dyscrasias have not been associated with xylenes. Chronic exposure to high concentrations of xylene in animal studies have demonstrated milk reversible decrease in red and white cell counts as well as increases in platelet counts.

Continue on next page

Section 6. Health Hazard Data, *continued*

irregularity was reported in association with workplace exposure to xylene perhaps due to effects on liver metabolism. Xylene crosses the human placenta, but does not appear to be teratogenic under conditions tested to date. **Medical Conditions Aggravated by Long-Term Exposure:** CNS, respiratory, eye, skin, gastrointestinal (GI), liver and kidney disorders. **Target Organs:** CNS, eyes, GI tract, liver, kidneys, and skin. **Primary Routes:** Inhalation, skin absorption (slight), eye contact, ingestion. **Acute Effects:** Inhalation of high xylene concentrations may cause dizziness; nausea, vomiting, and abdominal pain; eye, nose, and throat irritation; respiratory tract irritation leading to pulmonary edema (fluid in lung); drowsiness; and unconsciousness. Direct eye contact can result in conjunctivitis and corneal burns. Ingestion may cause a burning sensation in the oropharynx and stomach and transient CNS depression. **Chronic Effects:** Repeated or prolonged skin contact may cause drying and defatting of the skin leading to dermatitis. Repeated eye exposure to high vapor concentrations may cause reversible eye damage, peripheral and central neuropathy, and liver damage. Other symptoms of chronic exposure include headache, fatigue, irritability, chronic bronchitis, and GI disturbances such as nausea, loss of appetite, and gas.

FIRST AID *Emergency personnel should protect against exposure.* **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. Carefully dispose of contaminated clothing as it may pose a fire hazard. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. Monitor exposed person for respiratory distress. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, *do not induce vomiting!* If spontaneous vomiting should occur, keep exposed person's head below the hips to prevent aspiration (breathing liquid xylene into the lungs). *Aspiration of a few millimeters of xylene can cause chemical pneumonitis, pulmonary edema, and hemorrhage.* **Note to Physicians:** Hippuric acid or the ether glucuronide of *ortho*-toluic acid may be useful in diagnosis of *meta-*, *para-* and *ortho*-xylene exposure, respectively. Consider gastric lavage if a large quantity of xylene was ingested. Proceed gastric lavage with protection of the airway from aspiration; consider endotracheal intubation with inflated cuff.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and ventilate spill area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If feasible and without undue risk, stop leak. Use appropriate foam to blanket release and suppress vapors. Water spray may reduce vapor, but does not prevent ignition in closed spaces. For small spills, absorb on paper and evaporate in appropriate exhaust hood or absorb with sand or some non-combustible absorbent and place in containers for later disposal. For large spills dike far ahead of liquid to contain. Do not allow xylene to enter a confined space such as sewers or drains. On land, dike to contain or divert to impermeable holding area. Apply water spray to control flammable vapor and remove material with pumps or vacuum equipment. On water, contain material with natural barriers, booms, or weirs; apply universal gelling agent; and use suction hoses to remove spilled material. Report any release in excess of 1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** Little bioconcentration is expected. Biological oxygen demand 5 (after 5 days at 20 °C): 0.64 (no stated isomer). **Ecotoxicity values:** LD_{50}, Goldfish, 13 mg/L/24 hr, conditions of bioassay not specified, no specific isomer. **Environmental Degradation:** In the atmosphere, xylenes degrade by reacting with photochemically produced hydroxyl radicals with a half-life ranging from 1-1.7 hr. in the summer to 10-18 hr in winter or a typical loss of 67-86% per day. Xylenes are resistant to hydrolysis. **Soil Absorption/Mobility:** Xylenes have low to moderate adsorption to soil and when spilled on land, will volatilize and leach into groundwater. **Disposal:** As a hydrocarbon, xylene is a good candidate for controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Not listed as an 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-A)

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U239, F003 (spent solvent)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4); per RCRA, Sec. 3001]

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 respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations >1000 ppm, use any chemical cartridge respirator with organic vapor cartridges; any powered, air-purifying respirator with organic vapor cartridges; any supplied-air respirator; or any self-contained breathing apparatus. 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, **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. With breakthrough times > 8 hr, consider polyvinyl alcohol and fluorocarbon rubber (Viton) as materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the 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. Launder contaminated work clothing before wearing. Remove this material from your shoes 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 clearly labelled, tightly closed, containers in a cool, well-ventilated place, away from strong oxidizing materials and heat and ignition sources. During transferring operations, electrically ground and bond metal containers. **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. Use hermetically sealed equipment, transfer xylene in enclosed systems, avoid processes associated with open evaporating surfaces, and provide sources of gas release with enclosures and local exhaust ventilation. Use Class I, Group D electrical equipment. **Administrative Controls:** Establish air and biological monitoring programs and evaluate regularly. Consider preplacement and periodic medical examinations including a complete blood count, a routine urinalysis, and liver function tests. Consider hematologic studies if there is any significant contamination of the solvent with benzene. If feasible, consider the replacement of xylene by less toxic solvents such as petrol (motor fuel) or white spirit. Before carrying out maintenance and repair work, steam and flush all equipment to remove any xylene residues.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Xylenes	Packaging Authorizations	Quantity Limitations	Vessel Stowage Requirements
DOT Hazard Class: 3	a) Exceptions: 173.150	a) Passenger, Aircraft, or Railcar: 5L	a) Vessel Stowage: B
ID No.: UN1307	b) Nonbulk Packaging : 173.202	b) Cargo Aircraft Only: 60L	b) Other: –
DOT Packing Group: II	c) Bulk Packaging: 173.242		
DOT Label: Flammable Liquid			
Special Provisions (172.102): T1			

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 176, 180.
Prepared by: MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:
Sheet No. 313
Perchloroethylene
Issued: 11/78 Revision: E, 9/92

Section 1. Material Identification 39

Perchloroethylene (C_2Cl_4) Description: By chlorination of hydrocarbons and pyrolysis of the carbon tetrachloride that is formed, or by catalytic oxidation of 1,1,2,2-tetrachloroethane. Used in dry cleaning and textile processing, metal degreasing, insulating fluid and cooling gas in electrical transformers, production of adhesives, aerosols, paints, and coatings; as a chemical intermediate, a solvent for various applications, extractant for pharmaceuticals, a pesticide intermediate, and an antihelminthic (parasitic worm removal) agent in veterinary medicine.
Other Designations: CAS No. 127-18-4, Ankilostin, carbon dichloride, Didakene, ethylene tetrachloride, Perchlor, Perclene, Perk, Tetracap, tetrachloroethylene.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

R 1
I 3
S 2*
K 0
* Skin absorption

NFPA
0 / 2 0 / -

HMIS
H 2†
F 0
R 0
PPE‡
† Chronic effects
‡ Sec. 8

Cautions: Perchloroethylene is a central nervous system depressant, causes liver and kidney damage (from acute or chronic exposures), and is considered an IARC Class 2B carcinogen (animal sufficient evidence, human inadequate data).

Section 2. Ingredients and Occupational Exposure Limits

Perchloroethylene, < 99%. Impurities include a small amount of amine or phenolic stabilizers.

1991 OSHA PEL
8-hr TWA: 25 ppm (170 mg/m^3)

1990 IDLH Level
500 ppm

1990 NIOSH REL
NIOSH-X Carcinogen
Limit of Quantitation: 0.4 ppm

1992-93 ACGIH TLVs
TWA: 50 ppm (339 mg/m^3)
STEL: 200 ppm (1357 mg/m^3)

1990 DFG (Germany) MAK
TWA: 50 ppm (345 mg/m^3)
Category II: substances with systemic effects
Half-life: < 2 hr
Peak Exposure Limit: 100 ppm, 30 min average value, 4/shift

1985-86 Toxicity Data*
Man, inhalation, TC_{Lo}: 280 ppm/2 hr caused conjunctival irritation and anesthesia.
Human, lung: 100 mg/L caused unscheduled DNA synthesis.
Rat, oral, LD_{50}: 3005 mg/kg; caused somnolence, tremor, and ataxia.
Rat, inhalation, TC_{Lo}: 200 ppm/6 hr given intermittently over 2 years produced leukemia and testicular tumors.
Rabbit, eye: 162 mg caused mild irritation.
Rabbit, skin: 810 mg/24 hr caused severe irritation.

* See NIOSH, *RTECS* (KX3850000), for additional irritation, mutation, reproductive, tumorigenic, & toxicity data.

Section 3. Physical Data

Boiling Point: 250 °F (121.2 °C)
Freezing Point: -8 °F (-23.35 °C)
Vapor Pressure: 13 mm Hg at 68 °F (20 °C)
Surface Tension: 31.74 dyne/cm at 68 °F (20 °C)
Viscosity: 0.84 cP at 77 °F (25 °C)
Refraction Index: 1.50534 at 68 °F (20 °C)
Molecular Weight: 165.82

Density: 1.6311 at 59 °F (15/4 °C)
Water Solubility: 0.02% at 77 °F (25 °C)
Other Solubilities: Miscible with alcohol, ether, benzene, chloroform, and oils.
Odor Threshold: 47 to 71 ppm (poor warning properties since olfactory fatigue is probable)
Evaporation Rate: 0.15 gal/ft^2/day at 77 °F (25 °C)
Saturated Vapor Density (Air = 0.075 lb/ft^3 or 1.2 kg/m^3): 0.081 lb/ft^3 or 1.296 kg/m^3

Appearance and Odor: Colorless liquid with an ether-like odor.

Section 4. Fire and Explosion Data

Flash Point: Nonflammable	**Autoignition Temperature:** Nonflammable	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2). For large fires, use water spray, fog, or regular foam.
Unusual Fire or Explosion Hazards: Vapors are heavier than air and collect in low-lying areas.
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. 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: Perchloroethylene is stable up to 932 °F (500 °C) in the absence of catalysts, moisture, and oxygen but deteriorates rapidly in warm, moist climates. It is slowly decomposed by light. Amine or phenolic stabilizers are usually added. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Slowly (faster in presence of water) corrodes aluminum, iron, and zinc. It is incompatible with chemically active metals (i.e., barium, beryllium, and lithium (explodes with lithium shavings), strong oxidizers, sodium hydroxide, caustic soda, potash, and nitric acid. Perchloroethylene forms an explosive mixture with dinitrogen tetraoxide and reacts with activated charcoal at 392 °F (200 °C) to yield hexachloroethane and hexachlorobenzene. **Conditions to Avoid:** Contact with moisture and incompatibles.
Hazardous Products of Decomposition: Thermal oxidative decomposition of perchloroethylene can produce carbon dioxide and toxic chlorine, hydrogen chloride, and phosgene gas (also produced by contact with UV light).

Section 6. Health Hazard Data

Carcinogenicity: Perchloroethylene is listed as a carcinogen by The IARC (Group 2B, animal sufficient evidence, human inadequate data),(164) NTP (Class 2, reasonably anticipated as a carcinogen, with limited human evidence and sufficient animal evidence),(169) NIOSH (Class-X, carcinogen defined with no further explanation),(164) and DFG (MAK-B, justifiably suspected of having carcinogenic potential)(164). There is some controversy regarding human carcinogenicity because even though there is an increased number of cancers of the skin, colon, lung, urogenital tract, and lympho-sarcomas; the dry cleaning workers studied were also exposed to other chemicals. **Summary of Risks:** Perchloroethylene is stored in the fatty tissue and slowly metabolized with the loss of chlorine. The half-life of its urinary metabolite (trichloroacetic acid) is 144 hours. Perchloroethylene exerts the majority of its toxicity on the central nervous system causing symptoms ranging from light-headedness and slight 'inebriation' to unconsciousness. Liver damage is possible after severe acute or minor long-term exposure. It has a synergistic effect with toluene.

Continue on next page

Section 6. Health Hazard Data, *continued*

Medical Conditions Aggravated by Long-Term Exposure: Nervous, liver, kidney, or skin disorders. **Target Organs:** Liver, kidney, eyes, upper respiratory tract, skin, and central nervous system. **Primary Entry Routes:** Inhalation and skin and eye contact. **Acute Effects:** Exposure to high levels can cause liver damage which may take several weeks to develop. Vapor exposure can cause slight smarting of the eyes and throat (in high concentrations). In human studies, exposure to 2000 ppm/5 min caused mild CNS depression; 600 ppm/10 min caused numbness around the mouth, dizziness, and incoordination; 100 ppm/7 hr caused mild eye, nose, and throat irritation, flushing of the face and neck, headache, somnolence, and slurred speech. Skin contact may produce dermatitis because of perchloroethylene's defatting action (more common after repeated exposure). Direct eye contact causes tearing and burning but no permanent damage. Ingestion is rare but can cause irritation of the lips, mouth and gastrointestinal tract, irregular heartbeat, nausea & vomiting, diarrhea (possibly blood stained), drowsiness, unconsciousness, and risk of pulmonary edema (fluid in lungs). **Chronic Effects:** Prolonged exposure can cause impaired memory, extremity (hands, feet) weakness, peripheral neuropathies, impaired vision, muscle cramps, liver damage (fatty degeneration, necrosis, yellow jaundice, and dark urine) and kidney damage (oliguric uremia, conjestion and granular swelling).

FIRST AID ***Rescuers must not enter areas with potentially high perchloroethylene levels without a self-contained breathing apparatus.*** **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. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. *Never administer adrenalin!* **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. Be sure victim's head is positioned to avoid aspiration of vomitus into the lungs. **Note to Physicians:** Monitor level of consciousness, EEG (abnormalaties may indicate chronic toxicity), blood enzyme levels (for 2 to 3 wk after exposure), EKG, adequacy of respirations & oxygenation, and liver and kidney function. *BEIs:* C_2Cl_4 in expired air (10 ppm), sample prior to last shift of work week; C_2Cl_4 in blood (1 mg/L), sample prior to last shift of work week; trichloroacetic acid in urine (7 mg/L), sample at end of workweek.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources (although noncombustible, it forms toxic vapors from thermal decomposition). For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal. For large spills, dike far ahead of spill and await reclamation or disposal. Report any release in excess of 1 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** If released to soil, perchloroethylene evaporates and some leaches to groundwater. It may absorb slightly to soils with heavy organic matter. Biodegradation may be important in anaerobic soils. In water, it is subject to rapid volatilization with an estimated half-life from <1 day to several weeks. In air, it exists mainly in the vapor-phase and is subject to photooxidation with a half-life of 30 minutes to 2 months. **Ecotoxicity Values:** Guppy (*Poecilia reticulata*), LC_{50} = 18 ppm/7 days; fathead minnow (*Pimephales promelas*), LC_{50} = 18.4 mg/L/96 hr, flow through bioassay. **Disposal:** Consider recovery by distillation. A potential candidate for rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C) or fluidized bed incineration at 842 to 1796 °F (450 to 980 °C). 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. U210
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 100 lb (45.4 kg) [* per CWA Sec. 307 (a)]
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: 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-A)

Section 8. Special Protection Data

Goggles: Wear a faceshield (8 inch minimum) 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. For any detectable concentration, use a supplied-air respirator or 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 of butyl rubber, Neoprene, or Viton to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (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 after using this material, 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 a cool, dry, well-ventilated area away from sunlight, and incompatibles. Do not store sludge from vapor degreasers in tightly-sealed containers and keep outside until disposal is arranged. **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. Check stabilizer levels frequently and ventilation equipment (air velocity, static pressure, air valve) at least every 3 months. Install an air dryer in ventlines to storage tanks to prevent moisture from rusting and weakening the tank and contaminating or discoloring its contents. Purge all tanks before entering for repairs or cleanup. Build a dike around storage tanks capable of containing all the liquid. Ground tanks to prevent static electricity. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize liver, kidney, and nervous system function, and the skin. Alcoholism may be a predisposing factor.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Tetrachloroethylene
DOT Hazard Class: 6.1
ID No.: UN1897
DOT Packing Group: III
DOT Label: Keep away from food
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: 60 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: 40

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 140, 148, 149, 153, 159, 163, 164, 167, 168, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:
Sheet No. 317
Toluene
Issued: 8/79 Revision: E, 9/92 Errata: 2/94

Section 1. Material Identification

Toluene ($C_6H_5CH_3$) Description: Derived from petroleum i.e., dehydrogenation of cycloparaffin fractions followed by the aromatization of saturated aromatic hydrocarbons or by fractional distillation of coal-tar light oil and purified by rectification. Used widely as a solvent (replacing benzene in many cases) for oils, resins, adhesives, natural rubber, coal tar, asphalt, pitch, acetyl celluloses, cellulose paints and varnishes; a diluent for photogravure inks, raw material for organic synthesis (benzoyl & benzilidene chlorides, saccharine, TNT, toluene diisocyanate, and many dyestuffs), in aviation and high octane automobile gasoline, as a nonclinical thermometer liquid and suspension solution for navigational instruments.

R 1
I 3
S 2*
K 3
* Skin absorption

NFPA

HMIS
H 2- Chronic effects
F 3
R 0
PPE-Sec. 8

Other Designations: CAS No. 108-88-3, Methacide, methylbenzene, methylbenzol, phenylmethane, toluol, Tolu-sol.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Toluene is an eye, skin, and respiratory tract irritant becoming narcotic at high centrations. Liver and kidney damage has occurred. Pregnant women chronically exposed to toluene have shown teratogenic effects. Toluene is highly flammable.

Section 2. Ingredients and Occupational Exposure Limits

Toluene, < 100%; may contain a small amount of benzene (~ 1%), xylene, and nonaromatic hydrocarbons.

1991 OSHA PELs
8-hr TWA: 100 ppm (375 mg/m^3)
15-min STEL: 150 ppm (560 mg/m^3)

1990 IDLH Level
2000 ppm

1990 NIOSH RELs
TWA: 100 ppm (375 mg/m^3)
STEL: 150 ppm (560 mg/m^3)

1992-93 ACGIH TLV (Skin)
TWA: 50 ppm (188 mg/m^3)

1990 DFG (Germany) MAK*
TWA: 100 ppm (380 mg/m^3)
Half-life: 2 hr to end of shift
Category II: Substances with systemic effects
Peak Exposure Limit: 500 ppm, 30 min average value, 2/shift

1985-86 Toxicity Data†
Man, inhalation, TC_{Lo}: 100 ppm caused hallucinations, and changes in motor activity and changes in psychophysiological tests.
Human, oral, LD_{Lo}: 50 mg/kg; toxic effects not yet reviewed
Human, eye: 300 ppm caused irritation.
Rat, oral, LD_{50}: 5000 mg/kg
Rat, liver: 30 µmol/L caused DNA damage.

* Available information suggests damage to the developing fetus is probable.
†See NIOSH, *RTECS* (XS5250000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 232 °F (110.6 °C)
Melting Point: -139 °F (-95 °C)
Molecular Weight: 92.15
Density: 0.866 at 68 °F (20/4 °C)
Surface Tension: 29 dyne/cm at 68 °F (20 °C)
Viscosity: 0.59 cP at 68 °F (20 °C)
Refraction Index: 1.4967 at 20 °C/D

Water Solubility: Very slightly soluble, 0.6 mg/L at 68 °F (20 °C)
Other Solubilities: Soluble in acetone, alcohol, ether, benzene, chloroform, glacial acetic acid, petroleum ether, and carbon disulfide.
Vapor Pressure: 22 mm Hg at 68 °F (20 °C); 36.7 mm Hg at 86 °F (30 °C)
Saturated Vapor Density (Air = 0.075 lb/ft^3 or 1.2 kg/m^3): 0.0797 lb/ft^3 or 1.2755 kg/m^3
Odor Threshold (range of all referenced values): 0.021 to 69 ppm

Appearance and Odor: Colorless liquid with a sickly sweet odor.

Section 4. Fire and Explosion Data

Flash Point: 40 °F (4.4 °C) CC	**Autoignition Temperature:** 896 °F (480 °C)	**LEL:** 1.27% v/v	**UEL:** 7.0% v/v

Extinguishing Media: Toluene is a Class 1B flammable liquid. To fight fire, use dry chemical carbon dioxide, or 'alcohol-resistant' foam. Water spray may be ineffective as toluene floats on water and may actually spread fire. **Unusual Fire or Explosion Hazards:** Concentrated vapors are heavier than air and may travel to an ignition source and flash back. Container may explode in heat of fire. Toluenes' burning rate = 5.7 mm/min and its flame speed = 37 cm/sec. Vapor poses an explosion hazard indoors, outdoors, and in sewers. May accumulate static electricity. **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 firefighter's protective clothing provides only limited protection. Apply cooling water to sides of tanks 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 from fire and let burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire because a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Toluene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization can't occur. **Chemical Incompatibilities:** Strong oxidizers, concentrated nitric acid, nitric acid + sulfuric acid, dinitrogen tetroxide, silver perchlorate, bromine trifluoride, tetranitromethane, and 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione. **Conditions to Avoid:** Contact with heat, ignition sources, or incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of toluene can produce carbon dioxide, and acrid, irritating smoke.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list toluene as a carcinogen. **Summary of Risks:** Toluene is irritating to the eyes, nose, and respiratory tract. Inhalation of high concentrations produces a narcotic effect sometimes leading to coma as well as liver and kidney damage. 93% of inhaled toluene is retained in the body of which 80% is metabolized to benzoic acid, then to hippuric acid and excreted in urine. The remainder is metabolized to *o*-cresol and excreted or exhaled unchanged. Toluene metabolism is inhibited by alcohol ingestion and is synergistic with benzene, asphalt fumes, or chlorinated hydrocarbons (i.e. perchloroethylene). Toluene is readily absorbed through the skin at 14 to 23 mg/cm^2/hr. Toluene is absorbed quicker during exercise than at rest and appears to be retained longer in obese versus thin victims; presumably due to its lipid solubility. There is inconsistent data on toluene's ability to damage bone marrow; chronic poisoning has resulted in anemia and leucopenia with biopsy showing bone marrow hypo-plasia. These reports are few and some authorities argue that the effects may have been due to benzene contaminants. Chronic inhalation during pregnancy has been associated with teratogenic effects on the fetus including microcephaly, CNS dysfunction, attentional deficits, developmental delay + language impairment, growth retardation, and physical defects including a small midface, short palpebral fissures, with deep-set eyes, low-set ears, flat nasal bridge with a small nose, micrognathia, and blunt fingertips. There is some evidence that toluene causes an autoimmune illness in which the body produces antibodies that cause inflammation of its own kidney.

Continue on next page

Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Alcoholism and CNS, kidney, skin, or liver disease. **Target Organs:** CNS, liver, kidney, skin. **Primary Entry Routes:** Inhalation, skin contact/absorption. **Acute Effects:** Vapor inhalation causes respiratory tract irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, watering eyes, nervousness, insomnia, parasthesis, and vertigo progressing to narcotic coma. Death may result from cardiac arrest due to ventricular fibrillation with catecholamines loss. Liquid splashed in the eye causes conjunctival irritation, transient corneal damage and possible burns. Prolonged skin contact leads to drying and fissured dermatitis. Ingestion causes GI tract irritation and symptoms associated with inhalation. **Chronic Effects:** Symptoms include mucous membrane irritation, headache, vertigo, nausea, appetite loss and alcohol intolerance. Repeated heavy exposure may result in encephalopathies (cerebellar ataxia and cognitive dysfunction), liver enlargement, and kidney dystrophy (wasting away). Symptoms usually appear at workdays end, worsen at weeks end and decrease or disappear over the weekend. **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 an ophthalmologist 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 to dilute. *Do not* induce vomiting because of danger of aspiration into the lungs. Gastric lavage may be indicated if large amounts are swallowed; potential toxicity needs to be weighed against aspiration risk when deciding for or against gastric lavage. **Note to Physicians:** Monitor cardiac function. If indicated, use epinephrine and other catecholamines carefully, because of the possibility of a lowered myocardial threshold to the arrhythmogenic effects of such substances. Obtain CBC, electrolytes, and urinalysis. Monitor arterial blood gases. If toluene has > 0.02% (200 ppm) benzene, evaluate for potential benzene toxicity. BEI: hippuric acid in urine, sample at shift end (2.5 g/g creatinine); Toluene in venous blood, sample at shift end (1.0 mg/L).

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel protect against inhalation and skin/eye contact. Use water spray to cool and disperse vapors but it may not prevent ignition in closed spaces. Cellosolve, hycar absorbent materials, and fluorocarbon water can also be used for vapor suppression/containment. Take up small spill with earth, sand, vermiculite, or other absorbent, noncombustible material. Dike far ahead of large spills for later reclamation or disposal. For water spills, (10 ppm or greater) apply activated carbon at 10X the spilled amount and remove trapped material with suction hoses or use mechanical dredges/lifts to remove immobilized masses of pollutants and precipitates. Toluene can undergo fluidized bed incineration at 842 to 1796 °F (450 to 980 °C), rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C), or liquid injection incineration at 1202 to 2912 °F (650 to 1600 °C). Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Blue gill, LC_{50} = 17 mg/L/24 hr; shrimp (*Crangonfracis coron*), LC_{50} = 4.3 ppm/96 hr; fathead minnow (*Pimephales promelas*), LC_{50} = 36.2 mg/L/96 hr. **Environmental Degradation:** If released to land, toluene evaporates and undergoes microbial degradation. In water, toluene volatilizes and biodegrades with a half-life of days to several weeks. In air, toluene degrades by reaction with photochemically produced hydroxyl radicals. **Disposal:** Treat contaminated water by gravity separation of solids, followed by skimming of surface. Pass through dual media filtration and carbon absorption units (carbon ratio 1 kg to 10 kg soluble material). Return waste water from backwash to gravity separator. 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. U220
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg)
* per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307 (a)]
Listed as a 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 with shatter-resistant glass and side-shields 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 respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use any chemical cartridge respirator with appropriate organic vapor cartridges, any supplied-air respirator (SAR), or SCBA. For < 2000 ppm, use any SAR operated in continuous-flow mode, any SAR or SCBA with a full facepiece, or any air-purifying respirator with a full facepiece having a chin-style, front or back mounted organic vapor canister. 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 to prevent skin contact. Polyvinyl alcohol with a breakthrough time of > 8 hr, Teflon and Viton are recommended as suitable materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the 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 toluene from your shoes 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: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from ignition sources and incompatibles. Outside or detached storage is preferred. If stored inside, use a standard flammable liquids warehouse, room, or cabinet. To prevent static sparks, electrically ground and bond all equipment used with toluene. Do not use open lights in toluene areas. Install Class 1, Group D electrical equipment. Check that toluene is free of or contains < 1% benzene before use. **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. **Administrative Controls:** Adopt controls for confined spaces (29 CFR 1910.146) if entering areas of unknown toluene levels (holes, wells, storage tanks). Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, liver, kidney, and skin. Include hemocytometric and thrombocyte count in cases where benzene is a contaminant of toluene. Monitor air at regular intervals to ensure effective ventilation.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Toluene
DOT Hazard Class: 3
ID No.: UN1294
PG Packing Group: II
DOT Label: Flammable Liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 150
b) Non-bulk Packaging: 202
c) Bulk Packaging: 242

Quantity Limitations
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements
Vessel Stowage: B
Other: --

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 140, 148, 153, 159, 163, 164, 167, 169, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, CIH, MPH; **Medical Review:** AC Darlington, MD, MPH

Marathon Oil Company

No. 1

MATERIAL SAFETY DATA SHEET PAGE 1 OF 2

PRODUCT NAME: PREMIUM UNLEADED GASOLINE
MARATHON MSDS NO: 114MAR001

THE FOLLOWING INFORMATION IS FURNISHED SUBJECT TO THE DISCLAIMER ON THE BOTTOM OF THIS FORM.

SECTION 1 - PRODUCT IDENTIFICATION

PRODUCT NAME: PREMIUM UNLEADED GASOLINE

SYNONYMS:
GASOLINE, PREMIUM UNLEADED; PREMIUM UNLEADED GASOLINE; SUPER UNLEADED GASOLINE; SUPER-M LEAD FREE GASOLINE

MANUFACTURER / DISTRIBUTOR:
MARATHON OIL COMPANY
539 SOUTH MAIN STREET
FINDLAY, OH
45840

EMERGENCY PHONE NUMBERS:
(419) 422-2121 (MARATHON)
(800) 424-9300 (CHEMTREC)

CHEMICAL FAMILY: PETROLEUM HYDROCARBON
CHEMICAL FORMULA: MIXTURE

CAS NO: MIXTURE
PRODUCT CODE:

SECTION 2 - PHYSICAL PROPERTIES

BOILING POINT	MELTING POINT	SPECIFIC GRAVITY(H2O=1)
90-437 F	N.A. F	0.71-0.77
% SOLUBILITY IN WATER	VAPOR DENSITY(AIR=1)	VAPOR PRESSURE
NEGLIGIBLE	3-4	414-776 MM HG @ 100F

PH INFORMATION: PH: N.A. AT CONC.
APPEARANCE: RED OR CLEAR LIQUID ODOR: GASOLINE ODOR

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT	AUTOIGNITION TEMP	EXPLOSIVE LIMITS (% BY VOLUME IN AIR)
-50 F	C.A. 495 F	LOWER/UPPER: 1.4/ 7.6

NFPA CLASSIFICATION: HEALTH: 2 FIRE: 4 REACTIVITY: 1 OTHER:

EXTINGUISHING MEDIA:

CLASS B FIRE EXTINGUISHING MEDIA SUCH AS HALON, CO2, OR DRY CHEMICAL CAN BE USED. FIRE FIGHTING SHOULD BE ATTEMPTED ONLY BY THOSE WHO ARE ADEQUATELY TRAINED.

SPECIAL FIRE FIGHTING INSTRUCTIONS:

FLASHBACK MAY OCCUR ALONG VAPOR TRAIL. AVOID USE OF SOLID WATER STREAMS. WATER MAY BE INEFFECTIVE IN EXTINGUISHING LOW FLASH POINT FIRES, BUT CAN BE USED TO COOL EXPOSED SURFACES. AVOID EXCESSIVE WATER SPRAY APPLICATION.

PRODUCT NAME: PREMIUM UNLEADED GASOLINE
MARATHON MSDS NO: 114MAR001

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA (CON'T)

STABILITY: THE MATERIAL IS STABLE AT 70 F, 760MM PRESSURE
CONDITIONS TO AVOID:

HAZARDOUS DECOMPOSITION PRODUCTS:
CARBON MONOXIDE, ALDEHYDES, AROMATIC HYDROCARBONS

INCOMPATIBLE MATERIALS:
STRONG OXIDIZERS

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

SECTION 4 - PRODUCT COMPOSITION AND EXPOSURE LIMITS

EXPOSURE LIMITS FOR PRODUCT:	TLV			SOURCE
PREMIUM UNLEADED GASOLINE	300.00	PPM	(8 HR TWA)	ACGIH
	500.00	PPM	(STEL)	ACGIH
	300.00	PPM	(8 HR TWA)	OSHA
	500.00	PPM	(STEL)	OSHA

COMPONENTS:	PERCENT RANGE	TLV			SOURCE
SATURATED HYDROCARBONS (PARAFFINS & CYCLOPARAFFINS)	55.00- 70.00	0.00		( )	
UNSATURATED HYDROCARBONS (OLEFINS)	1.00- 10.00	0.00		( )	
AROMATIC HYDROCARBONS (INCLUDING BENZENE, TOLUENE, XYLENES, ETHYLBENZENE AND TRIMETHYL BENZENES)	20.00- 40.00	0.00		( )	
ETHYL BENZENE	1.00- 3.00	100.00	PPM	(8 HR TWA)	ACGIH
		125.00	PPM	(STEL)	ACGIH
		100.00	PPM	(8 HR TWA)	OSHA
		125.00	PPM	(STEL)	OSHA
1,2,4-TRIMETHYLBENZENE	2.00- 5.00	25.00	PPM	(8 HR TWA)	ACGIH
		25.00	PPM	(8 HR TWA)	OSHA
TOLUENE	3.00- 15.00	100.00	PPM	(8 HR TWA)	ACGIH
		150.00	PPM	(STEL)	ACGIH
		100.00	PPM	(8 HR TWA)	OSHA
		150.00	PPM	(STEL)	OSHA
XYLENE	5.00- 15.00	100.00	PPM	(8 HR TWA)	ACGIH
		150.00	PPM	(STEL)	ACGIH
		100.00	PPM	(8 HR TWA)	OSHA
		150.00	PPM	(STEL)	OSHA

PRODUCT NAME: PREMIUM UNLEADED GASOLINE
MARATHON MSDS NO: 114MAR001

SECTION 4 - PRODUCT COMPOSITION AND EXPOSURE LIMITS (CON'T)

COMPONENTS:	PERCENT RANGE	TLV			SOURCE
METHYL TERTIARY BUTYL ETHER	.01- 15.00	8.00		( )	
BENZENE	.50- 3.50	10.00	PPM	(8 HR TWA)	ACGIH
		1.00	PPM	(8 HR TWA)	OSHA
		5.00	PPM	(STEL)	OSHA

OSHA ACTION LEVEL 0.50 PPM (8 HR TWA)

***
COMPLEX MIXTURE OF PARAFFINIC, CYCLOPARAFFINIC, OLEFINIC AND AROMATIC HYDROCARBONS (PREDOMINANTLY C4-C12).
***
CONTAINS SMALL AMOUNTS OF DYE AND OTHER ADDITIVES (<0.02%) WHICH ARE NOT CONSIDERED HAZARDOUS AT THE CONCENTRATIONS USED.

SECTION 5 - POTENTIAL HEALTH EFFECTS

EYE:

EYE IRRITATION MAY RESULT FROM CONTACT WITH THE LIQUID OR EXPOSURE TO VAPOR CONCENTRATIONS ABOVE THE TLV.

SKIN:

PROLONGED OR REPEATED LIQUID CONTACT CAN DEFAT THE SKIN AND LEAD TO IRRITATION AND/OR DERMATITIS.

INHALATION:

EXPOSURE TO VAPOR CONCENTRATIONS EXCEEDING 1000 PPM CAN CAUSE RESPIRATORY IRRITATION, HEADACHE, DIZZINESS, NAUSEA AND LOSS OF COORDINATION. HIGHER CONCENTRATIONS MAY CAUSE LOSS OF CONSCIOUSNESS, CARDIAC SENSITIZATION, COMA AND DEATH RESULTING FROM RESPIRATORY FAILURE.

INGESTION:

INGESTION MAY RESULT IN NAUSEA, VOMITING, DIARRHEA AND RESTLESSNESS. ASPIRATION (BREATHING) OF VOMITUS INTO THE LUNGS MUST BE AVOIDED AS EVEN SMALL QUANTITIES IN THE LUNGS CAN PRODUCE CHEMICAL PNEUMONITIS AND PULMONARY EDEMA/HEMORRHAGE.

PRODUCT NAME: PREMIUM UNLEADED GASOLINE
MARATHON MSDS NO: 114MAR001

SECTION 5 - POTENTIAL HEALTH EFFECTS (CON'T)

ADDITIONAL TOXICITY INFORMATION:

TWO YEAR INHALATION TOXICITY STUDIES WITH FULLY VAPORIZED GASOLINE (67, 292 & 2056 PPM) PRODUCED KIDNEY DAMAGE AND KIDNEY TUMORS IN MALE RATS BUT NOT IN FEMALE RATS OR MALE AND FEMALE MICE. FEMALE MICE DEVELOPED A SLIGHTLY HIGHER INCIDENCE OF LIVER TUMORS COMPARED TO CONTROLS AT THE HIGHEST EXPOSURE LEVEL. RESULTS FROM SUBSEQUENT SCIENTIFIC STUDIES SUGGEST THAT THE KIDNEY DAMAGE AND PROBABLY THE KIDNEY TUMOR RESPONSE ARE UNIQUE TO THE MALE RAT. THE BIOLOGIC SIGNIFICANCE OF THE MOUSE LIVER TUMOR RESPONSE IN TERMS OF HUMAN HEALTH IS QUESTIONABLE.

REPEATED OR PROLONGED EXPOSURE TO BENZENE EVEN AT RELATIVELY LOW CONCENTRATIONS MAY CAUSE SERIOUS INJURY TO BLOOD-FORMING ORGANS. SIGNIFICANT CHRONIC EXPOSURE TO BENZENE VAPOR HAS BEEN REPORTED TO PRODUCE VARIOUS BLOOD DISORDERS, RANGING FROM ANEMIA TO LEUKEMIA (CANCER) IN MAN. BENZENE PRODUCED TUMORS IN RATS AND MICE IN LIFETIME CHRONIC TOXICITY STUDIES, BUT THE RESPONSE HAS NOT BEEN CONSISTENT ACROSS SPECIES, STRAIN, SEX OR ROUTE OF EXPOSURE. ANIMAL STUDIES ON BENZENE HAVE DEMONSTRATED IMMUNE TOXICITY, TESTICULAR EFFECTS AND ALTERATIONS IN REPRODUCTIVE CYCLES, EVIDENCE OF CHROMOSOMAL DAMAGE OR OTHER CHROMOSOMAL CHANGES, AND EMBRYO/FETOTOXICITY, BUT NOT TERATOGENICITY.

EMERGENCY FIRST AID PROCEDURES

EYE:

FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. IF SYMPTOMS OR IRRITATION OCCUR, CALL A PHYSICIAN.

SKIN:

WASH WITH SOAP AND LARGE AMOUNTS OF WATER. REMOVE CONTAMINATED CLOTHING. IF SYMPTOMS OR IRRITATION OCCUR, CALL A PHYSICIAN.

INHALATION:

MOVE PERSON TO FRESH AIR. IF NOT BREATHING OR IF NO HEARTBEAT, GIVE ARTIFICIAL RESPIRATION OR CARDIOPULMONARY RESUSCITATION (CPR). IMMEDIATELY CALL A PHYSICIAN.

INGESTION:

DO NOT INDUCE VOMITING. DO NOT GIVE LIQUIDS. IMMEDIATELY CALL A PHYSICIAN.

SECTION 6 - SPECIAL PROTECTION INFORMATION

VENTILATION:

LOCAL OR GENERAL EXHAUST REQUIRED IN ENCLOSED AREAS OR WITH INADEQUATE VENTILATION.

PRODUCT NAME: PREMIUM UNLEADED GASOLINE
MARATHON MSDS NO: 114MAR001

SECTION 6 - SPECIAL PROTECTION INFORMATION (CON'T)

RESPIRATORY PROTECTION:

APPROVED ORGANIC VAPOR CHEMICAL CARTRIDGE OR SUPPLIED AIR RESPIRATORS SHOULD BE WORN FOR EXPOSURES EXCEEDING THE TLV OR STEL. OBSERVE RESPIRATOR PROTECTION FACTOR CRITERIA CITED IN ANSI Z88.2 (1980). SELF-CONTAINED BREATHING APPARATUS SHOULD BE USED FOR FIRE FIGHTING.

PROTECTIVE GLOVES:

NEOPRENE, NITRILE, VITON OR PVA GLOVES FOR REPEATED OR PROLONGED SKIN EXPOSURE.

OTHER PROTECTIVE EQUIPMENT:

USE EXPLOSION-PROOF EQUIPMENT.

SECTION 7 - SPILL OR LEAK PROCEDURES

ENVIRONMENTAL EFFECTS:

LIQUID CAN BE TOXIC TO AQUATIC LIFE.

STEPS TO BE TAKEN IN CASE OF SPILL, LEAK OR RELEASE:

KEEP PUBLIC AWAY. SHUT OFF SOURCE OF LEAK IF POSSIBLE TO DO SO WITHOUT HAZARD. ELIMINATE ALL IGNITION SOURCES. ADVISE NATIONAL RESPONSE CENTER (800-424-8802) IF PRODUCT HAS ENTERED A WATER COURSE. ADVISE LOCAL AND STATE EMERGENCY SERVICES AGENCIES, IF APPROPRIATE. CONTAIN LIQUID WITH SAND OR SOIL. RECOVER AND RETURN FREE LIQUID TO SOURCE. USE SUITABLE SORBENTS TO CLEAN UP RESIDUAL LIQUID.

WASTE DISPOSAL METHOD:

DISPOSE OF CLEANUP MATERIALS IN ACCORDANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL REGULATIONS.

SECTION 8 - HANDLING AND STORAGE PRECAUTIONS

PRODUCT SHOULD BE HANDLED AND STORED IN ACCORDANCE WITH INDUSTRY ACCEPTED PRACTICES. IN THE ABSENCE OF SPECIFIC LOCAL CODE REQUIREMENTS, NFPA OR OSHA REQUIREMENTS SHOULD BE FOLLOWED. USE APPROPRIATE GROUNDING AND BONDING PRACTICES. STORE IN PROPERLY CLOSED CONTAINERS THAT ARE APPROPRIATELY LABELED. DO NOT EXPOSE TO HEAT, OPEN FLAME, OXIDIZERS OR OTHER SOURCES OF IGNITION. AVOID SKIN CONTACT. EXERCISE GOOD PERSONAL HYGIENE INCLUDING REMOVAL OF SOILED CLOTHING AND PROMPT WASHING WITH SOAP AND WATER.

PRODUCT NAME: PREMIUM UNLEADED GASOLINE
MARATHON MSDS NO: 114MAR001

SECTION 9 - HAZARD WARNING

DANGER!

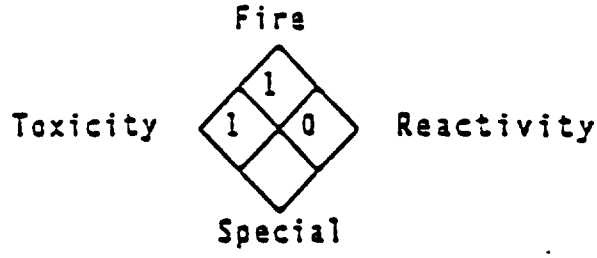
EXTREMELY FLAMMABLE

HARMFUL OR FATAL IF SWALLOWED

CONTAINS BENZENE WHICH MAY CAUSE CANCER OR BE TOXIC TO BLOOD-FORMING ORGANS.

SECTION 10 - COMMENTS.

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) 368-8111
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
Incompatibility (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)

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)

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)

(COMMENTS continued)

Prepared by: Robert Kellam
Title: Group Supervisor, Lubricants Testing, Maintenance, and Safety
Original Date: 05/18/81
Revision Date: 04/01/93
Supersedes : 04-05-90
Date Sent : 10/21/93

Sent to: SCOTT DUNNBAR
OHM
53335 TRIANGLE PARK, SUITE 450
NORCROSS GA 30092

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.

MSDS1011

No. 3

Material Safety Data Sheet
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List): ALCONOX

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name: ALCONOX, INC.	Emergency Telephone Number: (212) 473-1300
Address (Number, Street, City, State, and ZIP Code): 215 PARK AVENUE SOUTH	Telephone Number for Information: (212) 473-1300
NEW YORK, N.Y. 10003	Date Prepared: JULY 1, 1989
	Signature of Preparer (optional):

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
THERE ARE NO INGREDIENTS IN ALCONOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.				

Section III — Physical/Chemical Characteristics

Boiling Point	N.A.	Specific Gravity (H_2O = 1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Melting Point	N.A.
Vapor Density (AIR = 1)	N.A.	Evaporation Rate (Butyl Acetate = 1)	N.A.

Solubility in Water: APPRECIABLE (GREATER THAN 10 PER CENT)

Appearance and Odor: WHITE POWDER INTERSPERSED WITH CREAM COLORED FLAKES - ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used): NONE	Flammable Limits	LEL: N.A.	UEL: N.A.

Extinguishing Media: WATER, CO2, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures: FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS

Unusual Fire and Explosion Hazards: NONE

No. 3

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid NONE
	Stable	XX	

Incompatibility (Materials to Avoid) AVOID STRONG ACIDS

Hazardous Decomposition or Byproducts MAY RELEASE CO, GAS ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? YES Skin? NO Ingestion? YES

Health Hazards (Acute and Chronic) INHALATION OF POWDER MAY PROVE LOCALLY IRRITATING TO MUCOUS MEMBRANES. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.

Carcinogenicity: NTP? NO IARC Monographs? NO OSHA Regulated? NO

Signs and Symptoms of Exposure EXPOSURE MAY IRRITATE MUCOUS MEMBRANES. MAY CAUSE SNEEZING.

Medical Conditions Generally Aggravated by Exposure RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY POWDER

Emergency and First Aid Procedures EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES SKIN-FLUSH WITH PLENTY OF WA... INGESTION-DRINK LARGE QUANTITIES OF WATER, GET MEDICAL ATTENTION FOR DISCOMF...

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled MATERIAL FOAMS PROFUSELY. SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGEN...

Precautions to Be Taken in Handling and Storing STORE IN A DRY AREA TO PREVENT CAKING.

Other Precautions NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

Section VIII — Control Measures

Respiratory Protection (Specify Type) DUST MASK

Ventilation	Local Exhaust NORMAL	Special	N.A.
	Mechanical (General) N.A.	Other	N.A.
Protective Gloves	USEFUL-NOT REQUIRED	Eye Protection	USEFUL-NOT REQUIRED

Other Protective Clothing or Equipment NOT REQUIRED

Work/Hygienic Practices NO SPECIAL PRACTICES REQUIRED

No. 4

MATERIAL SAFETY DATA SHEET

IDENTITY: SIGHT SAVERS brand ANTI-FOG LIQUID

CATALOG #24, 25, 68, 69, 8565, 8570, 143060, 8569, 60103

SECTION 1: MANUFACTURER'S NAME AND ADDRESS

Bausch & Lomb
1400 N. Goodman St.
Rochester, NY 14609

(800) 553-5340 — MEDICAL EMERGENCY 8AM/4PM MON.-FRI. 8AM/5PM Other times: Call Local Poison Center

(800) 553-5340 — ALL OTHER QUESTIONS

Date Prepared: February 26, 1992

SECTION 2: HAZARDOUS INGREDIENTS

Ingredient (CAS#)	%	PEL	UNITS	TLV	UNITS	STEL	UNITS	SKIN
Isopropanol (67-63-0)	12	400	PPM	400	PPM	500	PPM	-
Sodium Lauryl Sulfate (151-21-3)	2	None	-	None	-	None	-	-
Dipropylene Glycol Monomethyl Ether (34590-94-8)	2	100	PPM	100	PPM	150	PPM	X

SECTION 3: PHYSICAL DATA

Boiling Point (C): 100
Vapor Pressure (mm Hg): 30
Vapor Density: (air=1):Not Determined
Solubility: soluble in water
ph: not determined
Specific Gravity: 1.0
Melting Point: N/A
Evaporation Rate: less/1
Percent Volatile by Weight: <16%
Appearance and Odor: Purple liquid, odor of rubbing alcohol

SECTION 4: FIRE AND EXPLOSION HAZARD DATA

Flash Point (F): 105 Open Cup Flammable Limits: not determined

Extinguishing Media: CO2, Foam, Dry Chemical, Water Fog

Fire Fighting Procedures: Use self contained breathing apparatus.

Unusual Fire and Explosion Hazards: None.

SECTION 5: REACTIVITY DATA

Stability: Stable

Incompatibility: Hydrogen & Palladium, Nitroform, Oleum, Potassium-Tert-Butoxide, Aluminum, Aluminum Isopropoxide, Crotonaldehyde, Oxidants, Phosgene

Hazardous Decomposition Products: CO, CO2, SiO2

Hazardous Polymerization: Will not occur

Conditions to avoid: Sources of ignition, heat, open flame

SECTION 6: HEALTH HAZARD DATA

Route(s) of Entry:
Inhalation: Irritation, central nervous system depression
Skin Contact: Defatting, dermatitis possible.
Ingestion: nausea, vomiting, headache, dizziness, coma possible, abdominal pain, vomiting, diarrhea

Health Hazards (Acute and Chronic):
Carcinogenicity: NTP: N/A IARC Monographs: N/A
OSHA Regulated: N/A
Signs and Symptoms of Exposure: N/A

Medical Conditions Generally Aggravated by Exposure: N/A

Emergency and First Aid Procedures:

Inhalation: Move to fresh air, get medical help.
Skin Contact: Wash with soap and water.
Ingestion: Gastric lavage, give fluids, get medical help.
Eye Contact: Flush with water for 15 minutes, get medical help.

SECTION 7: PRECAUTIONS FOR SAFE HANDLING AND USE

Spill Procedure: Remove sources of ignition, absorb with vermiculite.

Waste Disposal: As per local, state and Federal regulation.

Spill Reporting Information (49 CFR 171.8, 40 CFR 117)

Hazardous Substance: None
Reportable Quantity: None
Concentration of Hazardous Substance: N/A
Reportable Quantity of Product: N/A

Precautions to be taken in handling and storing:

Store in a cool, dry, well ventilated place.

SECTION 8: CONTROL MEASURES

Respiratory Protection: NIOSH Approved Respirator if exposure exceeds the permissible exposure limit (PEL)

Ventilation: Sufficient to keep exposure below the PEL, general room air circulation sufficient for normal use of product.

Eye and Face Protection: Safety Glasses and whatever is required by other occupational conditions.

Protective Clothing: None required for normal use of product.

Work/Hygienic Practices: N/A

Approved By: _____

The above information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

cc. MSDS

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

Data Sheet No. 5

HEALTH	2
FLAMMABILITY	0
REACTIVITY	1
PERSONAL	B

Product: REGULAR CLOROX BLEACH

Description: CLEAR, LIGHT YELLOW LIQUID WITH CHLORINE ODOR

Other Designations	Manufacturer	Emergency Telephone No.
EPA Reg. No. 5813-1 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 severe 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 glass/ful 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 (<3 gallons)
1) Absorb, containerize, and landfill in accordance with local regulations. (2) Wash down residual to sanitary sewer.*

Large Spills (>3 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

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 (H2O=1)	1.085
Solubility in Water	complete
pH	11.4

DATE PREPARED 1/92

No. 6

EXXON COMPANY, U.S.A.
A DIVISION OF EXXON CORPORATION

DATE ISSUED: 03/11/92
SUPERSEDES DATE: 12/02/91

MATERIAL SAFETY DATA SHEET

EXXON COMPANY, U.S.A. P.O. BOX 2180 HOUSTON, TX 77252-2180

A. IDENTIFICATION AND EMERGENCY INFORMATION

PRODUCT NAME
EXXON DIESEL 2

PRODUCT CODE
072700 - 00787

PRODUCT CATEGORY
Petroleum Distillate Fuel

PRODUCT APPEARANCE AND ODOR
Clear liquid, yellow color
Faint petroleum hydrocarbon odor

MEDICAL EMERGENCY TELEPHONE NUMBER
(713) 656-3424

B. COMPONENTS AND HAZARD INFORMATION

COMPONENTS	CAS NO. OF COMPONENTS	APPROXIMATE CONCENTRATION
Fuels, diesel, no. 2	68476-34-6	100%

All components of this product are listed on the U.S. TSCA inventory.

See Section E for Health and Hazard Information.

See Section H for additional Environmental Information.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS)

Health	Flammability	Reactivity	BASIS
1	2	0	Recommended by Exxon

EXPOSURE LIMIT FOR TOTAL PRODUCT	BASIS
100 ppm (900 mg/m3) for an 8-hour workday	Recommended by Exxon

C. PRIMARY ROUTES OF ENTRY AND EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT
If splashed into the eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

SKIN
In case of skin contact, remove any contaminated clothing and wash skin with soap and water. Launder or dry-clean clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

INHALATION
Overexposure may cause gasping, nausea and disorientation.

Vapor pressure is very low. Vapor inhalation under ambient conditions is normally not a problem. If overcome by vapor from hot product, remove from exposure and call a physician immediately. If breathing is irregular or has stopped, start resuscitation, administer oxygen, if available.

INGESTION
If ingested, DO NOT induce vomiting; call a physician immediately.

D. FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT (MINIMUM)
COMBUSTIBLE - Per DOT 49 CFR 173.115
60°C (140°F)
ASTM D 93, Pensky Martens Closed Cup

NOTE: Non-marine product may be 52°C (125°F) minimum flash to meet No. 2 Diesel Fuel Oil (ASTM D 975). Seasonal blends may be as low as 38°C (100°F).

AUTOIGNITION TEMPERATURE
Greater than 204°C (400°F)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) - HAZARD IDENTIFICATION

Health	Flammability	Reactivity	BASIS
0	2	0	Recommended by the National Fire Protection Association

HANDLING PRECAUTIONS
This liquid is volatile and gives off invisible vapors. Either the liquid or vapor may settle in low areas or travel some distance along the ground or surface to ignition sources where they may ignite or explode.

Keep product away from ignition sources, such as heat, sparks, pilot lights, static electricity, and open flames.

FLAMMABLE OR EXPLOSIVE LIMITS (APPROXIMATE PERCENT BY VOLUME IN AIR)
Estimated values: Lower Flammable Limit 0.9% Upper Flammable Limit 7%

EXTINGUISHING MEDIA AND FIRE FIGHTING PROCEDURES
Foam, water spray (fog), dry chemical, carbon dioxide and vaporizing liquid type extinguishing agents may all be suitable for extinguishing fires involving this type of product, depending on size or potential size of fire and circumstances related to the situation. Plan fire protection and response strategy through consultation with local fire protection authorities or appropriate specialists.

The following procedures for this type of product are based on the recommendations in the National Fire Protection Association's "Fire Protection Guide on Hazardous Materials", Eighth Edition (1984):

Use dry chemical, foam or carbon dioxide to extinguish the fire. Water may be ineffective, but water should be used to keep fire-exposed containers cool. If a leak or spill has ignited, use water spray to disperse the vapors and to protect men attempting to stop a leak. Water spray may be used to flush spills away from exposures. Minimize breathing of gases, vapor, fumes or decomposition products. Use supplied-air breathing equipment for enclosed or confined spaces or as otherwise needed.

NOTE: The inclusion of the phrase "water may be ineffective" is to indicate that although water can be used to cool and protect exposed material, water may not extinguish the fire unless used under favorable conditions by experienced fire fighters trained in fighting all types of flammable liquid fires.

DECOMPOSITION PRODUCTS UNDER FIRE CONDITIONS
Fumes, smoke, carbon monoxide, aldehydes and other decomposition products, in the case of incomplete combustion.

"EMPTY" CONTAINER WARNING
"Empty" containers retain residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION: THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Do not attempt to clean since residue is difficult to remove. "Empty" drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. For work on tanks refer to Occupational Safety and Health Administration regulations, ANSI Z49.1, and other governmental and industrial references pertaining to cleaning, repairing, welding, or other contemplated

operations.

E HEALTH AND HAZARD INFORMATION

VARIABILITY AMONG INDIVIDUALS
Health studies have shown that many petroleum hydrocarbons and synthetic lubricants pose potential human health risks which may vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

EFFECTS OF OVEREXPOSURE (Signs and symptoms of exposure)
Prolonged or repeated liquid contact with the skin will dry and defat the skin, leading to possible irritation and dermatitis.
High vapor concentrations (greater than approximately 1000 ppm, attainable at temperatures well above ambient) are irritating to the eyes and the respiratory tract, and may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death.

NATURE OF HAZARD AND TOXICITY INFORMATION
Prolonged or repeated skin contact with this product tends to remove skin oils, possibly leading to irritation and dermatitis; however, based on human experience and available toxicological data, this product is judged to be neither a "corrosive" nor an "irritant" by OSHA criteria.

Product contacting the eyes may cause eye irritation.

Lifetime skin painting studies conducted by the American Petroleum Institute, Exxon and others have shown that similar products boiling between 175-370°C (350-700°F) usually produce skin tumors and/or skin cancer in laboratory mice. The degree of carcinogenic response was weak to moderate with a relatively long latent period. The implications of these results for humans have not been determined.

Limited studies on oils that are very active carcinogens have shown that washing the animals' skin with soap and water between applications greatly reduces tumor formation. These studies demonstrate the effectiveness of cleansing the skin after contact.

Potential risks to humans can be minimized by observing good work practices and personal hygiene procedures generally recommended for petroleum products. See Section I for recommended protection and precautions.

Contains light hydrocarbon components. Lifetime studies by the American Petroleum Institute have shown that kidney damage and kidney cancer can occur in male rats after prolonged inhalation exposures at elevated concentrations of total gasoline. Kidneys of mice and female rats were unaffected. The U.S. EPA Risk Assessment Forum has concluded that the male rat kidney tumor results are not relevant for humans. Total gasoline exposure also produced liver tumors in female mice only. The implication of these data for humans has not been determined. Certain components, such as normal hexane, may also affect the nervous system at high concentrations (e.g., 1000-1500 ppm).

Product has a low order of acute oral and dermal toxicity, but minute amounts aspirated into the lungs during ingestion or vomiting may cause mild to severe pulmonary injury and possibly death.

This product is judged to have an acute oral LD50 (rat) greater than 5 g/kg of body weight, and an acute dermal LD50 (rabbit) greater than 3.16 g/kg of body weight.

Inhalation of components of exhaust from burning, such as carbon monoxide, may cause death at high concentrations.
Long-term repeated exposure of laboratory animals to whole diesel exhaust has resulted in an increased incidence of lung cancer.
Exposure to exhaust from burning and diesel exhaust should be minimized.

PRE-EXISTING MEDICAL CONDITIONS WHICH MAY BE AGGRAVATED BY EXPOSURE
Petroleum Solvents/Petroleum Hydrocarbons - Skin contact may aggravate an existing dermatitis.

No. 6

F. PHYSICAL DATA

The following data are approximate or typical values and should not be used for precise design purposes.

BOILING RANGE
160-350°C (320-660°F)

SPECIFIC GRAVITY (15.6 C/15.6 C)
0.86

MOLECULAR WEIGHT
Approximately 212 average

pH
Essentially neutral

POUR, CONGEALING OR MELTING POINT
-18°C (0°F)
Pour Point by ASTM D 97

VISCOSITY
2.7 cSt @ 40°C

VAPOR PRESSURE
Less than 1 mm Hg @ 20°C

VAPOR DENSITY (AIR = 1)
Greater than 5

PERCENT VOLATILE BY VOLUME
100

EVAPORATION RATE @ 1 ATM. AND 25 C (77 F) (n-BUTYL ACETATE = 1)
0.02

SOLUBILITY IN WATER @ 1 ATM. AND 25 C (77 F)
Negligible; less than 0.1%

G. REACTIVITY

This product is stable and will not react violently with water. Hazardous polymerization will not occur. Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, etc., as this presents a serious explosion hazard.

H. ENVIRONMENTAL INFORMATION

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Shut off and eliminate all ignition sources. Keep people away. Recover free product. Add sand, earth or other suitable absorbent to spill area. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Open all windows and doors. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter sewers, watercourses, or extensive land areas.
Assure conformity with applicable governmental regulations. Continue to observe precautions for volatile, combustible vapors from absorbed material.

THE FOLLOWING INFORMATION MAY BE USEFUL IN COMPLYING WITH VARIOUS STATE AND FEDERAL LAWS AND REGULATIONS UNDER VARIOUS ENVIRONMENTAL STATUTES:

REPORTABLE QUANTITY (RQ), EPA REGULATION 40 CFR 302 (CERCLA Section 102)
No RQ for product or any constituent greater than 1% or 0.1% (carcinogen).

THRESHOLD PLANNING QUANTITY (TPQ), EPA REGULATION 40 CFR 355 (SARA Sections 301-304)
No TPQ for product or any constituent greater than 1% or 0.1% (carcinogen).

TOXIC CHEMICAL RELEASE REPORTING, EPA REGULATION 40 CFR 372 (SARA Section 313)
No toxic chemical is present greater than 1% or 0.1% (carcinogen).

HAZARDOUS CHEMICAL REPORTING, EPA REGULATION 40 CFR 370 (SARA Sections 311-312)

	Acute Hazard	Chronic Hazard	Fire Hazard	Pressure Hazard	Reactive Hazard	Not Applicable
EPA HAZARD CLASSIFICATION CODE:		XXX	XXX			

I. PROTECTION AND PRECAUTIONS

VENTILATION
Use only with ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air.

RESPIRATORY PROTECTION
Use supplied-air respiratory protection in confined or enclosed spaces, if needed.

PROTECTIVE GLOVES
Use chemical-resistant gloves, if needed, to avoid prolonged or repeated skin contact.

EYE PROTECTION
Use splash goggles or face shield when eye contact may occur.

OTHER PROTECTIVE EQUIPMENT
Use chemical-resistant apron or other impervious clothing, if needed, to avoid contaminating regular clothing, which could result in prolonged or repeated skin contact.

WORK PRACTICES / ENGINEERING CONTROLS
Keep containers closed when not in use. Do not store near heat, sparks, flame or strong oxidants.

In order to prevent fire or explosion hazards, use appropriate equipment.

Information on electrical equipment appropriate for use with this product may be found in the latest edition of the National Electrical Code (NFPA-70). This document is available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

PERSONAL HYGIENE
Minimize breathing vapor, mist or fumes. Avoid prolonged or repeated contact with skin. Remove contaminated clothing; launder or dry-clean before re-use. Remove contaminated shoes and thoroughly clean before re-use; discard if oil-soaked. Cleanse skin thoroughly after contact, before breaks and meals, and at end of work period. Product is readily removed from skin by waterless hand cleaners followed by washing thoroughly with soap and water.

J. TRANSPORTATION AND OSHA RELATED LABEL INFORMATION

TRANSPORTATION INCIDENT INFORMATION
For further information relative to spills resulting from transportation incidents, refer to latest Department of Transportation Emergency Response Guidebook for Hazardous Materials Incidents, DOT P 5800.3.

DOT IDENTIFICATION NUMBER
Fuel Oil, No. 2 / Combustible Liquid / NA 1993

OSHA REQUIRED LABEL INFORMATION
In compliance with Hazard and Right-to-Know requirements, the following OSHA Hazard Warnings should be found on a label, Bill of Lading or invoice accompanying this shipment.

DANGER!

COMBUSTIBLE

LONG-TERM, REPEATED EXPOSURE MAY
CAUSE SKIN CANCER

Note: Product label will contain additional non-OSHA related information.

The information and recommendations contained herein are, to the best of Exxon's knowledge and

[illegible] is are reliable as of the date issued. Exxon does not warrant or guarantee their [illegible] or [illegible] liability, and Exxon shall not be liable for any loss or damage arising out of [illegible] thereof.

[illegible]nformation and recommendations are offered for the user's consideration and examination. [illegible]t is the user's responsibility to satisfy itself that they are suitable and complete for [illegible] particular use. If buyer repackages this product, legal counsel should be consulted to [illegible] proper health, safety and other necessary information is included on the container.

Environmental Information included under Section H hereof as well as the Hazardous Materials [illegible]ntification System (HMIS) and National Fire Protection Association (NFPA) ratings have been [illegible] by Exxon Company, U.S.A. in order to provide additional health and hazard classification [illegible]ormation. The ratings recommended are based upon the criteria supplied by the developers of [illegible] rating systems, together with Exxon's interpretation of the available data.

[illegible] ADDITIONAL INFORMATION ON HEALTH [illegible]FFECTS CONTACT:
DIRECTOR OF INDUSTRIAL HYGIENE
EXXON COMPANY, U.S.A.
KELLOGG TOWER, ROOM 330
P. O. BOX 2180
HOUSTON, TX 77252-2180
(713) [illegible]-2[illegible]

FOR OTHER PRODUCT INFORMATION CONTACT:

MANAGER, MARKETING TECHNICAL SERVICES
EXXON COMPANY, U.S.A.
ROOM 2355
P. O. BOX 2180
HOUSTON, TX 77252-2180
([illegible]3) [illegible]56-5949

17-325; 17-325-2; 17-325- No. 7

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, WORMALD 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		
Hazardous Polymerization:	May Occur ☐ Will Not Occur ☒	Conditions to Avoid:	N/A

No.7

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

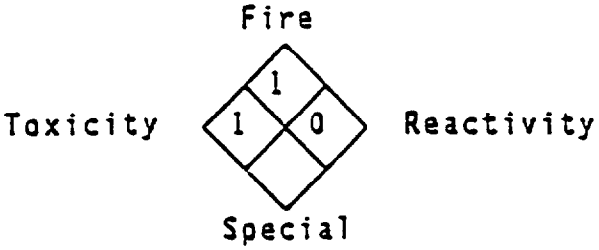
N/A = Not Applicable NDA = No Data Available

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

AMALIE MULTI-PURPOSE LS GEAR LUBRICANT

Product Code: 473 6752

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



DIVISION AND LOCATION---SECTION I

Division: AMALIE REFINING COMPANY
Location: BRADFORD, PENNSYLVANIA
ONE AMALIE WAY,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
Incompatibility (Keep away from):
strong oxidizers such as hydrogen peroxide, bromine, and chromic acid.
Toxic and Hazardous Ingredients:
none
Form: liquid Odor: pungent,sulfur type
Appearance: viscous liquid Color: green to brown
Specific Gravity (water=1): .89
Boiling Point: greater than 330°C (625°F)
Melting Point: -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: Less than 100

(Continued on next page)

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 (375°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: Call a physician immediately. DO NOT induce vomiting. (Vomiting may cause aspiration into lungs resulting in chemical pneumonia.)

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)

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

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.

Prepared by: Robert Kellam
Title: Group Supervisor, Lubricants Testing, Maintenance, and Safety
Original Date: 05/20/81
Revision Date: 04-12-90
Supersedes : 07-19-89
Date Sent : 10/30/92

Sent to: DAVID DABOIEN
OHM CORP
2910 WEST BEAVER ST
JACKSONVILLE FL 32205

(Continued on next page)

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.

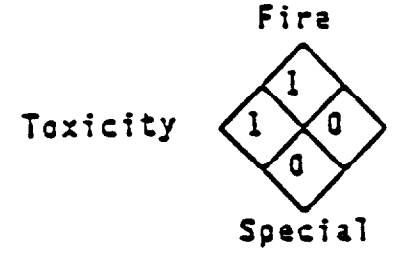
FE
No. 9

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: CHEM TREC 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)

(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:

Robert Kellam

Prepared by: L.D.DROMGOLD
Title: MANAGER,NEW PRODUCTS
Original Date: 06/18/82
Revision Date: 11/13/85
Supersedes : 05/11/84
Date Sent : 07/28/89

Sent to: CHRIS MCKEEMAN
OHM CORPORATION
16406 US ROUTE 224E
FINDLAY OH 45840

GO-JO® HAND CLEANER with Fine Italian PUMICE

HEALTH HAZARD DATA:

Routes of Entry:

___ Inhalation ___ Skin X Eye X Ingestion

Carcinogenicity:

X None Known ___ NTP ___ IARC ___ OSHA Regulated

Signs and Symptoms of Exposure:

EYE CONTACT - Irritation. SKIN CONTACT - Prolonged contact may result in contact dermatitis which is characterized by dryness, cracking, and reddening. INGESTION - Ingestion of small quantities is usually nonfatal unless aspiration occurs. Aspiration may lead to chemical pneumonitis which is characterized by pulmonary edema, and hemorrhage and may be fatal.

Medical Conditions Generally Aggravated by Exposure:

None Known

Emergency and First Aid Procedures:

EYE CONTACT - DO NOT RUB EYES. Flush with water for 15 minutes, if irritation persists, contact physician.
INGESTION - DO NOT INDUCE VOMITING. Contains mineral Oil. Contact Physician or Poison Control Center immediately.

PRECAUTIONS FOR SAFE HANDLING AND USE:

Steps to be Taken in Case Material is Released or Spilled:

Absorb and collect for disposal. Flush area with water to reduce possible slippery floor hazard.

Waste Disposal Method:

According to all local, state, and federal regulations.

Precautions to be Taken in Handling and Storage:

Avoid eye contact and store at ambient conditions.

Other Precautions:

KEEP OUT OF REACH OF CHILDREN!

CONTROL MEASURES:

Respiratory & Ventilation / Gloves & Eye Protection:

None Required if used as directed.

Other Protective Clothing or Equipment:

None Required if used as directed.

Work/Hygienic Practices:

Routine

PREPARED BY: Ronald A. Williams,
Administrative Scientist

DATE: 9/23/91

SUPERSEDES: 8/30/90

NOTICE: The information herein is based on data considered to be accurate as of the date of preparation of this Material Safety Data Sheet. However, no warranty or representation, expressed or implied, is made as to the accuracy or completeness of the foregoing data and safety information. The user assumes all liability for any damage or injury resulting from abnormal use, from any failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

= Not Applicable NO = No Data NE = Not Established

This form complies with OSHA Form 174.

(51-1.36)

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

Material Safety Data Sheets Collection:

Sheet No. 68
Calcium Hypochlorite

Issued: 7/80 Revision: A, 11/89

Section 1. Material Identification

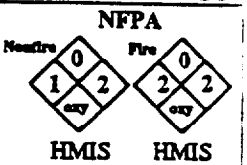
30

Calcium Hypochlorite Description: Calcium hypochlorite dihydrate precipitates from chlorinated lime slurry and caustic soda and is dried under vacuum to produce calcium hypochlorite. Used as a disinfectant (for swimming pools), bleaching agent (paper towels), fungicide, deodorant, oxidizing agent, bactericide, and algicide; in sugar refining and potable water purification.

Other Designations: Calcium oxychloride (improperly called); losantin; hypochlorous acid; calcium salt; HTH® (high-test hypochlorite); lime chloride; $Ca(OCl)_2$; CAS No. 7778-54-3.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide* (Genium ref. 73) for a suppliers list.

R	1
I	-
S	3
K	-



HMIS	HMIS
H 1	H 2
F 0	F 0
R 2	R 2
PPG*	PPG*

* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Calcium hypochlorite*

OSHA PEL	ACGIH TLV, 1988-89	NIOSH REL, 1987	Toxicity Data
None established	None established	None established	Rat, oral, LD_{50}: 850 mg/kg

* Concentration is usually stated in terms of weight % of available chlorine (see *ASTM* D2022). This material contains 39% or less available chlorine. Calcium hypochlorite mixture, dry, contains more than 39% available chlorine. HTH® contains about 70% available chlorine. Solid materials with less than 39% available chlorine include chloride of lime and bleaching powder, which contain much chloride ion, water, and possibly other impurities, for example, $Ca(OCl)Cl \cdot 2H_2O$. The presence of magnesium hypochlorite in material of high available chlorine level may reduce its stability.

Section 3. Physical Data

Boiling Point: None reported
Melting Point: Decomposes at 212 °F (100 °C)
Molecular Weight: 142.98 g/mol
Specific Gravity (H_2O = 1 at 39 °F (4 °C)): 2.35
Water Solubility: Soluble

Appearance and Odor: White nonhygroscopic (doesn't absorb moisture from the air) granules or tablets with a strong chlorine odor.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use a water spray to cool fire-exposed containers of this material and *drench* the area with large amounts of water from a safe position. *Never use* a dry chemical or CO_2.

Unusual Fire or Explosion Hazards: When heated in a fire situation, containers can rupture violently! Contaminating or mixing calcium hypochlorite with foreign materials (combustibles, grease, chemicals, fuels) can cause fires of great intensity. Its solid form is moderately explosive when heated.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Full protective clothing is also necessary. Fight massive fires using unmanned hose holders. If this is impossible, let fire burn and withdraw from hazardous areas.

Section 5. Reactivity Data

Stability/Polymerization: Calcium hypochlorite is stable at room temperature in suitable closed containers when kept dry and free from contamination. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Calcium hypochlorite is a powerful oxidizing agent that readily ignites combustibles. Violent reactions or explosions can occur, for example, with amines, carbon tetrachloride and heat, carbon or charcoal and heat, ethyl alcohol, metal oxides, mercaptons, sulfur, turpentine, strong reducing agents, organic matter, combustible materials, nitromethane, ammonium chloride, N,N-dichloromethylamine and heat, acetic acid and potassium cyanide, ethanol, isobutanethiol, methanol, 1-pro-panethiol, and rust. Reacts with water or steam to produce toxic and corrosive fumes or HCl and Cl^- (Sec. 6). Potentially explosive with sodium carbonate, starch, and sodium hydrogen sulfate. Reaction with nitrogenous bases or acetylene forms explosive products. Ignites on contact with glycerine algacide and hydroxy compounds (e.g., glycerol, diethylene glycol monomethyl ether, and phenol), and organic sulfur compounds. Material containing over 60% available chlorine ignites on contact with lubricating oil (addition of about 20% or more water prevents this). On contact with acids it forms hypochlorous acid and liberates Cl_2 gas. It forms the highly explosive NCl_3 with urea.

Hazardous Products of Decomposition: Rapid exothermic (heat-producing) decomposition above 347 °F(175 °C) releases oxygen and chlorine. When heated to decomposition, calcium hypochlorite emits highly toxic hydrochloric acid (HCl) fumes and explodes.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists calcium hypochlorite as a carcinogen.
Summary of Risks: This strong oxidizing agent can irritate and damage all the tissue it contacts, with the degree of injury depending on the dose, available chlorine level, and exposure time. The chlorine this compound generates is the primary toxic agent. Both the powder and solutions produce chlorine levels corrosive to body tissues. Inhaling its vapor is extremely irritating and toxic. Possible injuries include: conjunctivitis, blepharitis (inflammation of the margins of the eyelids), corneal ulcerations, gingivitis, contact dermatitis, and tooth damage. **Medical Conditions Aggravated by Long-Term Exposure:** Repeated contact can severely damage tissue. **Target Organs:** Skin, eyes, respiratory system, stomach. **Primary Entry:** Inhalation, ingestion. **Acute Effects:** Skin contact can produce irritation and vesicular eruptions. Dust inhalation irritates the respiratory tract and may cause pulmonary edema. Ingestion irritates the mouth, throat, and stomach, and gastric acid liberates hypochlorous acid. Fatalities can result from severe complications of local injury, shock, toxemia, hemorrage, wall perforation, and obstruction. **Chronic Effects:** Eczematoid dermatitis may result from repeated skin contact. Eye contact can cause severe eye damage.
FIRST AID
Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min. **Skin:** After rinsing affected area with flooding amounts of water, wash it 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, promptly rinse mouth of conscious person with water before giving large amounts of milk or water to drink, followed by milk of magnesia.
After first aid, get appropriate in-plant, paramedic, or community medical attention and support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of spills. Remove combustibles and ignition sources. Those involved in cleanup need protection against contact with the solid and dust inhalation. Prevent dust generation and prevent direct discharge into sewers or waterways since this material, in low concentrations, is toxic to aquatic life. Recover uncontaminated solid material in clean, dry containers. Cover other spilled material with weak reducing agents (3M H_2SO_4 with bisulfites or ferrous salts), slurry it with water, and then flush it with water to a suitable holding tank. Wash spill site well with soap solution containing a weak reducing agent.
Disposal: Use reducing agents to destroy available chlorine. Adjust this reduced liquid's pH to neutral and decant. Discharge neutral liquid, diluting with much water. Dispose of neutral sludge (if any) in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 10 lb (4.54 kg) [* per Clean Water Act, Sec. 311(b)(4)]
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).
Respirator: Wear a NIOSH-approved respirator if necessary. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. Use a dust respirator as required for dusty conditions.
Warning: Air-purifying respirators do *not* protect workers in oxygen-deficient atmospheres.
Other: Wear impervious neoprene gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103).
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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.
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 away from combustible and incompatible materials (Sec. 5) in closed containers in a cool, dry, well-ventilated low fire-risk area. Since traces of water may ignite or detonate this material, prevent contamination and protect containers from physical damage. Do not drop, roll, or skid containers.
Engineering Controls: Calcium hypochlorite, a powerful oxidizing agent, is a dangerous fire hazard when it contacts organic materials. Mix it only with water. These water solutions are unstable, but undergo a slow decomposition. Proper storage and shipping are essential; separate this material from ammonium compounds and heat sources.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Calcium hypochlorite mixture, dry (containing more than 39% available chlorine)
DOT Hazard Class: Oxidizer
ID No.: UN1748
DOT Label: Oxidizer
DOT Packaging Requirements: 49 CFR 173.217
DOT Packaging Exceptions: 49 CFR 173.153

IMO Shipping Name: Calcium hypochlorite mixtures, dry, with more than 39%, available chlorine (8.8% available oxygen)
IMO Hazard Class: 5.1
IMO Label: Oxidizer
IMDG Packaging Group: 2

MSDS Collection References: 1, 81, 84, 85, 90, 91, 101, 109, 126
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: Warren Silverman, MD M7

MATERIAL SAFETY DATA SHEET NO. C024 ISSUE DATE: 11/2/90

No. 11

MATERIAL NAME: DOVE LIGHT DUTY LIQUID DISHWASHING DETERGENT
SUPPLIER: LEVER BROTHERS COMPANY 390 PARK AVENUE NY, NY 10022
EMERGENCY PHONE: 212 688-6000
SYNONYMS: N.A.
COMPONENTS: Confidential
EPA/TSCA STATUS: N.A. CAS NO.: N.A.
DOT HAZARD CLASS: N.A.
DOT SHIPPING NAME: N.A.

NFPA CODE	EXPOSURE LIMITS
HEALTH: 2	
FLAMM: 0	OSHA PEL: N.A. ACGIH TWA: N.A.
REACT: 0	LEVER TLV: N.A. ACGIH STEL: N.A.

HAZARDOUS COMPONENTS	CAS NUMBER	%	OSHA PEL	ACGIH: TWA	STEL
None					

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR: Liquid
pH: 6.2-6.6
BOILING POINT: N.D.
SPECIFIC GRAVITY: 1.035-1.055
MELTING POINT: N.A.
SOLUBILITY: Soluble in Water
FREEZING POINT: N.D.
VAPOR PRESSURE: N.D.
VAPOR DENSITY: N.D.
SPILL OR LEAK PROCEDURES: Flush small amounts to sanitary sewer. For 5 gallons or more, use absorbent material.

FIRE, EXPLOSION, REACTIVITY DATA

FLASH POINT: N.A.
FLAMMABLE LIMITS: N.A.
UNUSUAL FIRE AND EXPLOSION HAZARDS: None
EXTINGUISHING MEDIA: Normal
HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of nitrogen and sulfur
FIRE FIGHTING PROCEDURES: Normal
NFPA CLASS: N.D.
SPECIAL PRECAUTIONS: N.D.
INCOMPATIBILITIES (materials to avoid): Chlorine containing compounds
STABILITY: Stable

DISPOSAL DATA

DISPOSAL SHIPPING NAME: N.A.
EPA HAZARD CODE: N.A.
EPA HAZARD WASTE #: N.A.
DOT HAZARD WASTE ID #: N.A.
DISPOSAL: Dispose in accordance with Federal, State and Local Regulations.

N.A. = NOT APPLICABLE N.D. = NOT DETERMINED

MATERIAL SAFETY DATA SHEET NO. C024 ISSUE DATE: 11/2/90
MATERIAL NAME: DOVE LIGHT DUTY LIQUID DISHWASHING DETERGENT

No. 11

ACUTE TOXICITY INFORMATION

ORAL:	Nontoxic
INHALATION:	N.D.
DERMAL:	N.D.
EYE IRRITATION:	Irritant to eyes by FHSA test standards. Minimal eye effects in humans with similar products.
SKIN IRRITATION:	Nonirritant
SKIN SENSITIZATION:	Nonsensitizer
PRIMARY ROUTES OF ENTRY:	Eye

CHRONIC EXPOSURE EFFECTS

TARGET ORGANS: Eye

CARCINOGEN: (NTP, IARC & OSHA LIST) None

MEDICAL CONDITION AGGRAVATED BY EXPOSURE: None Known

SYMPTOMS AND EFFECTS OF EXPOSURE

EYE:	May cause discomfort, lacrimation and erythema.
SKIN:	Possible irritation from prolonged or repeated contact.
INGESTION:	May produce nausea, abdominal discomfort and diarrhea. Spontaneous emesis may occur if ingested in sufficient amount.
INHALATION:	May produce irritation of respiratory tract.

EMERGENCY AND FIRST AID TREATMENT

EYE:	Immediately rinse eyes with water. Remove contact lenses, if any, then continue rinsing for 5 to 10 minutes.
SKIN:	Remove contaminated clothing and rinse skin with water.
INGESTION:	Drink a glass of water or milk. Vomiting need not be induced, but ingestion of large quantities may produce spontaneous vomiting.
INHALATION:	Move person to fresh air.
COMMENTS:	Call a physician if symptoms persist or amount swallowed was large.

PERSONAL SAFETY MEASURES AND EQUIPMENT

EYES:	Safety glasses with side shields.
RESPIRATOR:	Not normally needed.
GLOVES:	Impermeable gloves if needed.
VENTILATION:	Local exhaust if needed.

AGA

AGA 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 I.D. 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 -317.8°F (-194.3°C)	LIQUID DENSITY AT BOILING POINT 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) N/A	AUTO IGNITION TEMPERATURE N/A	FLAMMABLE LIMITS - % BY VOLUME 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 (Gen.) 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).

*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 will not be reflected in this data sheet. The customer should review these regulations to ensure that he is in full compliance.

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.

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Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
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GENIUM PUBLISHING CORP.

No. 674

ISOBUTYLENE

Issued: November 1988

SECTION 1. MATERIAL IDENTIFICATION

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Material Name: ISOBUTYLENE

Description (Origin/Uses): Obtained from refinery steams by absorption on 65% sulfuric acid (H_2SO_4) at 59°F (15°C). Used primarily to produce diisobutylene, trimers, butyl rubber, and other polymers; also used to produce antioxidants for foods, plastics, and packaging food supplements.

NFPA

Other Designations: Isobutene; 2-Methylpropene; *gamma*-Butylene; $CH_2=C(CH_3)_2$; CAS No. 0115-11-7

HMIS
H 1
F 4
R 0
PPG*
*See sect. 8

R 1
I 1
S 1
K 4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

SECTION 2. INGREDIENTS AND HAZARDS

Ingredients	%	Exposure Limits
Isobutylene, CAS No. 0115-11-57	Ca 100	OSHA PEL None Established ACGIH TLV, 1988-89 None Established NIOSH REL None Established Toxicity Data* Rat, Inhalation, LC_{50}: 620 g/m³ (4 Hrs) Mouse, Inhalation, LC_{50}: 415 g/m³ (2 Hrs)

*Monitor NIOSH, *RTECS* (UD0890000), for additional data.

SECTION 3. PHYSICAL DATA

Boiling Point: -19.6°F (-6.9°C)
Melting Point: -220°F (-140°C)
Vapor Density (Air = 1): 1.9
Specific Gravity (H_2O = 1): Ca 0.6
Molecular Weight: 56 Grams/Mole
Solubility in Water (%): Insoluble*
% Volatile by Volume: 100

Appearance and Odor: A colorless, extremely flammable gas; odor not listed.

*Isobutylene is very soluble in alcohol, ether, and sulfuric acid.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point*	Autoignition Temperature: 869°F (465°C)	LEL: 1.8% v/v	UEL: 9.6% v/v

Extinguishing Media: Isobutylene gas is an extremely flammable gas that has a substantial explosive air-gas range. For isobutylene fires, the recommended fire-fighting technique is to stop the flow of gas instead of extinguishing the fire. If the flames are extinguished and the isobutylene gas continues to escape or leak, an explosive air-gas mixture can form quickly and ignite without warning. A resulting explosion could cause greater damage than that which would be caused by allowing the fire to burn itself out. If the fire must be extinguished to allow safe access to shutoff valves, recommended extinguishing agents include CO_2 and dry chemical. **Unusual Fire or Explosion Hazards:** In many cases, the preferred strategy is to allow the flames to continue to burn and to cool the surroundings with water spray to prevent ignition of nearby combustibles. Isobutylene gas is heavier than air and can collect in low-lying, confined spaces. Potentially explosive air-gas mixtures are especially likely to build up in such an area, so enter it with extreme caution whether or not it is presently involved in a fire. Possible sources of ignition must not be brought into any area suspected of containing substantial concentrations of isobutylene gas. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* Sax (Genium ref. 6) reports a flash point of -105°F (-76°C) for isobutylene.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Isobutylene is stable in closed, pressurized containers during routine operations at room temperature. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Isobutylene can react dangerously with strong oxidizing materials. **Conditions to Avoid:** Prevent exposing isobutylene to any source of ignition such as an open flame, sparks, lighted tobacco products, or steam lines. **Hazardous Products of Decomposition:** Isobutylene fires can produce toxic gases such as carbon monoxide (CO) or lower-molecular-weight hydrocarbons. **Comments:** The extreme flammability of isobutylene means that any reactions involving this material, including nonhazardous ones, must be performed carefully in order to prevent fires and/or explosions.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Isobutylene is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: Isobutylene is a simple asphyxiant. As such it will not cause significant physiological responses, but it can displace the minimum required atmospheric oxygen level. Significant displacement by isobutylene results in an oxygen-deficient atmosphere with no adequate warning properties. Asphyxiation fatalities can occur especially in confined, low-lying, poorly ventilated spaces because isobuty-

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SECTION 6. HEALTH HAZARD INFORMATION. cont.

lene gas is almost twice as dense as air itself (see sect. 3). Medical Conditions Aggravated by Long-Term Exposure: None reported. Target Organs: None reported. Primary Entry: Inhalation. Acute Effects: Initial symptoms of the effects of simple asphyxiant ases are rapid respiration and air hunger, diminished mental alertness, and impaired muscular coordination. Continuing lack of oxygen causes faulty judgment, depression of all sensations, rapid fatigue, and emotional instability. As the asphyxia continues, nausea; vomiting; prostration; loss of consciousness; and, finally, convulsions; deep coma; and death can occur. Chronic Effects: None reported. FIRST AID: Inhalation. Would-be rescuers need to be concerned about their own safety when entering confined, poorly ventilated, oxygen-deficient areas. Self-contained breathing equipment must be readily available for rescuers. Station standby workers outside the immediate area so that they can summon additional help if it is needed. Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Comments: The extreme flammability of isobutylene gas warrants special attention even during rescue operations. Rescue personnel must not smoke. All emergency lamps and floodlights that must be lowered into enclosed areas for rescue operations must be explosion proof. Obtain this equipment before any emergency occurs and make it accessible to emergency-response personnel. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: *Treat any isobutylene gas leak as an emergency.* If the leaking gas has not yet ignited, use water spray to direct flammable gas-air mixtures away from sources of ignition. Extinguish all sources of ignition as quickly as possible; however, if the leaking gas is burning, do not attempt to extinguish the flames until the source of the isobutylene gas is located and sealed. Otherwise, flammable isobutylene gas-air mixtures can explode without warning and cause widespread damage that might not have occurred if the original fire had been allowed to burn itself out. If it is necessary to extinguish isobutylene flames in order to gain access to a shutoff valve, use dry chemical or carbon dioxide as extinguishing agents. Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z): Not Listed

EPA Designations (40 CFR 302.4): Not Listed

SECTION 8. SPECIAL PROTECTION INFORMATION

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (leaks or cleaning reactor vessels and storage tanks), wear an SCBA. Warning: Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres, which lack warning properties; to work in them safely requires that an SCBA be worn. Ventilation: Install and operate general and local aximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of this material below the lower explosive limit ted in section 4. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Comments: Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale isobutylene vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store isobutylene in closed, pressurized containers in a cool, dry, well-ventilated area away from sources of ignition, combustible materials, and strong oxidizers. Protect containers from physical damage. Engineering Controls: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Electrically ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations to prevent static sparks. Comments: Isobutylene is an extremely explosive and flammable gas. It must not be exposed to any possible source of ignition in work or storage areas.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Liquefied Petroleum Gas
DOT Hazard Class: Flammable Gas
ID No. UN1055
DOT Label: Flammable Gas
DOT Packaging Requirements: 49 CFR 173.304, .314, .315
DOT Packaging Exceptions: 49 CFR 173.306

IMO Shipping Name: Isobutylene
IMO Hazard Class: 2.1
IMO Label: Flammable Gas

eferences: 1, 6, 84-94, 116, 117, 120, 122.

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: W Silverman, MD

No. 14

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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 42

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, Spectrar.
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)

* Vacated 1989 Final Rule Limits

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

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†
†Sec. 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

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.
otective 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, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

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: Guppies (*Poecilia reticulata*) LC_{50} = 7,060 ppm/7 days; fathead minnow (*Pimephales promelas*) LC_{50} = 11,830 mg/L/1 hr. BOD = 133 %/5 days.

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 *Desulfoviörio*. 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

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No. 15

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).

No. 15

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: PJ Igoe, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: MJ Hardies, MD

LUBRIPLATE®

MATERIAL SAFETY DATA SHEET

No. 16

Section I

PRODUCT NAME OR NUMBER	FORMULA
LUBRIPLATE Hydraulic Oils - HO-0, HO-1, HO-2, HO-2A, HO-3, HO-4, HO-5	Mineral Oil and Additives
Manufacturer's Name: Fiske Brothers Refining Co.	Emergency Telephone Number: 201-589-9150
Address (Number, Street, City, State, and ZIP Code): 129 Lockwood St., Newark, NJ 07105	Telephone Number for Information: 201-589-9150

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Oil Mist in Air (Not Encountered in Normal Usage)	5mg/m^3	5mg/m^3		

Hazardous Material Identification System (HMIS): Health-1, Flammability-1, Reactivity-0

Section III — Physical/Chemical Characteristics

Boiling Point	> 550°F	Specific Gravity (H_2O = 1)	0.8708 - 0.8894
Vapor Pressure (mm Hg.)	< 0.01	Melting Point	Liquid
Vapor Density (AIR = 1)	> 5	Evaporation Rate (Butyl Acetate = 1)	< 0.01

Solubility in Water: Negligible

Appearance and Odor: Transparent amber liquid with mineral oil odor

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
C.O.C. - 415°F - 565°F		0.9%	7.0%

Extinguishing Media: Foam, Dry Chemical, Carbon Dioxide or Water Spray (Fog)

Special Fire Fighting Procedures: Cool exposed containers with water. Use air-supplied breathing equipment for enclosed or confined spaces.

Unusual Fire and Explosion Hazards: Do not store or mix with strong oxidants. Empty containers retain residue. Do not cut, drill, grind, or weld, as they may explode.

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid: N/A
	Stable	x	

Incompatibility (Materials to Avoid): Avoid contact with strong oxidants like liquid chlorine, concentrated oxygen.

Hazardous Decomposition or Byproducts: May form SO_2. If incomplete combustion, carbon monoxide.

Hazardous Polymerization	May Occur		Conditions to Avoid: N/A
	Will Not Occur	x	

No. 17

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
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(518) 377-8855

GENIUM PUBLISHING CORP.

No. 523
n-PENTANE
(Revision A)

Issued: October 1986
Revised: August 1987

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: *n*-PENTANE

DESCRIPTION (Origin/Uses): Prepared by dehydration and subsequent hydrogenation of 2- and 3-pentanol. Found in petroleum and is a constituent of petroleum ether. Used as an industrial solvent.

OTHER DESIGNATIONS: Amyl Hydride; C_5H_{12}; NIOSH *RTECS* #RZ9450000; CAS #0109-66-0

MANUFACTURER/SUPPLIER: Available from several suppliers, including: Ashland Chemical Co., Industrial Chemicals & Solvents Division, PO Box 2219, Columbus, OH 43216; Telephone: (614) 889-3844

COMMENTS: *n*-Pentane is a serious fire and explosion hazard.

HMIS	
H 1	
F 4	R 1
R 0	I -
PPE*	S 1
*See sect. 8	K 4

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
n-Pentane, CAS #0109-66-0; NIOSH *RTECS* #RZ9450000 $H_3C-CH_2-CH_2-CH_2-CH_3$ NIOSH REL 1986 10-Hr TWA: 120 ppm, 350 mg/m^3 15-Min Ceiling: 610 ppm, 1800 mg/m^3 Current OSHA PEL-TWA: 1000 ppm (2950 mg/m^3). The 1987-88 ACGIH TLVs are TWA = 600 ppm (1800 mg/m^3) and STEL = 750 ppm (2250 mg/m^3). *Immediately dangerous to life and health	>99	TOXICITY DATA Human, Inhalation, LC_{Lo}: 130000 ppm Human, Inhalation, TC_{Lo}: 90000 ppm/5 Min. Mouse, Intravenous, LD_{50}: 446 mg/kg IDLH* Level: 15000 ppm

SECTION 3. PHYSICAL DATA

Boiling Point ... 97°F (36.1°C)
Vapor Pressure ... 400 Torr at 65.3°F (18.5°C)
Vapor Density (Air = 1) ... 2.5
Solubility in Water ... 0.04% at 68°F (20°C)
Viscosity ... 0.43 at 32°F (0°C)
Specific Gravity ... 0.626 at 68°F (20°C)
Melting Point ... -202°F (-130°C)
Evaporation Rate (n-BuAc = 1) ... 28.6
Volatiles, % ... 100
Molecular Weight ... 72.15 Grams/Mole

Appearance and odor: Clear, colorless, mobile liquid. Mild gasolinelike odor. Threshold odor concentration: 50% recognition at 990 ppm.

COMMENTS: *n*-Pentane's high vapor density, volatility, and evaporation rate will generate explosive and flammable concentrations of vapor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
<-40°F (<-40°C)	500°F (260°C)	% by Volume	1.5%	7.8%

EXTINGUISHING MEDIA: Use carbon dioxide, dry chemical, or foam. Water is ineffective in putting out a fire involving *n*-pentane, and a water stream will spread flames; but a water spray should be used to cool fire-exposed containers to prevent pressure rupture. Also, water spray may be used to flush spills away from exposures to sources of ignition. This flammable liquid is a dangerous fire hazard and a dangerous explosion hazard. Fight fire from a safe distance. UNUSUAL FIRE/EXPLOSION HAZARDS: The heavier-than-air vapors of *n*-pentane may travel along low-lying surfaces to distant sources of ignition and then flash back to the original source of the material. SPECIAL FIRE-FIGHTING PROCEDURES: *n*-Pentane is an OSHA class IA flammable liquid. Wear a self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode. This material is extremely flammable. Exercise due caution to protect against flashbacks.

SECTION 5. REACTIVITY DATA

n-Pentane is stable. Hazardous polymerization cannot occur.

CHEMICAL INCOMPATIBILITIES: *n*-Pentane is incompatible with oxidizing agents.

CONDITIONS TO AVOID: Avoid sources of ignition such as sparks, excessive heat, open flame, and lighted tobacco products.

PRODUCTS OF HAZARDOUS DECOMPOSITION can include oxides of carbons.

SECTION 6. HEALTH HAZARD INFORMATION

n-Pentane is not listed as a carcinogen by the NTP, IARC, or OSHA.

SUMMARY OF RISKS: Vapors of this material are mildly narcotic and may cause irritation to the respiratory passages. (It has been reported that human exposures at 5000 ppm for 10 minutes did not cause mucous membrane irritation.) Extremely high and sustained concentrations may cause central nervous system depression and narcosis. This material is a defatting agent; repeated or prolonged skin contact with its liquid may result in drying, cracking, and dermatitis. Eye contact can be irritating. Swallowed liquid can vaporize (BP 97°F [36.1°C]) in the trachea. Aspiration into the lungs will cause dilution of alveolar air (asphyxiation hazard). TARGET ORGANS: Eyes, skin, respiratory system. PRIMARY ENTRY: Inhalation. ACUTE EFFECTS: Eyes, skin, and respiratory tract irritation; and possibly central nervous system depression. CHRONIC EFFECTS: Unknown. MEDICAL CONDITIONS AGGRAVATED BY LONG-TERM EXPOSURE: None reported.

FIRST AID: EYE CONTACT: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Get medical help.* SKIN CONTACT: Remove contaminated clothing. Flush affected area with water; wash with soap and water. Get medical help.* INHALATION: Remove victim to fresh air. Restore and/or support his breathing as required. Get medical help.* INGESTION: Do not induce vomiting. Never give anything by mouth to someone who is unconscious or convulsing. Get medical help.*

* GET MEDICAL ASSISTANCE = IN PLANT, PARAMEDIC, COMMUNITY. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of *n*-pentane spills or leaks. If a spill or leak has not ignited, use water spray to disperse the gas or vapor and to protect those who are attempting to stop a leak. Keep upwind of a leak or spill. Remove sources of heat or ignition. Provide maximum explosion-proof ventilation. Cleanup personnel need protection against inhalation of vapors and contact with liquid. Flush waste to the ground and away from sensitive areas with a cold water spray. Small spills can be absorbed with vermiculite, picked up with nonsparking tools, or allowed to evaporate with good ventilation or in a hood or open area. Pick up large spills if it is safe to do so and place them into an appropriate container for recovery or disposal. Keep waste out of sewers or places where it can vaporize into confined spaces. DISPOSAL: Burn properly (because of material's low flash point) in an approved incinerator. Follow Federal, state, and local regulations. Aquatic Toxicity, TLm 96: 100-10 ppm. *n*-Pentane is reported in the 1980 EPA TSCA Inventory. EPA Hazardous Waste Number (40 CFR 261.21, Ignitability): D001. *n*-Pentane is not designated as a hazardous substance by the EPA (40 CFR 116.4). EPA Reportable Quantity (40 CFR 117.3): Not Listed.

SECTION 8. SPECIAL PROTECTION INFORMATION

GOGGLES: Wear chemical safety goggles or eyeglasses to prevent eye contact where splashing is possible.

GLOVES: Wear rubber or neoprene gloves to prevent skin contact.

RESPIRATOR: For emergency or nonroutine exposures above the TLV, use a NIOSH-approved respirator with an organic vapor canister or air-supplied or self-contained breathing apparatus below 5000 ppm.

VENTILATION: Provide general and local explosion-proof exhaust ventilation to meet TLV requirements. The ventilation systems must be explosion proof and nonsparking.

SAFETY STATIONS: Make eyewash stations, washing facilities, and safety showers available in areas of use and handling.

CONTAMINATED EQUIPMENT: Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them.

OTHER PERSONAL PROTECTIVE EQUIPMENT: Wear protective clothing appropriate to the work situation to prevent skin contact. Remove soiled clothing and launder it before wearing it again, because it is a health and fire hazard.

COMMENTS: Practice good personal hygiene. Keep materials off of your clothes and equipment. Avoid transferring materials from hands to mouth while eating, drinking, or smoking.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store *n*-pentane in tightly closed containers in a cool, well-ventilated area away from oxidizing agents and sources of heat and ignition. Protect containers from physical damage. SPECIAL HANDLING/STORAGE: Ground and bond containers during transfers to prevent the generation of static sparks. Use nonsparking tools. Use metal safety cans for handling small amounts. Storage and handling must be suitable for an OSHA Class IA flammable liquid. Do not smoke where this material is stored or used. ENGINEERING CONTROLS: The heavier-than-air *n*-pentane vapors may travel to distant sources of ignition and flash back. These vapors collect in low-lying areas; minimize sources of ignition there.

OTHER PRECAUTIONS: Avoid breathing *n*-pentane vapors! Prevent its contact with skin and eyes! Do not eat this material! Institute exposure-monitoring and record-keeping requirements that have been proposed by NIOSH for alkanes.

TRANSPORTATION DATA (per 49 CFR 172.101-2):

DOT Shipping Name: Pentane	DOT Hazard Class: Flammable Liquid
DOT Required Label: Flammable Liquid	DOT ID No. UN1265
IMO Class: 3.1	IMO Label: Flammable Liquid

References: 1-12, 14, 16, 23, 25, 27, 31, 34, 38, 42, 45, 47, 49, 54, 55, 58, 59, 63, 73, 75, 82, 87-94, CK

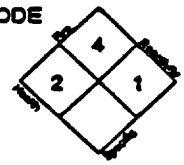
Approvals	JO Reviewed
Indust. Hygiene/Safety	CTL 12/87
Medical Review	JJH 12/87

No. 18

FIRST BRANDS

Material Safety Data Sheet
PRESTONE® Engine Starting Fluid

Any questions, please call:	EMERGENCY TELEPHONE (24 Hours)	NFPA HAZARD CODE
First Brands Corporation 83 Wooster Heights Road Building 301 Danbury, CT 06813-1911 Telephone: (203) 731-2300	CHEMTREC (800) 424-9300 483-7616 in District of Columbia	4 = Extreme 3 = High 2 = Moderate 1 = Slight 0 = Insignificant



I. IDENTIFICATION

PRODUCT NAME	PRESTONE® Engine Starting Fluid
TYPE	Automotive Engine Starting Fluid (Aerosol)
STOCK	AS237
FORMULA	13374-84

II. PHYSICAL DATA

BOILING POINT, 760 mm Hg	95°F
FREEZING POINT	less than -30°F
DENSITY (at 68°F)	5.6 lbs/gal
VAPOR DENSITY (Air = 1)	2.6
VAPOR PRESSURE (at 68°F)	305 mm Hg
AEROSOL CONTAINER PRESSURE (at 70°F psig)	85
VOLATILES BY VOLUME	99%
SOLUBILITY IN WATER, by Wgt.	4.5%
EVAPORATION RATE (Butyl Acetate = 1)	23
APPEARANCE AND ODOR	Clear liquid, ether odor

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

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.

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.

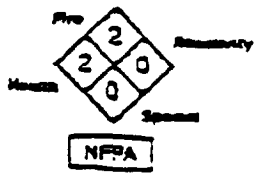
If more information is needed, please contact:

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:	
		Emergency Only:	1 (800) 424-9300 (CHEMTREC)
Address:	1061 Cudahy Place (92110) P.O. Box 80607 San Diego, California 92138-9021	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. 1C

VI. REACTIVITY DATA

Stability:	Stable X	Unstable
Conditions to avoid:	NA	
Incompatibility:	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 NDA = No data available < = Less than > = More than

APPENDIX D

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
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 _____

_____

_____

(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 all 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

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HEAVY EQUIPMENT
DAILY INSPECTION LOG

Equipment Description:_____
(Name/Serial No./Model No.)

Date Mobilized:_____Week Ending_____

Item Inspected/ Date Inspected	Mon./	Tues./	Wed./	Thur./	Fri./	Sat./
Windshield						
Seat Belts						
Back-up Alarm						
Horn						
Brakes						
Fire Extinguisher						
Tires						
Hydraulics (leaks)						
Steering Pin						
Inspected by:						

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

DIRECT READING INSTRUMENT LOG

Project: ______________________ Job No.: ______________________

Date: ______________________ Operator: ______________________

Instrument: ______________________ Calibration: ______________________
Amt, Component, Date

Sampling Technique: ____

____

Sample Interval: ____

Background Reading: ____

Action Level/Response: ____

Time	Location	Reading (units)	Detection Limit (Scale)

OHM 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)

C[illegible] 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

OHM Remediation Services Corp.

DIRECT READING INSTUMENT LOG

NAME: _____ JOB NO.: _____

PROJECT: _____ OPERATOR: _____

INSTRUMENT: _____ CALIBRATION: _____

PROJECT ACTIVITIES: _____

_____

_____

_____

BACKGROUND READING: _____

WEATHER CONDITIONS: _____

TIME	LOCATION	READING	DURATION	COMMENTS

HM 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.

OHM Remediation Services Corp.

SITE SAFETY OFFICER DAILY REPORT

DATE: _____ PROJECT NO. _____

SSO: _____ PROJECT NAME: _____

SITE SUPERVISOR: _____

Safety Meeting Topics:		
Air Monitoring Instruments	Calculated/Checked	Task Monitored
Other Activities		

OHM Site Activities

Task Performed	Protection Level	Type Air Monitoring

Subcontractor Activities

Safety Observation/Issues

OHM Remediation Services Corp.

SITE SAFETY OFFICER DAILY REPORT

DATE: _____ PROJECT NO. _____

SSO: _____ PROJECT NAME: _____

SITE SUPERVISOR: _____

Safety Meeting Topics:		
Air Monitoring Instruments	**Calculated/Checked**	**Task Monitored**
Other Activities		

OHM Site Activities

Task Performed	Protection Level	Type Air Monitoring

Subcontractor Activities

Safety Observation/Issues

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?

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? ____ ____

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? ____ ____

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:		

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

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.