03.06-03/01/95-01533

OHM Remediation
Services Corp.

REMEDIAL ACTION WORK PLAN
SOIL REMEDIATION
OPERABLE UNIT 1, SITES 21 AND 78
MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Delivery Order 0062

Prepared by

OHM Remediation Services Corp.
Norcross, Georgia

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March 1995

OHM Project No. 16866

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1.0 INTRODUCTION

This Remedial Action Work Plan (RAWP) reviews OHM Remediation Services Corp.'s (OHM) approach to implementation of the scope of work under Delivery Order No. 0062 of Navy Atlantic Division (LANTDIV) Contract N62470-93-D-3032. Several other plans have been developed for this delivery order and are to be considered as complementary components to this work plan. They include:

- Site-Specific Health & Safety Plan (SHSP)
- Environmental Protection Plan (EPP) (included herein as Section 3.0)
- Construction Quality Control Plan (CQCP)
- Sampling and Analysis Plan (SAP) (included herein as Section 7.0)

This RAWP identifies and describes how OHM will implement the major tasks encompassing the remedial action for Operable Unit No. 1 (OU No. 1) in conformance with the contract requirements. It includes the following sections:

- Section 2.0 Remedial Action Objectives
- Section 3.0 Environmental Protection Plan
- Section 4.0 Site Preparation and Mobilization
- Section 5.0 Material Excavation
- Section 6.0 Transportation and Disposal Plan
- Section 7.0 Verification Sampling and Analysis Plan
- Section 8.0 Site Restoration
- Section 9.0 Demobilization/Final Report

1.1 SITE BACKGROUND

MCB Camp Lejeune was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), National Priorities List (NPL) effective October 4, 1989 (54 Federal Register 41015, October 4, 1989). Subsequent to this listing, the United States Environmental Protection Agency (USEPA) Region IV, the North Carolina Department of Environment, Health and Natural Resources (NCDEHNR) and the United States Department of the Navy (DoN) entered into a Federal Facilities Agreement (FFA) for MCB Camp Lejeune. The primary purpose of the FFA was to ensure that environmental impacts associated with past and present activities at MCB Camp Lejeune were thoroughly investigated and appropriate CERCLA response/Resources Conservation and Recovery Act (RCRA) corrective action alternatives were developed and implemented as necessary to protect the public health and the environment.

Following a CERCLA Remedial Investigation (RI) and Feasibility Study (FS) of OU No. 1 in 1993 and 1994, the DoN, Naval Facilities Engineering Command, LANTDIV contracted Baker Environmental, Inc. (Baker) to develop a remedial design for the remediation of

contaminated soil. The scope of this soil remediation effort includes the removal, transportation and disposal of pesticides and polychlorinated biphenyl (PCB) contaminated soils from four areas of concern (AOC) with Sites 21 and 78.

1.2 SITE DESCRIPTION

Camp Lejeune is a training base for the U.S. Marine Corps, located in Onslow County, North Carolina. The base covers approximately 170 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. The remedial action area, OU No. 1, is one of 13 operable units within Camp Lejeune. An "operable unit" as defined by the National Contingency Plan (NCP) is a discrete action that comprises an incremental step toward comprehensively addressing site problems. OU No. 1, which covers an area of approximately 690 acres, is comprised of three sites: Sites 21, 24 and 78. OU No. 1 is located approximately 1 mile east of the New River and two miles south of State Route 24. The Operable Unit is bordered to the northwest by Holcomb Boulevard, to the northeast by Sneads Ferry Road, to the southwest by Main Service Road, and to the southeast by Cogdels Creek (see Figure 1).

Site 21 is located within the northwest section of Site 78. The site is bordered by Ash Street to the southwest, Center Road to the southeast, and a wooded area to the northwest. A dirt road surrounds most of the site along with surface drainage ditches. The southern and central portions of the site (approximately 220 feet by 900 feet) include several fenced-in areas, while the northern section (approximately 500 feet long) is an open area. A water tower is located in the fenced portion of the site. Surface cover within the site consists of gravel, sandy soil, and concrete with a few vegetated areas. The southern portion of the site is periodically utilized for storage by Marine Corps reserve units. Currently this portion of the site is being used for storage of military vehicles.

Three primary AOCs were identified at Site 21. They are the Former PCB Transformer Disposal Area (AOC 1) and the Former Pesticide Mixing/Disposal Area (AOCs 2 and 3). Figure 1 shows the location of these three AOCs. The Former Transformer PCB Disposal Area is located in the northeastern portion of the site, and the Former Pesticide Mixing/Disposal Area is located in the southwestern portion of the site. With the exception of a small, slightly depressed area at the northern portion of the site, which may have been the former transformer oil disposal pit, there are no visual signs of waste disposal throughout the site. The contaminants of concern (COCs) at AOC 1 and AOC 2 are PCBs. The COCs at AOC 3 are pesticides including 4,4'-DDD, 4,4'-DDT, and chlordane.

01533S01Z

CONTROL MONUMENT E5
UTM GRID COORDINATES
CONCRETE MONUMENT

CONTROL MONUMENT E4
UTM GRID COORDINATES
CONCRETE MONUMENT

PROJECT SITE

SITE 78 BOUNDARY

SITE 21 BOUNDARY

AOC 1

AOC 2

AOC 3

AOC 4

MARS ANTENNA SITE

OUTDOOR THEATER

PLAYGROUND

SKEET RANGE

RANGE F11

GOVERNMENT SUB. STA.

CONTRACTOR STORAGE

GAS PUMPS

TRANSFORMER CONDENSATE TANK

CHEMICAL STO. TANKS

COAL LANDING

HOT DOG STAND

R BALL COURTS

OPEN STOR.

Beaver Dam Creek

BOULEVARD

ROAD

STREET

DRIVE

500 0 250 500
1 INCH = 500 FEET

LOCATION MAP

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1	ISSUE FOR REVIEW & APPROVAL	OHM	3/1/95	

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

AT FULL SCALE (IF NOT 2"-SCALE ACCORDINGLY)
CADD FILE: SITE.DWG
DRAWN: J. COLLINS
DESIGNED:
CHECKED: JAD

SUBMITTED: PROJECT MANAGER DATE: 3/15/95
APPROVED: OF SR. PROJECT ENGINEER DATE:

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
LANTDIV RAC CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO. 0062
OPERABLE UNIT NO. 1 — MARINE CORPS BASE, CAMP LEJEUNE, N.C.

REMEDIAL ACTION WORK PLAN
FIGURE 1
GENERAL SITE LAYOUT PLAN

Site 78 encompasses the industrial area of MCB, Camp Lejeune and is bordered by Holcomb Boulevard, Sneads Ferry Road, Duncan Street, and Main Service Road. This area is comprised of maintenance shops, warehouses, painting shops, printing shops, automobile body shops, and other similar industrial facilities. Site 78 covers approximately 590 acres. With the exception of buildings, the majority of the site area is paved (e.g., roadways, parking lots, loading dock areas, and storage lots), however, there are many small lawn areas associated with individual buildings within the site and along lengthy stretches of roadways. In addition, there are several acres of woods in the southern portion of the site. Recreational ball fields and a parade ground are located in the southwest corner of the site.

One soil AOC has been identified within Site 78, a grassed area on the northeast side of Building 1502 (AOC 4). Figure 1 shows the location of AOC 4. The COCs at AOC 4 are pesticides including 4,4'-DDD, 4,4'-DDT, and chlordane.

1.3 SITE HISTORY

Site 21 has had a history of pesticide usage and reported transformer oil disposal. The site was used as a pesticide mixing area and as a cleaning area for pesticide application equipment from 1958 to 1977. This area, the Former Pesticide Mixing/Disposal Area, was reported to be located in the southeast corner of the lot (the exact location is not documented). Chemicals reportedly stored and handled at this site included diazinon, chlordane, lindane, DDT, malathion (46 percent solution), mirex, 2,4-D, silvex, dalapon and dursban. Small spills, discharge of washout fluids, and indiscriminate disposal are believed to have occurred in this area. In 1977, before these mixing/cleaning activities were moved to a different location, overland discharge of washout fluids was estimated to be approximately 350 gallons per week. It is not clear for how long this discharge of washout fluids occurred.

The Former Transformer Oil Disposal Pit was located in the northeastern portion of the site. The pit was reportedly used as a disposal area for transformer oil during a one year period between 1950 and 1951. The pit reportedly measured 25 to 30 feet long by 6 feet wide by 8 feet deep. Sand was occasionally placed in the pit when oil was found standing in the bottom of the pit. The total quantity of oil disposed in this pit is unknown. A small area, slightly depressed in elevation, which may be the former oil pit, is evident in the northern portion of Site 21.

Site 78, constructed in the late 1930s, was the first developed area at MCB, Camp Lejeune. It was comprised of approximately 75 buildings and facilities including maintenance shops, gas stations, administrative offices, commissaries, snack bars, warehouses, and storage yards. There is presently no known uncontrolled disposal of wastes related to the various industrial activities at the site. Due to the industrial nature of the site, many spills and leaks have occurred over the years. Most of these spills and leaks have consisted of petroleum-related

products and solvents from underground storage tanks (USTs), drums, and uncontained waste storage areas.

2.0 REMEDIAL ACTION OBJECTIVES

In accordance with Section 121(d)(1) of CERCLA, remedial actions must attain a degree of clean-up which assures protection of human health and the environment. Remedial goals have been based on meeting an Applicable or Relevant and Appropriate Requirement (ARAR), or a site-specific risk based action level. Soil remedial goals were established based on ARARs or risk-based action levels for the protection of public health or groundwater.

2.1 REMEDIAL ACTION OBJECTIVES FOR SOIL

The remedial objective for soil areas of concern is to remove and dispose of the contaminated soils in OU No. 1, AOCs 1 through 4 which have contaminants of concern exceeding the established remediation goals. The low levels of PCBs detected in the soils do not justify on-site treatment. Under this approach, removal and off-site disposal potential risks due to contaminated soil exposure will be reduced.

The remediation goals for OU No. 1 were provided in the final design package Basis of Design Report by Baker Environmental dated November 11, 1994. Table 2.1 presents the applicable requirements for contaminated soil in AOC 1 through AOC 4.

Table 2.1
Remediation Goals for OU No. 1 –Soil Remediation

Media	Contaminant of Concern	Remediation Goal	Unit
Soil	4,4'-DDD	12,000	µg/kg
	4,4'-DDT	8,400	µg/kg
	Chlordane (total)	2,200	µg/kg
	PCBs (total)	370	µg/kg

The primary contaminants of concern for AOCs 1 and 2 are PCBs (Aroclor-1260) and for AOCs 3 and 4 pesticides including 4,4'-DDD, 4,4'DDT and chlordane. Although other Aroclors and metabolites of DDT were detected, the aforementioned PCB and pesticide compounds represent the primary constituents of concern. Soil in each of the AOCs will be excavated and disposed of off-site (incineration). Table 2.2 summarizes the estimated volumes of soil from each AOC, and the proposed method of management.

Table 2.2
Summary of Soil Areas of Concern

AOC No.	Area of Excavation (sq. ft.)	Depth of Excavation (ft.)	Volume (c.y.)	Method
1	3,070	1	115	Incineration
2	610	1	25	Incineration
3	5,660	1	210	Incineration
4	1,300	1	50	Incineration

3.0 ENVIRONMENTAL PROTECTION PLAN

This Environmental Protection Plan (EPP) has been prepared in accordance with standard OHM policies and procedures. The EPP provides specific information relating to the scope of work under Delivery Order No. 0062 Removal of Contaminated Soil, Sites 21 and 78 Operable Unit. No. 1 The plan will provide site-specific information for:

- Land resources management
- Water resources management
- Air and noise pollution control
- Non-compliance/corrective action
- Post-evacuation cleanup

The control of environmental pollution will consider air, water and land impacts, as well as noise and solid waste management.

The land resources within the property of MCB Camp Lejeune, but outside the limits of permanent work, will be preserved in their condition or restored to a condition after completion of construction that does not detract from the appearance of the area. As much as is practical, construction activities will be limited to areas defined by the plans and specifications.

3.1 HISTORICAL AND ARCHAEOLOGICAL FINDS

Although the presence of historical artifacts is not anticipated, if a historical artifact is encountered during field operations, OHM will stop work and notify the NTR. The NTR will be responsible for contracting federal, state, and local authorities to determine if the site may contain other important historical artifacts, and whether this site qualifies for possible placement on the National Registrar of Historical Places. Field operations will not resume until the NTR issues a written authorization to proceed.

3.2 TEMPORARY CONSTRUCTION ROADS

The construction of all temporary construction roads in and around the project site will be performed in a manner as to minimize the impact to the natural environment. Water will be used for dust control, as necessary. It is not expected that a significant number of construction roads will be necessary during removal action.

3.3 PROTECTION OF TREES AND SHRUBS

Prudent steps will be taken to protect trees and shrubs outside of the excavation zone as necessary. Those trees and shrubs within the excavation zone will be removed by the Forestry Division except for tree roots located in the excavation zone. All trees and shrubs removed as a result of the construction activities will be cut into manageable pieces and moved from the

project site so as not to interfere with operations. Precautions will be taken to minimize the construction activities' impact on existing vegetation and will include but not be limited to:

- Utilization of existing or temporary construction roads only
- Closely supervised equipment operators with an emphasis placed on preservation of vegetation in non-work areas
- Proper guidance of heavy equipment and truck operators by site personnel to minimize damage to adjacent vegetation not directly affected by construction activities
- Utilization of equipment appropriately designed and sized for precise excavation

3.4 RESTORATION

Upon completion of the field construction activities, disturbed areas will be seeded. Prior to seeding and fertilization, lime will be applied as a soil amendment for pH adjustment at a rate of approximately 40 pounds per acre.

Any trees or other landscape features damaged by equipment will be restored if practical by trimming of damaged limbs and application of tree dressing. Damaged trees which cannot be restored will be felled, limbed and left on-site. Soil will be placed and compacted around any root systems exposed during excavation activities.

3.5 WATER RESOURCES PROTECTION

New River and Beaver Dam Creek are located near Sites 21 and 78 and could possibly be impacted by construction activities if proper sediment and erosion protection measures are not taken. To protect against damage, stormwater surface run-off leaving the site will be controlled by temporary erosion/sediment control techniques such as berms, silt fencing and grading. The area of bare soil exposed at any one time by construction activities will be held at a minimum.

3.5.1 Erosion Sediment Control

Prior to disturbance of native vegetation and soils, temporary erosion/sediment control will be established on the down gradient side of each excavation. Control techniques to be utilized will involve silt fencing.

Silt fencing will be installed with the fabric a minimum of 6 inches below grade and extending 36 inches above grade and fastened to posts no more than 6 feet apart. The posts will be installed with a minimum of 24 inches below grade and extend a minimum of 36 inches above

grade. Fabric will be attached to the upslope side of the posts using 1-inch staples or tie wires. Silt fences will be inspected after every rain and daily during extended rain fall. Accumulated sediment will be removed before the depth reaches 12 inches.

3.5.2 Spill Control

Measures will be taken to prevent chemicals, fuels, oils, greases, bituminous materials and contaminated materials from entering streams, rivers or lakes. Absorbants will be available to solidify any leaks outside containment and any soil contaminated with fuel spills will be immediately removed and placed into appropriate containers and sampled to determine proper disposition.

3.6 DUST AND AIR POLLUTION CONTROL

3.6.1 Air and Noise Monitoring

Personnel and ambient air monitoring will be conducted as necessary in order to determine airborne dust and contaminant levels. Ambient air monitoring will be conducted at working locations and on occasion at the perimeter of the project site. This ensures that respiratory protection is adequate to protect personnel against the contaminants that are encountered as well as ensuring that harmful levels of airborne contaminants are not leaving the site.

OHM will only perform operations of heavy equipment during daylight hours to minimize the impact of noise pollution on off-site personnel. Noise exposure to off-site residents or personnel is expected to be minimal. Hearing protection will still be implemented if necessary as specified in the SHSP.

3.6.2 Particulate Emission Controls

Specific measures to be taken to minimize particle emissions for major activities during site construction include the following:

Soil Excavation, Handling, Site Grading and Transportation

- Apply water to work and traffic areas as necessary to minimize dust emissions
- Cover stockpiles with sheeting to minimize wind and/or stormwater erosion
- Move and load soil for transport within the site that limits freefall of material and is least likely to generate dust emissions
- Halt dust-generating work when on-site wind conditions exceed 35 miles per hour

Movement of Equipment

- Water traffic areas as required to minimize dust emissions
- Designate equipment traffic patterns to minimize travel distance and vehicular dust emissions
- Limit vehicle speed to minimize dust emissions

3.6.3 Burning

No burning will be performed on-site. In the event of an expected fire on-site, work will stop immediately and the MCB Camp Lejeune fire department will be notified.

3.7 POST-EXCAVATION CLEANUP

All excavation equipment will be decontaminated in a lined pad prior to demobilizing from the site. Decontamination will consist of scraping and pressure-washing to remove visible soil and debris from tires and undercarriage of vehicles and heavy equipment. Decontamination fluids will be containerized and samples procured and analysis prior to disposal.

The site will then be turned over to the MCB prior to acceptance of site conditions.

4.0 SITE PREPARATION AND MOBILIZATION

Prior to mobilization, OHM will arrange a pre-construction meeting at MCB Camp Lejeune with LANTDIV and other responsible parties. The purpose of this meeting will be to:

- Confirm roles and responsibilities of key personnel and flow of communication for project execution
- Review the project schedule, sequence of tasks and key milestones
- Identify and discuss Base-specific issues relative to the upcoming mobilization and construction activities
- Obtain the necessary security clearances for operations personnel
- Obtain photographs of the sites for pre-construction documentation of existing site conditions

OHM will submit the qualifications and licenses of subcontractors performing hazardous waste transportation and disposal. The qualifications of subcontractors including small and disadvantaged businesses proposed to perform work at the site will also be submitted. Additionally, other material/product submittals jointly identified as necessary will be submitted in accordance with the approved submittal register.

OHM will obtain samples of soil from each of the AOCs for laboratory analysis to determine wastestream characterizations. Soil sampling procedures are described in Section 7.3.3. Waste profiles will be prepared and approved by both the generator and the disposal facility prior to initiation of mobilization activities.

OHM will mobilize personnel and equipment from its Southern Region offices, including Morrisville, North Carolina; Covington, Georgia; and Gallatin, Tennessee 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 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 limits of excavation for each AOC, and location of other features such as construction roads and equipment laydown areas.

- **Temporary Facilities Installation** - OHM will utilize its office trailer already located at Lot 203 as an administrative area and command center. This area will serve as the control check point for contractor/subcontractor personnel entering the site. A decontamination trailer will also be mobilized and placed adjacent to the office trailer.

- **Excavation Limits** – The areas to be excavated will be delineated and visibly marked for easy recognition using paint and/or wooden stakes. Visibly marking the excavation areas allows for better determination of the work/safety zones and clearly defines the work area for the equipment operator.

- **Clearing and Grubbing** - Trees located within the excavation zones will be cut and staged in a convenient location for pickup by the Forestry Service.

- **Upgrade access roads** – Roads leading to the project site will be graded and if necessary stone will be placed in low, soft or water accumulating areas.

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

- **Install Construction Fences** - OHM personnel will erect safety fencing around the planned excavations in AOC 1 through AOC 4. Fencing will be 3 feet high, bright orange, polyethylene, mesh fence to prevent personnel from accidentally entering the open excavation. Additional fencing will be placed around monitoring wells located in close proximity to construction activities.

- **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.

- **Site Security** - The OHM command trailer will serve as a security check point for the project site. All persons entering the site will be required to sign in and out daily. OHM reserves the right to deny access to any individual not showing proper identification.

- **Health and Safety Zones** - The site will be segregated into work areas on the basis of degree of hazard and PPE requirements. In general, the fenced area will comprise the contamination reduction zone (CRZ). Personnel working within the CRZ will be required to wear the appropriate PPE as outlined in the Site-Specific Health and Safety Plan. Excavation areas within the CRZ will be designated the exclusion zone and will be delineated by orange safety fencing. OHM health and safety personnel will provide continuous site air monitoring and will adjust work zone boundaries as appropriate.

- **Personnel Decontamination Facility** - OHM will mobilize and setup a personnel decontamination trailer at the site. The trailer will be situated near the command trailer (Lot 203) and/or near construction areas depending on the phase of remediation activities. It will be furnished with showers and hand-basins. All decontamination and cleaning water generated from the decontamination trailer will be collected and stored prior to treatment.

5.0 MATERIAL EXCAVATION (AOCs 1 THROUGH 4)

AOCs 1 through 4 *in situ* soils have been determined to be contaminated with either PCBs or Pesticide compounds in excess of the Remedial Action Objectives (RAOs) for site soils (Figures 2 through 5). The soils will be characterized in-place for disposal prior to excavation in accordance with the Sampling and Analysis Plan (SAP). Areas will be excavated by OHM to the vertical and horizontal limits based on the figures and in-place sampling. Excavated soil will be directly loaded into transport vehicles, weighed, and transported to the selected treatment/disposal facility. Off-site incineration is planned for the soils from AOCs 1 through 4 exceeding the RAOs. Confirmation sampling will verify that remaining soils meet RAOs prior to backfilling these areas.

The approximate dimensions of each AOC will be marked prior to beginning excavation. The contaminated soils in each AOC will be removed to the pre-determined dimensions as identified from the in-place sampling effort. A tracked excavator equipped with a 1/2 cubic yard bucket will carefully excavate soil. Excavation depths will be manually monitored with a tape measure or equivalent measuring device to avoid any over excavation of soil. After excavation to the specific limits, a visual inspection will be performed on the surrounding soil. If the visual inspections reveal evidence of contaminated soil, OHM will consult with the NTR to discuss and/or recommend the extent of additional excavation. Exposed excavation areas with no evidence of contaminated soil will undergo verification sampling and analysis utilizing an on-site laboratory equipped with a gas chromatograph (GC). Areas indicated clean will be resampled and samples routed to the designated off-site analytical laboratory for confirmatory analysis as discussed in the SAP (Section 7).

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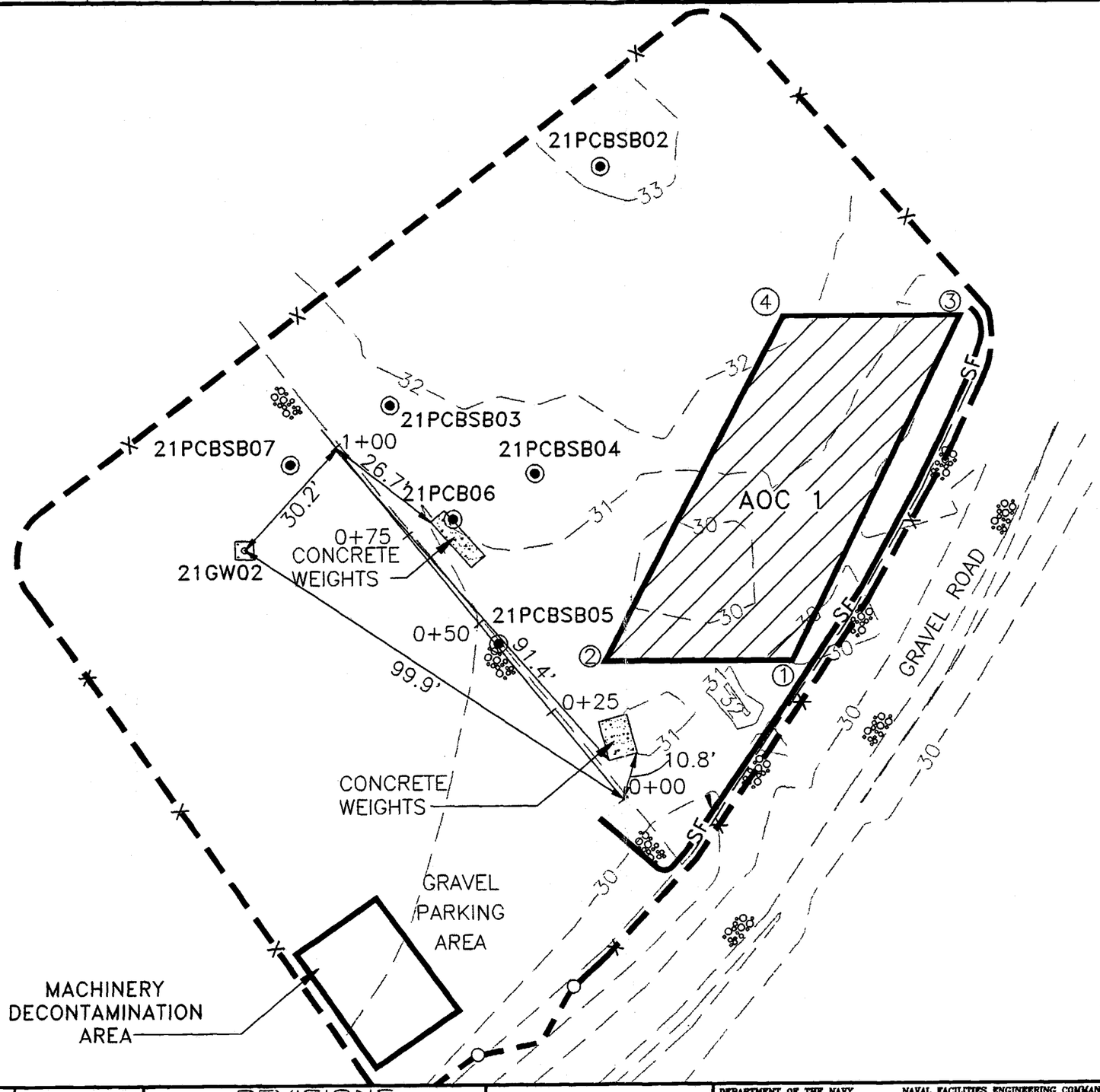


POINT NUMBER	STATION	OFFSET
1	0+00	48'R
2	0+26.5'	16.5'R
3	0+35'	125'R
4	0+60'	94'R

SITE 21
AREA OF CONCERN NO. 1

25 0 12.5 25
1 INCH = 25 FEET

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

SUBMITTED: [signature] PROJECT MANAGER DATE: 3/15/95
APPROVED: [signature] PROJECT MANAGER DATE: 2/15/95

AT FULL SCALE (IF NOT 8"-SCALE ACCORDINGLY)
CADD FILE: FIG2.DWG
DRAWN: J. COLLINS
DESIGNED: -
CHECKED: JJD

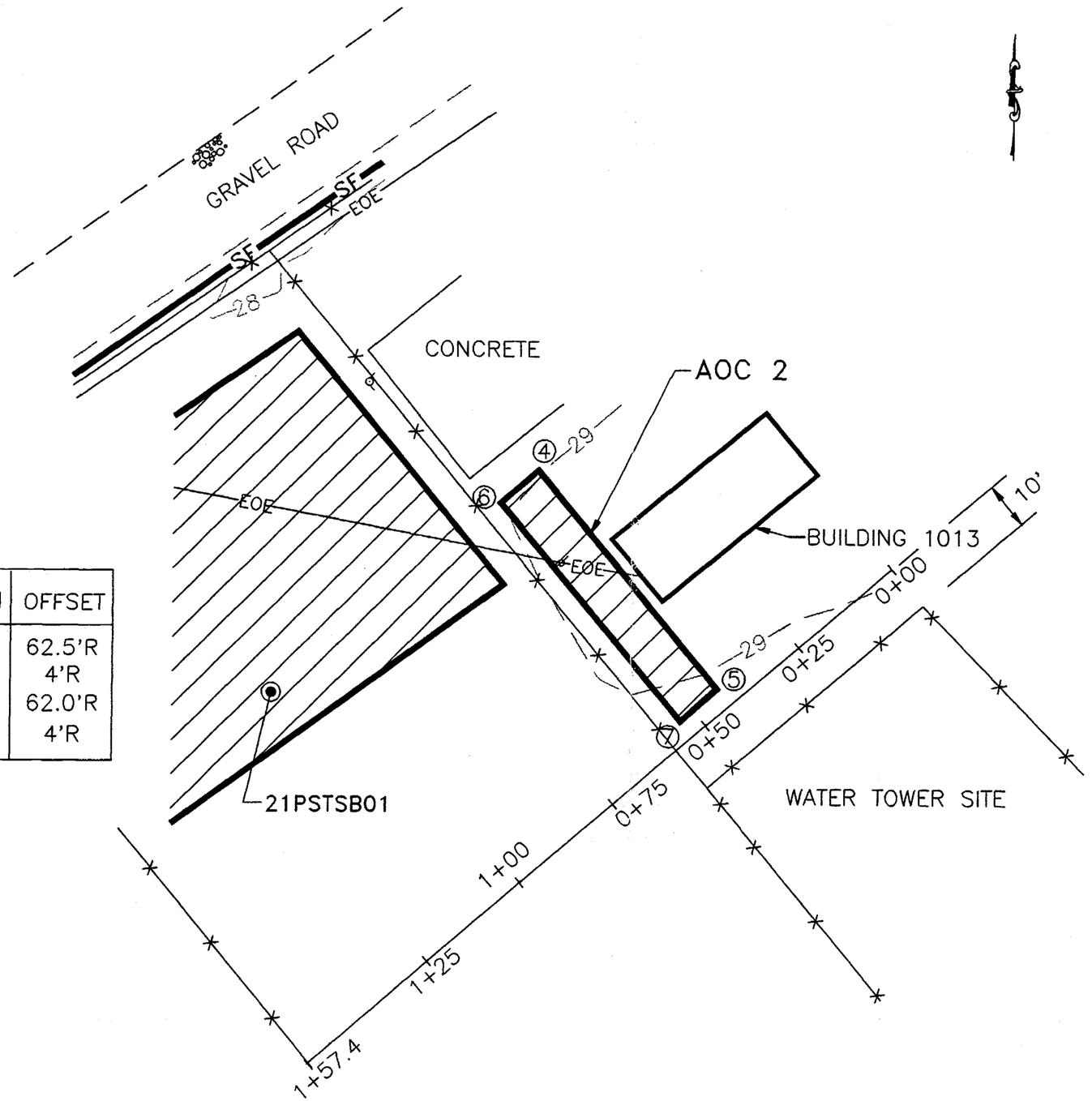
REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1	ISSUE FOR REVIEW & APPROVAL	OHM	3/1/95	

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
LANTDIV RAC CONTRACT N62470-93-D-3032 DELIVERY ORDER NO. 0062
OPERABLE UNIT NO. 1 MARINE CORPS BASE, CAMP LEJEUNE, N.C.

REMEDIAL ACTION WORK PLAN
FIGURE 2
AOC 1 SITE LOCATION PLAN

01533S032



POINT NUMBER	STATION	OFFSET
4	0+42.5'	62.5'R
5	0+43'	4'R
6	0+53'	62.0'R
7	0+53.5'	4'R

SITE 21
AREA OF CONCERN NO. 2

25 0 12.5 25
1 INCH = 25 FEET

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

SUBMITTED: PROJECT MANAGER DATE: 3/15/95
APPROVED: SR. PROJECT MANAGER DATE: 3/15/95
APPROVED: DEPT. MANAGER

AT FULL SCALE (IF NOT 2"-SCALE ACCORDINGLY)
CADD FILE: FIG3.DWG
DRAWN: J. COLLINS
DESIGNED: —
CHECKED: JAD
CHECKED: —

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1	ISSUE FOR REVIEW & APPROVAL	OHM	3\15\95	

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION — NORFOLK, VIRGINIA
LANTDIV RAC CONTRACT N62470-93-D-3032 — DELIVERY ORDER NO. 0062
OPERABLE UNIT NO. 1 — MARINE CORPS BASE, CAMP LEJEUNE, N.C.

REMEDIAL ACTION WORK PLAN
FIGURE 3
AOC 2 SITE LOCATION PLAN

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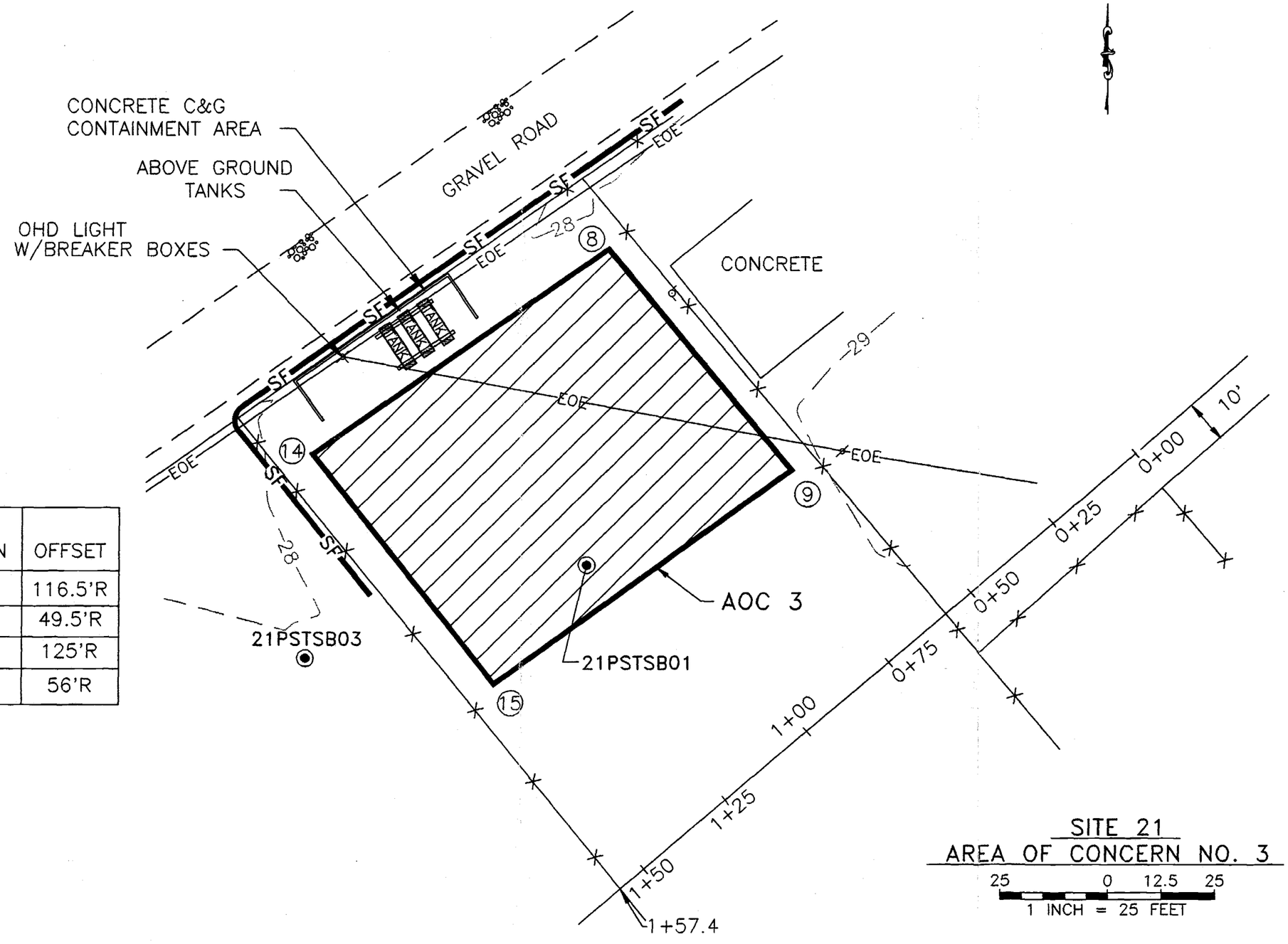

POINT NUMBER	STATION	OFFSET
8	0+62'	116.5'R
9	0+63'	49.5'R
14	1+46'	125'R
15	1+49'	56'R

SITE 21
AREA OF CONCERN NO. 3

25 0 12.5 25
1 INCH = 25 FEET

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

SUBMITTED: PROJECT MANAGER DATE: 3/15/95
APPROVED: DEPT. MANAGER DATE: 3/15/95
APPROVED: DATE:

AT FULL SCALE (IF NOT 2"-SCALE ACCORDINGLY)
CADD FILE: FIG4.DWG
DRAWN: J. COLLINS
DESIGNED: —
CHECKED: JAD
CHECKED:

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1	ISSUE FOR REVIEW & APPROVAL	OHM	3\15\95	

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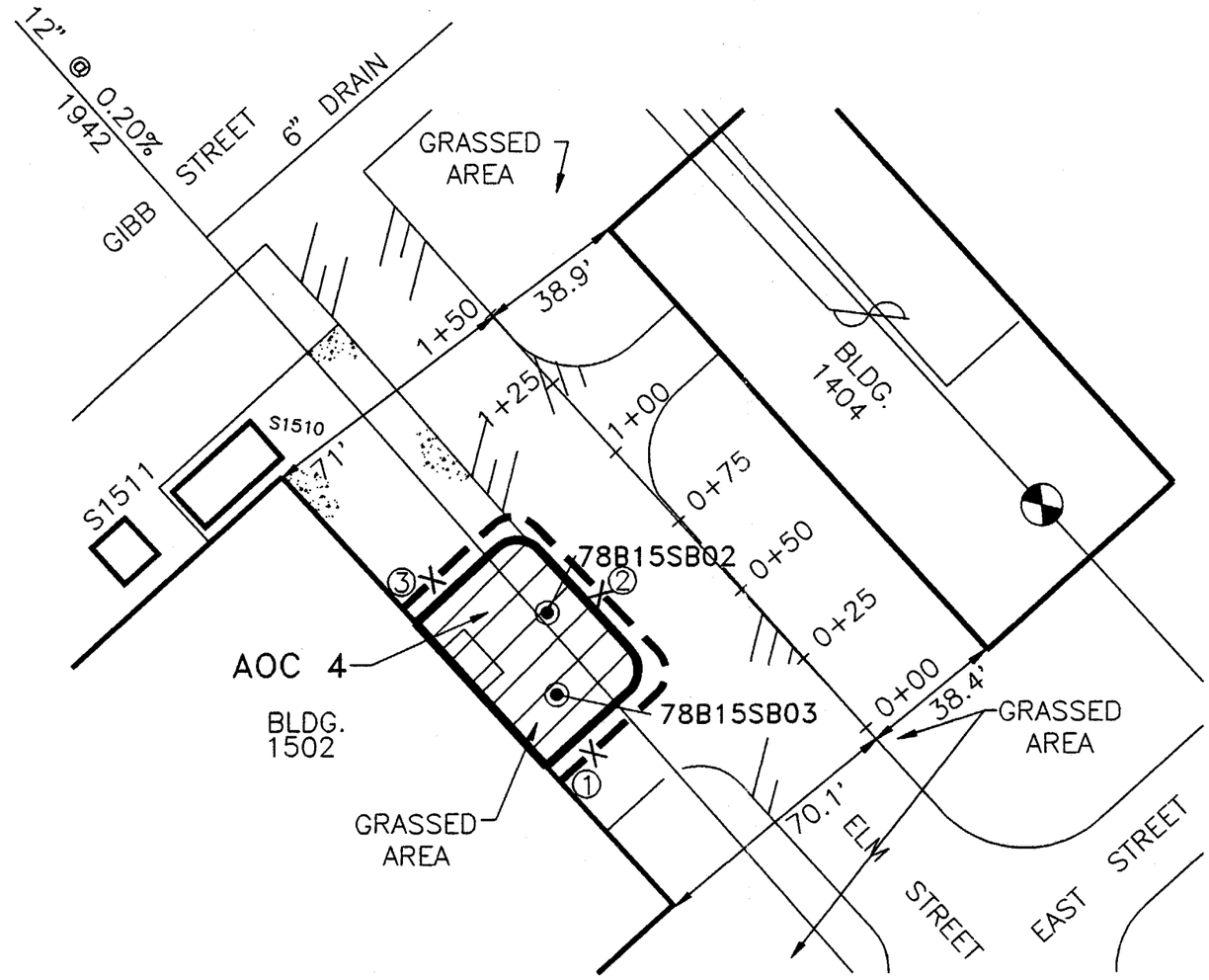
REMEDIAL ACTION WORK PLAN
FIGURE 4
AOC 3 SITE LOCATION PLAN

01533 S052



POINT NUMBER	STATION	OFFSET
1	0+50'	70'L
2	0+76'	33'L
3	1+02'	70'L

—X—X— SILT FENCE

SITE 78
AREA OF CONCERN NO. 4

40 0 20 40
1 INCH = 40 FEET

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

SUBMITTED: _____ PROJECT MANAGER DATE: 3/15/95
APPROVED: _____ QC PROJECT ENGINEER DATE: _____
APPROVED: _____ DEPT. MANAGER DATE: 3/15/95

AT FULL SCALE (IF NOT 2"-SCALE ACCORDINGLY)
CADD FILE: FIG5.DWG
DRAWN: J. COLLINS
DESIGNED: —
CHECKED: MJS
CHECKED: _____

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.
	1	ISSUE FOR REVIEW & APPROVAL	OHM	3\1\95	

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
ATLANTIC DIVISION
NAVAL STATION NORFOLK, VIRGINIA
LANTDIV RAC CONTRACT N62470-93-D-3032 DELIVERY ORDER NO. 0062
OPERABLE UNIT NO. 1 MARINE CORPS BASE, CAMP LEJEUNE, N.C.

REMEDIAL ACTION WORK PLAN
FIGURE 5
AOC 4 SITE LOCATION PLAN

6.0 PREPARATION OF REQUIRED DOCUMENTATION

6.1 INTRODUCTION

All trucks used for transporting material will be decontaminated prior to leaving the project site to prevent the off-site spread of contaminants. When all contaminated soils have been loaded for transportation, OHM will remove residual soils from the excavator by scraping and brushing, prior to moving to the next AOC. Upon completion of excavation activities, the excavator will be moved to the decontamination pad for final decontamination by pressure washing.

Personnel involved with excavation will be attired in Level C Personal Protective Equipment (PPE). Used PPE will be placed in the trucks with the soil for disposal.

All hazardous waste destined for off-site treatment/disposal will be transported by licensed hazardous waste haulers. All trucks will pre-weigh at the base scales to establish their tare weight prior to being loaded with contaminated soil. After loading and prior to exiting the controlled area, a pressure washer will be used to decontaminate the truck's tires and trailer sides. The trailer will then be tarped and weighed at the base scales. Each load will be properly manifested for the designated hazardous waste disposal facility. LANTDIV, or designated MCB Camp Lejeune personnel, will be responsible for signing manifests as the generator for each off-Base shipment.

6.2 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

- Aptus Environmental
  Coffeeville, KS
- Browning-Ferris Industries
  Charlotte, North Carolina
- Chemical Waste Management
  Port Authur, Texas
- LWD
  Calvert City, Kentucky

Transportation

- A.R. Paquette & Company (SB)
  Glenwood, Florida
- EPA Transportation Services (SDB, WBE)
  Rose City, TX
- Chemical Development Corp. (SB, WBE)
  Tierra Verde, Florida
- Hilco Transport Inc. (SB, WBE)
  Wilmington, North Carolina
- Robbie D. Wood
  Dolomite, Alabama
- Terra First
  Jacksonville, FL

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 could be performed by a small business or small disadvantaged business. The pesticide-contaminated soils have been tentatively schedule for disposal by incineration at LWD, Inc. located in Calvert City, Kentucky. The PCB-contaminated soils have been tentatively schedule for disposal at Aptus Inc. located in Coffeeville, Kansas. It is anticipated that decontamination liquids will be sent to the Base POTW for treatment.

6.3 PREPARATION OF REQUIRED DOCUMENTATION

OHM will prepare (or oversee the preparation of) all paperwork associated with off-site disposal for review and signature by LANTDIV and Camp Lejeune representatives. This will include TSDF waste profiles, hazardous waste manifests, land disposal restriction forms, labels and all other paperwork. The selected vendor(s) will be required to provide all labels, manifests, LDR forms, and other 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 labels, manifests, LDR forms and other shipping paperwork will be received by OHM's on-site personnel at least 5 days 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 all vehicles and containers were decontaminated prior to leaving the disposal site will be provided within three days of receipt of the waste materials. 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 destruction will be provided within seven days of the date of actual waste disposal and for final payment of all invoices.

6.4 WASTE PACKAGING

OHM plans to excavate and load all soils directly into end-dumps. This will be a continuous operation and wastes will be transported directly to the disposal facility at that time. No provision will exist for on-site stockpiles or on-site storage for roll-offs or dumps.

Non-hazardous materials will be accumulated on-site until sufficient quantities are available for shipment of a full load (≈80 drums or 20-30 cubic yards). OHM will conduct weekly inspections of the waste storage areas. All temporary storage will be in compliance with 40 CFR 262.34 and the applicable North Carolina regulations.

6.5 SHIPPING

The Site Supervisor will contact the selected vendor and schedule waste pick-ups 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 the attached Waste Disposal Activities Checklist. This checklist is to be completed for each waste shipment leaving the site. A copy of the completed form will be provided to the CO prior to waste transportation and with the Final Report.

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 FIELD SAMPLING PLAN

7.1 CONFIRMATION AND WASTE CHARACTERIZATION SAMPLING

Subsequent to removal of contaminated soils, AOC-1 through AOC-4 will be sampled to determine if the RAOs for site soils have been met. Sampling will be based on the surface area of each AOC excavated, with approximately one sample collected for each 500 square feet of surface area and one sample for each 50 linear feet of sidewall.

Verification analyses will be conducted in an on-site mobile laboratory. Unsatisfactory results may warrant a decision to continue excavation which will be made by the NTR based upon the analytical results and OHM's recommendations. When results indicate satisfactory removal of the contaminants of concern, confirmation samples will then be collected at the floor and the walls of the excavation. Confirmatory analysis for this project will be performed by an off-site NEESA-certified laboratory. Data packages will include all forms required for NEESA Level C. Data validation will be performed on all confirmatory data by an independent qualified and experienced subcontractor.

Waste characterization will be conducted on soil, debris and water matrix where required by the disposal facility. This disposal analysis will be performed by an off-site NEESA-certified laboratory. A Level C data package will not be required for this analysis.

7.2 PROJECT MANAGEMENT

The project management organization is based on specific project requirements. The project team and their responsibilities are described in this section. The project manager is the primary contact for both the site supervisor and the Navy's Remedial Project Manager (RPM). The PM will coordinate activities with other Camp Lejeune projects on-site and perform overall project management tasks. The Site supervisor is the primary contact for the NTR. He will be responsible for day-to-day 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 available on an "as-needed" basis to assist in successful project execution. The project manager will be supported by a supervisory, health and safety, and QA/QC staff to ensure that the project is safely executed in compliance with applicable laws, regulations, statutes, and industry codes.

Each specific project will be assigned to a project manager. Reporting to the project manager may be several individuals fulfilling as required the roles of site supervisor, project chemist, site safety officer, project engineer and QA/QC officers. These individuals are responsible for fulfilling appropriate portions of the project QA program in accordance with assignments made by the project manager. The project manager is responsible for satisfactory completion of the project QA program. Specific responsibilities may be assigned by the project manager to the site supervisor and other members of the project staff.

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

Project Manager – James A. Dunn, Jr., P.E.
The project manager is responsible for the overall direction of this project executed under his/her supervision. The project manager provides the managerial administrative skills to ensure that resource allocations, planning, execution, and reporting meet contract requirements. The project manager 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 of changes in the scope of work
- Supervision of preparation and review and final approval of project-specific procedures, work plans, and other project plans
- Approval of project design bases, design parameters, drawings, and reports
- Approval of project remedial action/construction methodologies
- Dissemination of project-related information from the client such as design bases, input parameters, and drawings
- Liaison for communications with the RPM
- Decision of whether or not drawings require independent review
- Resolve nonconformances and changes in project documents and activities
- Determination of the effect of nonconformances on the project and the appropriateness for reporting such items to the RPM/NTR, and providing appropriate documentation for reporting
- Notification of project and QA personnel of nonconformances and changes

- Notification of the project staff and, as appropriate, QA personnel of void project-related documents and information
- 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 project field activities.

Site Supervisor – Randy E. Smith

The site supervisor is responsible for the day-to-day management of this specific delivery order. The site supervisor will ensure sufficient resource allocations to maintain project schedule and budget. He will provide daily feedback to the Camp Lejeune OHM project manager on project progress, issues requiring resolution, etc. The quality-related responsibilities of the site supervisor can 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 of subcontractor services
- Liaison for communications with OHM project staff and other internal groups as well as with the NTR and on-site inspector
- Supervising 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 Chemist – Terence Whitt

The project chemist is responsible for implementing the project plans and ensuring that the chemical quality assurance and data quality objectives are being met for the project. He/she is also responsible for informing the QC engineer of any site-specific problems and for coordination of QA efforts with the contracted laboratory. His/her specific responsibilities include, but is not limited to:

- Tracking validation data and ensuring adherence to published guidelines
- Determining if the levels of QA are being met for the project in accordance with this plan
- Certifying the level of QA that has been achieved during the generation of analytical data
- Implementing QA/QC procedures
- Assuring the continuity of chain-of-custody evidence
- Initiating and overseeing all audit functions
- Work with the QC engineer to compile and submit required QA reports (QARs)
- Compiling, revising, updating, and submitting SAPs
- Implement corrective actions as required and ordered by the QC engineer or QC manager
- Reviewing subcontractor's QA Manuals and/or Laboratory Quality Management Plans (LQMPs)
- Ongoing QA/QC training of new and current personnel
- Stopping work if quality objectives are not being met.

Field Chemist – Missy Art

The field chemist will:

- Oversee all field sampling
- Performing field analyses utilizing an on-site gas chromatograph
- Fill out sample tracking forms and related analytical and QC forms and logbooks
- Report QC data to the project chemist

Sample Technician – To Be Determined

The sample technician will be responsible for:

- Carrying out all sampling in accordance to approved procedures and methodologies as defined in the SAP

- Generating trip blanks, field blanks, equipment blanks, and acquiring field duplicate samples as required by the SAP

- Completing sampling logbooks, sampling forms, and chain-of-custody forms.

7.3 SAMPLING AND ANALYSIS

7.3.1 Types of Samples

In general, two basic types of sampling techniques are recognized : composite samples and grab samples.

Composite Samples

Composite samples are combinations of more than one subsample collected at various sampling locations and/or different points in time. Area composites are samples composited from individual grab samples that are collected on an areal or cross-sectional basis. Area composites will be made up of equal volumes of grab samples; each grab sample will be collected in an identical manner. Examples of area composites include: sediment composites made up of quarter-point grab samples from a stream, soil samples from grid points on a grid system, water samples collected at various depths at the same point or from quarter-points in a stream, etc.

Analyses of composites yield an average value and can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing of samples can mask problems by diluting isolated concentrations of some hazardous compounds to below detection limits. Compositing should not be performed when sampling for volatiles, oil and grease, or microbiological analysis. When compositing trace organics and/or metals, only stainless-steel, glass or Teflon bowls and spatulas should be used.

Grab Samples

A grab sample is defined as a single sample representative of the specific location at a given point in time. The sample is collected all at once and at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples decreases.

7.3.2 Site-Specific Sampling Events

The sampling events for this project include the following:

- Post-excavation soil sampling (verification samples)
- Post-excavation soil sampling (confirmation samples)
- Excavated materials to be shipped off-site (disposal characterization samples)
- Decontamination water and PPE (disposal characterization samples)

7.3.3 Soil Sampling

Disposal Characterization Samples

Waste characterization samples will be collected for the purpose of determining handling, transportation, and disposal requirements and for determining personal and environmental protection and monitoring requirements.

Characterization samples will be collected from the soils from each AOC (1, 2, 3, and 4). One thoroughly mixed composite sample will be collected for each AOC. The composite sample will consist of six grab samples from the most soiled areas of the material being sampled. The grab samples will be thoroughly mixed to obtain a relatively homogenous mixture.

Sampling equipment will be thoroughly cleaned between samples using the decontamination procedure described in Section 7.3.8. Field sampling personnel will wear disposable gloves during sampling and will change gloves between sample locations to minimize the potential for cross-contamination.

Verification and Confirmation Samples

After soils have been removed from the excavation at each AOC and on-site verification samples show levels below the cleanup criteria, confirmation samples will be taken from the excavation floor and sidewalls to determine if Remedial Action Objectives (RAOs) have been met. Samples will be taken at the rate of one sample per 500 sq. ft. of excavated surface area and one sample every 50 linear feet of side wall.

All samples will be collected using stainless steel hand augers and will be composited using stainless steel spoons and stainless steel or glass bowls. Sampling equipment will be thoroughly cleaned between samples using a detergent water wash and distilled water rinse. Field sampling personnel will wear disposable gloves during sampling, and will change gloves between sample locations to minimize the potential for cross-contamination.

Required analysis for each AOC, as well as sample volumes and field QC requirements are included in Table 7.1.

Table 7.1
Soil Sampling and Analysis

Sample Location	Frequency	Required Analysis	Sample Volume/ Preservation	Analytical Level/Field QC
Disposal Characterization		14-day TAT		FB = 1 per source* RB = 1 per day*
AOC-1, 2, 3 and 4	1 composite sample of 6 grab samples	Characterization Analysis: TCLP Volatiles (1311, 8240) TCLP Semi-Vols (1311, 8270) TCLP Pesticides (1311, 8080) TCLP Herbicides (1311, 8150) TCLP Metals (1311, 6010, 7470) TCL Inorganics (8240, 8270, 8080) TAL Organics (6010, 7060, 7471, 7740) RCRA Characteristics: (Flashpoint, pH, Reactive Sulfide, Reactive Cyanide) Percent Moisture Paint Filter 9095	1 x 4 ounce glass (Volatiles/4°C) 2 x 8 ounce glass for remaining tests/4°C	
Decontamination water/PPE	As required	As required by disposal facility	As needed	
Verification (On-site Laboratory)		24 hour TAT DDT, DDD, Chlordane, A-1260 PCB by Modified 8080	1 x 4-ounce glass	FD = 10%
Confirmation		48 hour TAT		NEESA Level C FB = 1 per source EB = 1 per day FD = 10%
AOC-1, 2, 3 and 4	1 grab sample per 500 sq. ft. of excavated + 1 grab sample per 50 linear feet of side wall	PCBs (8080)	1 x 8 ounce glass/4°C	

Notes:
FB = Field Blank – to be analyzed for full required analysis
RB = Rinsate Blank – to be analyzed for full required analysis
FD = Field Duplicate – to be analyzed for full required analysis
TB = Trip Blank – to be analyzed for volatiles only

*Collect if equipment is field cleaned

7.3.4 Sample Identification

All samples collected on-site will be provided with a unique sample designation. This will be comprised of a sample number along with the sample identification. The sample number format will appear as follows:

CLJXX-Y-NNN

Where:

XX = D.O. for project (62)
Y = Type of sample S = Soil, L = Liquid
NNN = Sequential number starting at 001

If the sample is a QA/QC sample, add the appropriate designations from below to the end of the sample number.

FB = Field Blank
TB = Trip Blank

RB = Rinsate Blank
D = Duplicate

Additional information will be required in the sample identification (ID) column. This will include operable unit, site designation, AOC number, and any grid coordinates associated with the sample. An example of the sample ID is:

OU1/Site 21/AOC2/Grid X7, Y19

7.3.5 Sample Preservation

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. This preservation method is in addition to any chemical preservation required by the analytical laboratory and is not intended, nor should it be used, in place of that type of preservation. All other shipping guidelines listed in the following sections will be utilized.

7.3.6 QA/QC Samples

The appropriate number of field QA/QC samples will be collected during this project. These samples will include field blanks, rinsate blanks and duplicate samples. These samples will be collected at the following frequencies:

- 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 must be collected and analyzed for the same parameters 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 must be collected daily for NEESA Level C reporting.

- Field Duplicate – Duplicates for soil samples are collected, homogenized, and split, except volatiles, which are not homogenized and split. Volatile samples are select segments of soil which are taken from the length of the core and placed in 4 oz glass jars. The duplicates for water samples should be collected simultaneously. Field duplicates must be collected at a frequency of 10% per sample matrix for Level C reporting. All the duplicates should be sent to the primary laboratory responsible for analysis, along with the samples. The field duplicates should be used by the laboratory to prepare the laboratory duplicate or matrix spikes.

- Trip Blank -- Trip blanks are defined as samples which originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile samples. One trip blank should accompany each cooler containing volatiles, should be stored at the laboratory with the samples, and analyzed by the laboratory. Trip blanks are only analyzed for volatile organic compounds.

7.3.7 Personal Protection

It has been anticipated that activities in AOC 1 through AOC 4 will be conducted in Level C. Level C will include tyvek overgarments, steel toe boots with tingley overboots, nitrile gloves, respiratory protection and hard hats. All soil sampling will be conducted in Level C.

The Site-Specific Health and Safety Plan governs all personal protection levels and discusses these levels in detail.

7.3.8 Equipment 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), using a stiff brush to remove all surface contaminants

3) Rinse thoroughly with tap water

4) Rinse thoroughly with deionized water

5) Rinse twice with pesticide grade isopropanol

6) Rinse thoroughly with organic-free water and allow to air dry (Do not rinse with distilled/deionized 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 stored in holding tanks for treatment through plant.

7.3.9 Sample Log Book

It is necessary for the sampling crew to maintain daily field notes. Items that must be included are sampling protocol, any changes to the procedures, meetings, instructions, safety precautions, personnel protection, and activities pertaining to the samples. The person taking notes must be knowledgeable enough about these activities to know which details are important.

Repetition of information recorded in other permanent logs should be avoided; but enough should be recorded to present a clear and accurate picture of technical activities. At a later date, should a question arise concerning a specific event or a procedure used, it will be answered from these notes. Some items that would be considered noteworthy are as follows:

- Termination of a sample point or parameter and reasons
- Unusual appearance or odor of a sample
- Depth of groundwater, if encountered
- 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, regulatory agencies, NTR, project manager, or supervisor.
- Details concerning any samples split with another party
- Details of QC samples obtained

These notes must be dated and signed (each page) for validity in a court of law. 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.

All samples should be logged in the logbooks. The following columns are standard for all projects:

1) DATE -- Date sample was obtained

2) SAMPLE NUMBER -- Consecutive series of numbers which are assigned to every sample.

3) LOCATION -- Description of area sampled

4) TIME -- Military time sampled

5) SAMPLERS -- Initials of persons obtaining sample (usually two, at least witnessing if not involved in actual sampling task)

6) DESCRIPTION OF SAMPLE -- Physical description of sample (e.g., clear, cloudy, odor)

7) WEIGHT OR VOLUME -- Size of sample (500ml, 1L, etc)

8) DATE RESULTS ARE DUE -- Date analytical results should be reviewed

9) LABORATORY -- Laboratory who performed analytical work

10) RESULTS -- Will vary according to project requirements; should be in consistent units (ppm, ppb, etc.,) when possible

11) CHAIN-OF-CUSTODY NUMBER-- For samples sent to laboratory or given to client

12) ADDITIONAL COMMENTS -- Space reserved for any other information concerning particular sample or special procedure or analysis.

13) PRESERVATIVES -- Preservatives used or included by the lab

14) DATE SAMPLES SENT -- Date samples were sent to the lab

15) AIRBILL NUMBER

The following guidelines will be implemented for all log books:

- Each page will be signed, dated, and numbered;

- Blank pages will be identified as such;
- The time of each entry will be noted (24 hour clock);
- Logbook extensions (field sheets, purge records, etc.) will be recorded in the logbook; and
- Logbooks will be returned to the site supervisor upon completion, during periods of absence, and at the end of the investigation.

This information will also be entered into the data base program that has been prepared for this site. It will be entered daily by the chemist or sample tech for the site. This person will be the point of contact for all sampling and analytical information. Report outputs from the database is an acceptable substitute for the sample log book.

7.3.10 Sample Labeling

Samples other than *in situ* measurements are identified by a sample label attached to the sample container. Included on the label is the following information:

1) OHM PROJECT NUMBER
2) DATE -- Month, day, year
3) TIME -- Military time of sample collection
4) SAMPLE NUMBER -- see Table 1 for designations
5) SAMPLE DESCRIPTION
6) TAKEN BY -- Sampler name
7) WITNESS

The information described above should be printed neatly using an indelible marker. After the sample is taken and the label is securely attached, the sample is logged into the sample log book.

7.3.11 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 should 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 opening of the sample transport containers. An example custody seal is included in Appendix A.

7.3.12 Chain-of-Custody (COC) 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 COC form will include the following information:

1) PROJECT NAME

2) PROJECT LOCATION -- City and State in which the project is located

3) JOB 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) PROJECT TELEPHONE NUMBER -- Telephone number of on-site office trailer or number where person responsible for samples can be contacted.

6) DATE -- Month, Day, Year

7) TIME -- Military time

8) SAMPLE IDENTIFICATION -- Sample number/location

9) BOTTLE SIZE -- 12 ounces, 8 ounces, 1 liter, etc.

10) ANALYSES REQUESTED

11) LABEL, TAG NO./ REMARKS

12) AIRBILL NO

13) LABORATORY -- Laboratory where samples are to be sent

14) PHONE -- Telephone number of laboratory

15) ATTN -- Contact for laboratory

16) RELINQUISHED BY -- Signature of sender (OHM)

17) DATE -- Date samples are sent

18) TURNAROUND TIME -- Turnaround times requested or date the results are required from the lab.

The COC needs to be sealed in a ziploc bag and taped in place on the underside of the top of the sample transport container (cooler).

7.3.13 Shipment of Samples

Samples will be shipped via Federal Express to the appropriate laboratory. Also, COCs have been prepared accordingly and are organized according to sampling events.

The following 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.

1) Samples must be shipped in "strong outer packaging". A plastic cooler is acceptable.

2) Both the shipper's and receiver's addresses must be on the container.

3) The following shipping name must be printed on the container:

   OTHER REGULATED SUBSTANCES,
   ID # 8027

4) A Class 9 hazardous material shipping label must appear on the top of the box.

5) Inner packages cannot exceed 1 gallon each, and the entire shipment (cooler, samples, and absorbent) cannot exceed 66 lbs.

6) Coolers must be packed with absorbent such as vermiculite or kitty litter.

7) Inner containers should have their lids secured with tape or wire.

8) The materials must be shipped using a Federal Express Hazardous Materials Airbill

9) Any questions regarding shipment of samples should be referred to OHM's Norcross, Georgia, office.

7.4 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.

7.4.1 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.

The following paragraphs outline the data reduction plan for the collected, data criteria used to validate the data and the decision flow from raw data to the validated concentrations.

These criteria will be used by the contracted analytical laboratory. More detailed procedures should be included in the laboratory's Quality Assurance Plan (QAP), which will be in the laboratory files at the Norcross, Georgia, office.

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
- Verifying that all QA/QC checks are supportive of data
- Verifying that all documentation is complete and accurate in respective log books

- Verifying that all chromatograms and strip chart recordings are labeled with data, instrument number, run parameters and analyst

Conventional Parameters

Data calculation and reduction will be performed as described in the individual approved methods.

Trace Metal Parameters

Atomic Absorption Spectrophotometry is based upon the principle in which the amount of light of a particular wavelength absorbed by a specific metal will enable the percent absorption to be determined and then used to ultimately calculate the absorbance. Since absorbance is directly related to concentration, a plot of the two parameters is linear in certain operable ranges and allows for the determination of unknown concentrations in solutions (direct samples or extracts) after measurement of absorbance. The computer system controlling the instrument actually completes the calculations and reports the concentration in mg/l. The following equations show how the final sample concentration is calculated using the instrument calculated concentration.

$$\text{mg/l metal} = \frac{A(Vi)\ (D)}{(Vf)}$$

Where:

A = Concentration from instrument in mg/l
Vi = Initial volume (before digestion) ml
Vf = Final volume (after digestion) ml
D = Dilution factor if necessary

$$\text{mg/kg metal} = \frac{A(Vf)\ (D)}{W\ (P)}$$

Where:

A = Concentration from instrument in mg/l
Vf = Initial volume (before digestion) ml
D = Dilution factor if necessary
W = Sample weight in g
P = Percent solids in decimal (if results in dry weight are needed)

Organics

Gas Chromatograph Results

Calculations are performed for each analyte after its identification is determined. Identification is based upon the retention time of the suspect peak compared to the retention time of the external standard. The concentration of the analyte is determined by using the calibration curve and the peak area of the analyte. A calibration factor is determined from the calibration curve and used to calculate the concentration.

Gas Chromatograph/Mass Spectrometry Results

Qualitative identification of an analyte is determined by obtaining the extracted ion current profiles (EICPs) for the three identifying mass ions and following the criteria listed below:

- The intensity of the three characteristic masses of each analyte must maximize within one scan of one another
- The relative peak height ratios of the three characteristic masses must be within ±25 percent when compared to the mass spectrum of the reference standard analyte
- The relative retention time of the suspect peak must be with ±0.06 of the standard reference peak

In order to list structural isomers as separate analytes, they must have acceptable resolution. Acceptable resolution is achieved if the baseline to valley height between the isomers is less than 25 percent of the sum of the two peaks. Otherwise, structural isomers must be identified as unresolved isomeric pairs.

The following equations demonstrate how the actual sample calculations are carried out.

GC Volatiles

$$\text{ug/L (ug/kg)} = \frac{\text{As (D)}}{\text{CF (Vf)(P)}}$$

Where:

As = Area response of targeted analyte
D = Dilution factor if necessary
Vf = Final volume purged in ml or g
CF = Calibration factor from standard analysis
P = Percent solids in decimal (if results in dry weight are needed)

$$CF = \frac{As}{AMT}$$

Where:

As = Area response of targeted analyte
AMT = Amount of targeted analyte in ng

GC/MS Volatiles

$$ug/L\,(ug/kg) = \frac{As\ (AMT)\ (D)}{Ais\ (RF)\ (Vf)\ (P)}$$

Where:

As = Area response for targeted analyte
AMT = Amount of internal standard in ng
D = Dilution factor if necessary
Ais = Area of internal standard
Vf = Final volume purged in ml or g
P = Percent solids in decimal (if results in dry weight are needed)
RF = Response factor from standard analysis calculated as

$$RF = \frac{As\ (AMTis)}{Ais\ (AMTs)}$$

Where:

As = Area response for targeted analyte
AMTis = Amount of internal standard in ng
Ais = Area response of the internal standard
AMTs = Amount of the targeted analyte in ng

GC Extractable

$$ug/L\,(ug/kg) = \frac{As\ (Vf)}{CF\ (Vi)(P)}$$

Where:

AS = Area response for targeted analyte
CF = Calibration factor as explained above
Vf = Final extract volume in uL

Vi = Initial volume in ml or weight in g
P = Percent solids in decimal (if results in dry weight are needed)

To quantitate multicomponent mixtures (i.e., PCBs, chlordane) area summations are used. For PCBs at least five peaks where possible are included in the area summation for quantitation. The same relative peaks (based on pattern and retention times) are used to calculate the calibration factor from the standard. For toxaphene and chlordane total area summations are used for quantitation.

GC/MS Extractable

$$ug/L\,(ug/kg) = \frac{As\ (AMTis)\ (Vf)\ (D)}{Ais\ (RF)\ (Vi)\ (P)}$$

Where:
As = Area response for targeted analyte
AMTis = Amount of internal standard in ng
Vf = Final extract volume in uL
D = Dilution factor if necessary
Ais = Area of internal standard
RF = Response factor as listed above
Vi = Initial volume in ml or weight in g
P = Percent solids in decimal (if results in dry weight are needed)

7.4.2 Laboratory Data Validation

All data generated within the laboratory will be extensively checked for accuracy and completeness. The data validation process consists of data generation, reduction, and three levels of review.

The analyst who generates the raw data has the prime responsibility for the correctness and completeness of the data. All data generated and reduced follows protocols specified in the laboratory. Each analyst reviews the quality of his work based on an established set of guidelines. The guidelines are:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- The appropriate Standard Operating Procedures (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, and 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 meet the overall objectives of the project.

Once the data have been validated, they are ready for report production. The report will contain:

- Description of sample types
- Tests performed, problems encountered during testing
- Dates sampled

- Date received
- Date extracted
- Analytical results
- Reportable limit
- 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.

7.4.3 Project Data Review

Project 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 project chemist is then responsible for informing the Project Manager, Site Supervisor and QC Engineer of any laboratory and/or sampling deficiencies or issues. The project chemist alone should not make decisions on the acceptability of the data. These issues and subsequent decisions will be documented on a report to the Program QC Manager and Project Manager.

QC Engineer Data Review Responsibilities

The QC Engineer is responsible for interfacing with the project chemist, project manager, and the laboratory's QA Officer to resolve any QA/QC issues affecting the data. He/she is also responsible for finalizing any QA/QC issues with the laboratory and/or the project chemist. This includes obtaining a corrective action from the parties involved.

7.4.4 Project Data Validation

Data validation is an extensive review of the data for technical and legal validity. This procedure will be performed only by qualified and experienced personnel of an independent consultant company. The NEESA 20-2-047B and Functional Guidelines for Evaluating Data prepared by USEPA Region IV will be used to review data to ensure that raw data are not altered and that an audit trail is developed for those data which require reduction.

7.4.5 Data Reporting

Generally, preliminary data is faxed to the project manager. This data may or may not have undergone the full laboratory review process and may contain errors and discrepancies. Approximately two days later, the hard and final copy will be received on-site and will be reviewed by the project chemist or scientist, the project manager, and the site QC engineer. Any discrepancies will be brought to the Program QC Manager's attention, who will contact the laboratory regarding the issues.

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.

7.4.6 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 a contractor has completed the project objectives, 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 eight years. All archives are accessed by the archives file master list which is maintained in a separate location from the archives.

7.5 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 Quality Assurance Manual.

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.

7.5.1 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."

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.

7.5.2 Precision

Duplicate and replicate samples analyzed by the laboratory assess the precision of the sampling effort. Control limits for duplicate/replicate RPDs is set at 0 to 20 percent to provide interim guidelines. 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 are based on historical laboratory data.

Present practice is to include Matrix Spike (MS) and Matrix Spike Duplicate (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. This value should be less than 20 percent.

7.5.3 Completeness

The field chemist 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 chemist 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. The minimum acceptable completeness limit is 95 percent.

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.

7.5.4 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.

7.5.5 Method Detection Limits And Practical Quantitation Limits

A number of terms have been used, by the EPA and other technical groups, to express the lowest concentration of an analyte which can be measured. Some of these terms, their definitions, and sources are listed in Table 7.2.

Table 7.2
Definition Of Detection Limit Terms

	Definition	Determination	Calculation	Source
Detection Limit (DL)	The concentration which is distinctly detectable above, but close to a blank	Analysis of replicate standards	Two times the standard deviation that is derived from procedures used to determine MDL	Methods for Chemical Analysis of Water and Blank
Limit of Detection (LOD)	The lowest concentration that can be determined to be statistically different from a blank	Analysis of replicate samples	Three times the standard deviation	ACS Definition
Method Detection Limit (MDL)	The minimum concentration of a substance that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero	Analysis of a minimum of seven replicates spiked at 1 to 6 times the expected detection limit	The standard deviation times the Student t-value of the desired confidence level (for 7 replicates, the value is 3.14)	40 CFR 136 Definition for PA Water Programs
Instrument Detection Limit (IDL)	The smallest signal above background noise that an instrument can detect reliably	Analysis of 3 replicate standards at concentrations of 3-6 times the detection limit	Three times the standard deviation	Contract Laboratory Program
Method Quantitation Limits (MQL)	The minimum concentration of a substance that can be measured and reported	Analysis of replicate samples	Five times the standard deviation	SW-846
Limit of Quantitation (LOQ)	The level above which quantitative results may be obtained with specified degree of confidence	Analysis of replicate samples	Ten times the standard deviation	ACS Definition
Practical Quantitation Limit (PQL)	The lowest level that can be reliably determined within specified limits of precision and accuracy during routine laboratory operating conditions	Interlaboratory analysis of check samples	1) ten times the MDL 2) Value where 86% of laboratories are within 20% of the true value	RCRA SDWA Programs
Contract Required Detection Limit (CRDL)	Reporting limit specified for laboratories under contract to the EPA for Superfund activities	Unknown	Unknown	Contract Laboratory Program

OHM takes very seriously its responsibility to report technically defensible data. Therefore, we have established a Reporting limit (RL) for each analyte in each method. The RL represents the value above which were believe reliable data can be routinely obtained. These Reporting Limits were established by collecting Method Detection Limit (MDL) data and Instrument Detection Limit (IDL) data for analyses from the laboratory. The MDL data were collected using the procedures described in 40 CFR 136 Appendix B. IDL data were calculated using the procedures outlined in the EPA Contract Laboratory Program (CLP) Statement of Work dated December 1987. The MDL/IDL data were then compared to various limits published in EPA methods and in the regulations. For example, for volatile organics,

the MDL data generated in OHM field laboratories were compared to the Practical Quantitation Limits (PQLs) published in SW-846 Method 8240; the PQLs contained in the July 9, 1987 Federal Register Final Rule-making on Appendix IX; the Contract Required Detection Limits (CRDLs) in the CLP Method for volatile organics; and the MDLs in Method 624. Then a Reporting Limit for each analyte, considering all of this information, was established. The RL was set at a level above which we were confident that our laboratories could detect and quantify the analyte consistently. Using this procedure, the Reporting Limits established are generally between 2 and 5 times the laboratory MDL/IDL. This range is consistent with the American Chemical Society definition for the Limit of Quantitation (LOQ).

It is not always possible to use RLs because of the regulating body's or client's requirements. In this case, the MDLs required will be provided by the regulating body or by the client.

7.5.6 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.

7.6 PERFORMANCE AND SYSTEM AUDITS

An audit is defined as a systematic check to determine the quality of operation of field and laboratory activities. It is comprised of the following:

- Performance audits
- 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.

7.6.1 Field Performance Audits

Field performance audits are performed on an ongoing basis during the project as field data are 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.

7.6.2 Field System Audits

System audits of site activities are accomplished by an inspection of all field activities by the QC Engineer. This audit is composed of comparisons between current field practices and standard procedures. The following is a list of criteria to be used in the evaluation of field activities:

- Overall level of organization and professionalism
- All activities conducted in accordance with work plan
- All procedures and analyses conducted according to procedures outlined in this document
- Sample collection techniques versus the site sampling and analysis plan
- Level of activity and sample documentation
- Working order of instruments and equipment
- Level of QC conducted by each field team
- Contingency plans in case of equipment failure or other event preventing the planned activity from proceeding

- Decontamination procedures
- Level of efficiency which each team conducts planned activities at the site
- Sample packaging and shipment

After the audit, any deficiencies are discussed with the field staff, and corrections are identified. If any of these deficiencies might affect the integrity of the samples being collected, the QC Engineer informs the field staff immediately, so corrections can be made.

OHM will also submit to all requests by regulatory agencies, or other clients for external field systems audits.

7.6.3 Laboratory Performance Audits

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 QC Engineer 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, NEESA, etc, are not routinely scheduled. However OHM and its subcontracted laboratories will submit to any external audit upon request by the USEPA or LANTDIV.

7.6.4 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 SAP. An on-site inspection is routinely performed by the laboratory's QA Manager and may also be frequently performed by the OHM QC Engineer. 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.

7.7 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 site SAP
- Failure to adhere to standard operating procedures and methods
- Data completeness below required limits
- Control limits are exceeded for QC samples

If, during system and performance audits, deficiencies or problems are discovered, corrective action will be initiated immediately. The appropriate field and laboratory personnel will be notified immediately and an investigative process will be implemented 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 QC Engineer 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 are not limited to:

- Modifications to procedures
- Recalibration of instruments
- Replacement of solvents, reagents, and/or standards
- Additional training of personnel
- Reassignment of personnel

7.7.1 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 QC Engineer 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 will 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.

7.7.2 Quality Assurance Report

The project manager, QC Engineer, 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 QC Engineer will be responsible for preparing this report weekly or daily, as well as monthly written QA reports to OHM QA management. The Program QC Manager will be responsible for reviewing and approving these monthly reports. Verbal reports will be made on a more frequent basis. All reports will be made available to the Project Manager and LANTDIV. 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.

8.0 SITE RESTORATION

Once the contaminated materials have been removed from the site and the verification sampling has confirmed sufficient removal, OHM will begin site restoration activities.

8.1 BACKFILL

Backfilling operations will be implemented as soon as possible after analytical confirmation that the area is clean, in order to mitigate collection of stormwater within open excavations. The excavated areas will be backfilled with suitable backfill material from the borrow area at Camp Lejeune and regraded to the original contours.

Fill will be spread evenly above the approved subgrade in lifts not exceeding 12 inches and compacted in horizontal layers as nearly even as possible.

8.2 GRAVEL

Upon completion of backfill placement, areas which had previously been graveled will be paved with gravel material meeting NCDOT Standard Specifications For Roads And Structures, Section 905. Material size will be No. 4. Paving thickness will match existing thickness of adjacent areas. Gravel will be completed to 95 percent of maximum density by ASTM D 698 Method D.

8.3 TOPSOIL

After placement of the fill layers in areas not to be graveled, OHM will place and grade 4 inches of topsoil over the excavated area. Topsoil will be placed in such a manner that will control erosion and allow quick germination of vegetation.

8.4 SEEDING

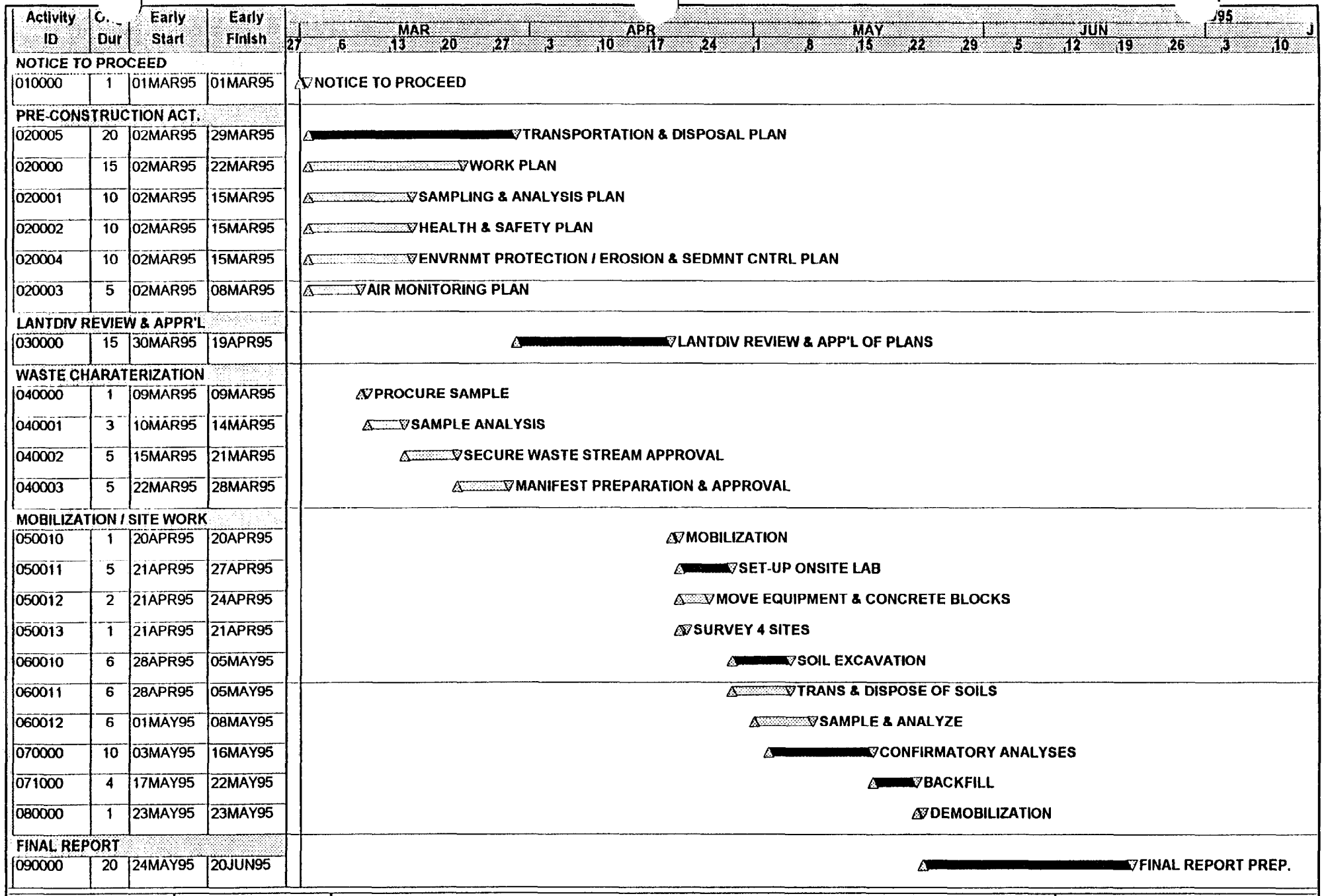
Grass seed matching existing vegetation will be placed at the rate of 5 pounds per 1,000 square feet over topsoil areas. Fertilizer, Type I, Class 2, 10-10-10 analysis will be applied at the rate of 25 pounds per 1,000 square feet. Mulch and water will be applied as required to obtain an acceptable stand of grass.

9.0 DEMOBILIZATION AND FINAL REPORT

All equipment, support trailers and personnel will be demobilized from the project site. A Contractor Close-out Report will be completed and submitted for review and comment.

10.0 SCHEDULE

The project schedule depicts the major tasks and durations to perform the remediation of AOCs 1 through 4.


Activity ID
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27 6 13 20 27 3 10 17 24 1 8 15 22 29 5 12 19 26 3 10
NOTICE TO PROCEED
010000 1 01MAR95 01MAR95 NOTICE TO PROCEED
PRE-CONSTRUCTION ACT.
020005 20 02MAR95 29MAR95 TRANSPORTATION & DISPOSAL PLAN
020000 15 02MAR95 22MAR95 WORK PLAN
020001 10 02MAR95 15MAR95 SAMPLING & ANALYSIS PLAN
020002 10 02MAR95 15MAR95 HEALTH & SAFETY PLAN
020004 10 02MAR95 15MAR95 ENVRNMT PROTECTION / EROSION & SEDMNT CNTRL PLAN
020003 5 02MAR95 08MAR95 AIR MONITORING PLAN
LANTDIV REVIEW & APPR'L
030000 15 30MAR95 19APR95 LANTDIV REVIEW & APP'L OF PLANS
WASTE CHARATERIZATION
040000 1 09MAR95 09MAR95 PROCURE SAMPLE
040001 3 10MAR95 14MAR95 SAMPLE ANALYSIS
040002 5 15MAR95 21MAR95 SECURE WASTE STREAM APPROVAL
040003 5 22MAR95 28MAR95 MANIFEST PREPARATION & APPROVAL
MOBILIZATION / SITE WORK
050010 1 20APR95 20APR95 MOBILIZATION
050011 5 21APR95 27APR95 SET-UP ONSITE LAB
050012 2 21APR95 24APR95 MOVE EQUIPMENT & CONCRETE BLOCKS
050013 1 21APR95 21APR95 SURVEY 4 SITES
060010 6 28APR95 05MAY95 SOIL EXCAVATION
060011 6 28APR95 05MAY95 TRANS & DISPOSE OF SOILS
060012 6 01MAY95 08MAY95 SAMPLE & ANALYZE
070000 10 03MAY95 16MAY95 CONFIRMATORY ANALYSES
071000 4 17MAY95 22MAY95 BACKFILL
080000 1 23MAY95 23MAY95 DEMOBILIZATION
FINAL REPORT
090000 20 24MAY95 20JUN95 FINAL REPORT PREP.
Project Start 01MAR95
Project Finish 20JUN95
Data Date 01MAR95
Plot Date 03MAR95
(c) Primavera Systems, Inc.
Early Bar
Progress Bar
Critical Activity
DO62
Sheet 1 of 1
OHM REMEDIATION SERVICES CORP
LANTDIV - DELIVERY ORDER #62

OHM Remediation
Services Corp.

CONSTRUCTION QUALITY CONTROL PLAN
SOIL REMEDIATION
OPERABLE UNIT 1, SITES 21 AND 78
MCB CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Delivery Order 0062

Prepared by

OHM Remediation Services Corp.
Norcross, Georgia

George E. Krauter, P.E.
Program Manager

Michael I. Gilman
Program QC Manager

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

March 1995

OHM Project No. 16866

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1.0 INTRODUCTION

OHM Remediation Services Corp. (OHM), a subsidiary of OHM Corporation, will provide and maintain an effective Contractor Quality Control (QC) Program as required by contract clauses. This program will be performed in conjunction with the Program Quality Control Plan (OHM, 1993) as applicable and in accordance with the requirements of Contract No. N62470-930D-3032, Atlantic Division (LANTDIV), Naval Facilities Engineering Command (NAVFAC), dated August 1993. OHM will perform the inspections and tests required to ensure that materials, workmanship and construction conform to the LANTDIV-approved drawings and specifications and contract requirements. OHM will perform the tests or inspections specified, unless the required inspection and/or test is specifically designated to be performed by the Government.

The Government, defined as the United States Navy (USN), will perform the quality assurance (QA) role. Supporting the Navy Technical Representative (NTR) is OHM's QC Engineer who will serve to provide quality control.

2.0 PROGRAM ORGANIZATION AND PERSONNEL RESPONSIBILITIES

OHM will implement the Quality Control Plan (QCP) by establishing a Quality Control (QC) organization which reports directly to the Program QC Manager. The QC organization will consist of not less than one QC person who will be responsible for the job site while work is in progress to verify compliance with the contract requirements. The QC organization will be supplemented by additional QC personnel as may be necessary. OHM recognizes that the NTR reserves the right to replace a member of the QC staff who, in the opinion of the NTR, is not accomplishing their assigned duties.

The QCP includes an inspection system, which will be available for review prior to the start of construction and throughout the life of the project. The inspection and testing processes will monitor the overall quality of work, and project controls will be instituted to assure correction of deficiencies identified during the inspections and testing. Project scheduling will be instituted to assure proper sequence and performance of work activities.

The NTR will be notified in writing prior to proposed changes to the QCP, and the proposed changes will be subject to the NTR's approval prior to implementation.

OHM's QC organization chart for Delivery Order No. 0062 is included as Figure 2.1. Professional profiles of OHM's project team and QC organization are provided in Appendix A. The responsibilities of each person identified in the QC organization are presented below.

2.1 PROGRAM MANAGER, GEORGE E. KRAUTER, P.E.

The Program Manager has ultimate responsibility for QC of project deliverables. Specific responsibilities include:

- Reviewing all deliverables prior to submittal to LANTDIV
- Communicating with the Project Manager to ensure project schedule and scope compliance
- Interfacing with the Contracting Officer (CO), Contracting Officer's Technical Representative (COTR), and /or NTR on a regular basis to review project progress and contract compliance
- Reviewing program QC procedures
- Providing cost accounting updates to verify project is within budget

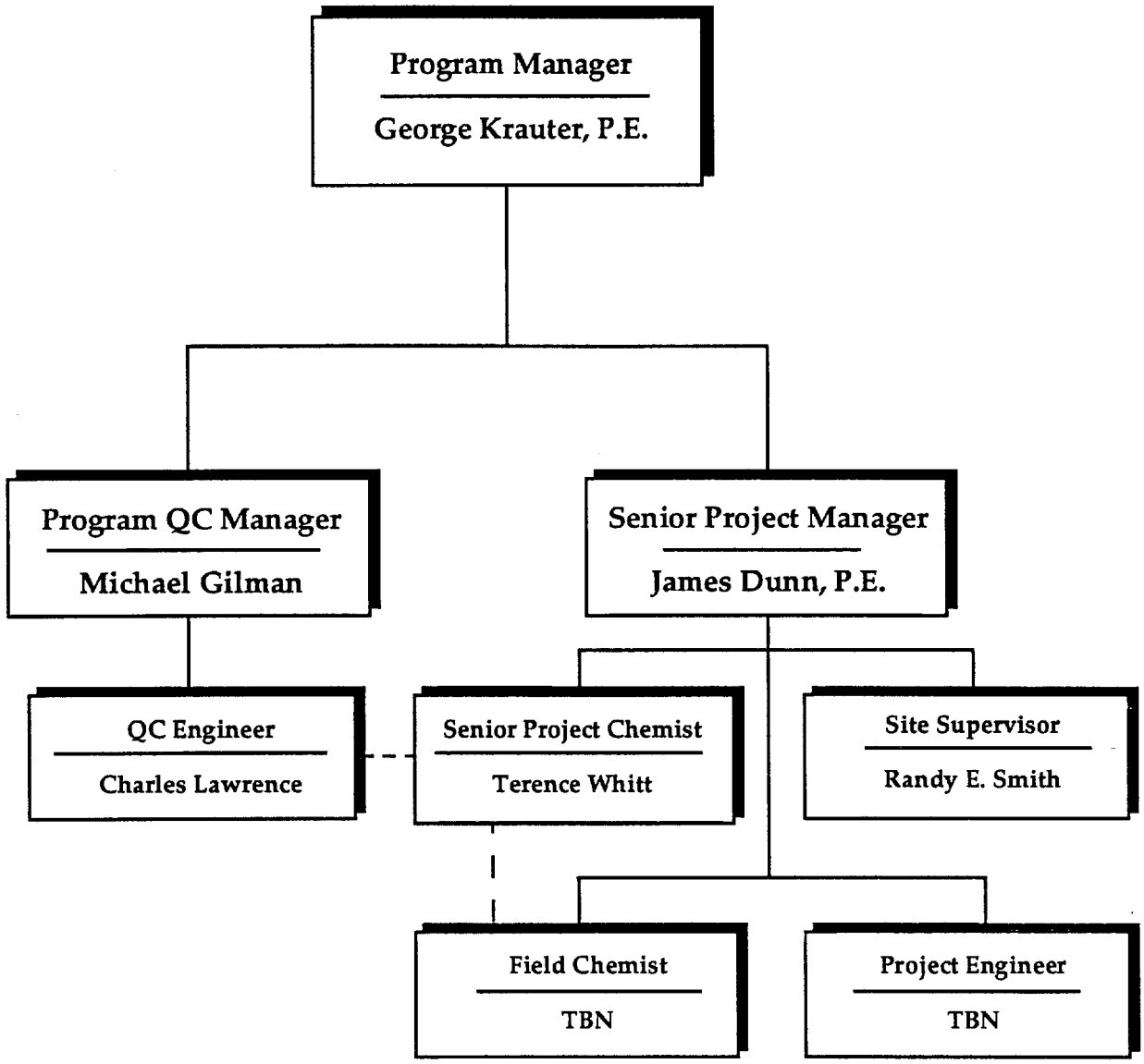

Figure 2.1

QC Organization Chart

OHM Remediation Services Corp.

2.2 PROJECT MANAGER, JAMES DUNN, P.E.

The project manager is responsible for the overall direction of this project executed under his supervision. The project manager provides the managerial administrative skills to ensure that planning, execution, and reporting meet contract requirements. The project manager is ultimately accountable to the program manager 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
- Participating in the coordination and mutual understanding meeting
- Communication to the project staff regarding client requirements and QA practices
- Identification, documentation and notification to the client and project staff of changes in the scope of work
- Review and approve of project-specific procedures, work plans, and other project plans
- Approval of project design bases, design parameters, drawings, and reports
- Approval of project remedial action/construction methodologies
- Dissemination of project-related information from the client such as design bases, input parameters, and drawings
- Liaison for communications with the RPM
- Decision of whether or not drawings require independent review
- Resolve nonconformances and changes in project documents and activities
- Determination of the effect of nonconformances on the project and the need for reporting such items to the RPM/NTR
- Notification of project and QA personnel of nonconformances and changes

- Notification of the project staff and, as appropriate, QA personnel of void project-related documents and information
- 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 Delivery Order Manager and/or the Site Supervisor, who will remain on-site throughout project field activities.

2.3 SITE SUPERVISOR, RANDY E. SMITH

The site supervisor is responsible for:

- Participating in the coordination and mutual understanding meeting
- Supervising all day-to-day site activities in accordance with project and program requirements
- Oversight of subcontractor services
- Preparing the Contractor Production Report
- Initiating corrective actions for non-conformances identified on site
- Communicating with the Project Manager on project progress in all areas
- Maintaining the latest applicable drawings and specifications with amendments and/or approved modifications at the job site and assuring that they are used for shop drawings, fabrication, construction, inspections and testing

2.4 PROGRAM QC MANAGER, MICHAEL I. GILMAN

The Program QC Manager is responsible for:

- Managing implementation of program quality requirements
- Conducting independent audits of site activities

- Overseeing the work of the Project Quality Engineer
- Monitoring non-conformances and corrective actions

2.5 QC ENGINEER, CHUCK LAWRENCE

The QC Engineer is responsible for implementing the project QC Plan to ensure compliance with program requirements and to monitor on-site QC activities. The QC Engineer may also serve as the site QC representative referenced throughout this document.

- Drafting the project CQC Plan
- Reviewing the laboratory QC program for conformance with contract requirements
- Participating in the coordination and mutual understanding meeting
- Interfacing with project technical staff to ensure compliance with program quality requirements
- Conducting periodic independent QA/QC reviews, surveillances, and/or audits of engineering/design/construction activities
- Performing, or causing to be performed, daily inspections and tests in accordance with Section 3.1 of this plan
- Conducting, or causing to be conducted, biweekly QC meetings in accordance with Section 8.2 of this plan
- Coordinating with the site supervisor to ensure that corrective actions are implemented for all non-conformances
- Reviewing the LANTDIV-approved submittal register for the duration of the contract. Appropriate actions will be undertaken should delays or other changes so necessitate
- Authorization to reject materials to be used if they are not in compliance
- Monitoring Rework Items List program
- Accompanying and assisting Government representatives at the prefinal inspection and the final acceptance inspection

- Preparing the daily Contractor QC Report
- Monitoring the Testing Plan and Log for field activities

The QC Engineer is authorized to:

- Temporarily shut down a portion of work if work practices or procedures are determined to be incorrect or out of compliance with the specifications
- Stop a work task or series of tasks after consultation with the site supervisor and NTR in the event that severe weather conditions interfere with the quality of work

2.6 PROJECT ENGINEER, TO BE NAMED

The project engineer is responsible for:

- Providing technical direction and expertise for daily work on-site
- Ensuring the engineering activities on-site are performed in compliance with project drawings and specifications
- Interfacing the site supervisor and QC engineer concerning any technical or engineering issues concerning subcontractors.
- Inspecting major equipment for conformance to the project specifications upon delivery to the site

3.0 METHOD OF INSPECTION AND REWORK

A three phase quality control system will be implemented for each definable feature of work and will include preparatory, initial and follow-up inspections. A definable feature of work is a separate and distinct task that requires separate control requirements. The QC Engineer will ensure that no work proceeds until the appropriate inspection phase has been completed. In addition to and independent of the QC Engineer, the Site Safety Officer (SSO) and Site Supervisor will implement this same control system as a part of their normal duties and responsibilities. The inspection phases are discussed in the following paragraphs.

3.1 THREE PHASES OF CONTROL

The QC Engineer shall perform the three phases of control to ensure that work complies with contract requirements. The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each definable feature of work.

3.1.1 Preparatory Phase

Conduct the preparatory phase with the site supervisor and the person responsible for the definable feature of work. Document the results of the preparatory phase actions in the daily Contractor QC Report. Perform the following prior to beginning work on each definable feature of work:

a) Notify the NTR at least two working days in advance of each preparatory phase;

b) Review each paragraph of the applicable specification sections;

c) Review the contract drawings;

d) Review the inspection schedule

e) Verify that appropriate shop drawings and submittals for materials and equipment have been received and approved in accordance with the Submittal Register. Verify receipt of approved factory test results, when required;

f) Review the testing plan and ensure that provisions have been made to provide the required QC testing;

g) Examine the work area to ensure that the required preliminary work has been completed;

h) Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

i) Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDSs) are on hand; and

j) Discuss construction methods.

As a part of this preparatory work, the QC Engineer will review shop drawings, certificates and other submittal data prior to submission to the NTR. The Project Engineer will also assist with this effort. Each submittal presented to the NTR will bear the date and the signature of the QC Engineer indicating that the submittal has been reviewed and is in compliance with plans and specifications, or show the changes required to meet the specifications. The NTR will be notified a minimum of 24 hours prior to the beginning of each preparatory inspection.

3.1.2 Initial Phase

When crews are ready to start work on a definable feature of work, the QC Engineer will conduct the initial phase with the personnel responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with contract requirements. Document the results of the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

a) Notify the NTR at least two working days in advance of each initial phase;

b) Establish the quality of workmanship required;

c) Resolve conflicts;

d) Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and

e) Ensure that testing is performed.

3.1.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary until the completion of each definable feature of work and document results in the daily Contractor QC Report:

a) Ensure the work is in compliance with contract requirements;

b) Maintain the quality of workmanship required;

c) Ensure that testing is performed; and

d) Ensure that rework items are being corrected.

3.1.4 Notification of Three Phases of Control for Off-Site Work

Notify the NTR at least two weeks prior to the start of the preparatory and initial phases.

3.2 SPECIAL INSPECTIONS

In addition to this three phase inspection control system, special inspections or testing may be conducted in the event of an approved change or modification to work plans or field operations. The QC Engineer will coordinate scheduling of special inspections with the NTR at the time when a change or modification in work operations has been approved.

3.3 REWORK

It is OHM's responsibility to identify and correct deficiencies in the work. To ensure that defective work is corrected and not built upon, a Rework Items System will be initiated and monitored by the QC Engineer. Rework items identified in the work during any inspections or tests by a party to this contract will be corrected as soon as practicable and recorded on a Rework Items List. The list will be issued to the site supervisor and a copy attached to the inspection report. The Site Supervisor will be responsible for ensuring correction by the responsible party and will return a report upon correction with a description of the action taken and date completed. The Rework Items List will be updated accordingly. Rework items will be corrected prior to the final inspection.

4.0 SAMPLING PROCEDURES

OHM sampling procedures will meet the requirements of the project scope of work. The protocol for performing the analytical work on the site water and subsurface soil prior to and during the remediation work is presented in the Sampling and Analysis Plan (SAP) for this project.

5.0 ANALYTICAL TESTING

OHM will employ the services of a fully qualified laboratory to perform the program's analytical testing. The tests and/or services to be performed by the testing laboratory are presented in the Sampling and Analysis Plan for this project. The work to be performed in this section deals with chemical analyses of the water and soil on site prior to and during remediation activities.

6.0 FIELD VERIFICATION TESTING

The following procedures will be used by the QC Engineer to verify compliance with the contract requirements. Additions or modifications to these procedures may be necessary to address changing circumstances. During field implementation of delivery order tasks, the Navy will provide an inspector to perform QA checks. The responsibilities of the QC Engineer are fully described in Section 2.0.

6.1 GEOTECHNICAL QUALITY CONTROL PROCEDURES

6.1.1 Field Verification Testing

Specific field verification testing will be performed in accordance with this plan. OHM is responsible to perform the required field soils testing, per contract specifications. The Geotechnical Technician will maintain a QA program to which equipment is calibrated on regular intervals. All measurements will be traceable to National Bureau of Standards. The laboratory test capabilities include field control; specifically, water content (Nuclear Density Gauge), and density (Nuclear Density Gauge).

Field tests are developed from accepted test procedures (e.g. ASTM). Each test is an approved procedure to test for specific characteristics. Some tests are less comprehensive than others and require periodic verification by more detailed tests. Field tests of this type do not usually determine the primary characteristic of interest, but instead are used to correlate results. In the event that any single test fails to meet specification requirements, a second test will be performed. Should the second test fail, the appropriate corrective action will be taken in the field. If the second test meets the specification requirements, then the corresponding verification test will be conducted. The results of that test will then be used to determine the acceptance or rejection of the task being monitored.

Field tests will be performed by trained testing personnel and performed on a timely basis to provide prompt confirmation or rejection of material or work.

6.1.2 Field Sampling

Samples of excavated materials and constructed work will be obtained in the field for verification testing. The site technician will collect the specified samples, as appropriate, as specified in the Sampling and Analysis Plan or when a portion of the constructed work is completed.

6.2 INSPECTIONS

In addition to inspections directed by the QC Engineer, standard inspections will be performed during the course of remediation to verify the quality of the final constructed work. There will be visual inspections performed by the site supervisor, a qualified general foreman, or other appropriate personnel. These inspections are supplemental to the QC inspections and are

intended to enhance the QC inspections by identifying problem areas that may require more stringent QC inspection. In the event of a discrepancy between one of these visual inspections and the field verification tests, the field verification test results will take precedence.

Inspections will be performed in accordance with this plan or checklists developed for use at the site. Inspections performed to a guide procedure will be documented in the daily field log, while inspections performed to a checklist will be documented on the checklist and on the daily Contractor QC Report.

6.3 PERFORMANCE DOCUMENTATION

To provide evidence of satisfactory work performance, verification test data, data reduction and the results of field inspections and sampling will be completely documented. Whenever possible, information will be recorded on a standardized form or in a bound filed logbook. Documentation will include a daily log of construction activities; appropriate field test, laboratory test, and survey data forms; photographs; and field collection and sampling custody forms.

Construction inspection personnel (e.g., site supervisor and foreman) will maintain a daily log of project activities. Copies of the daily logs will be sent to the Project Manager on a daily basis. After this review, the logs will be routed to other members of the project team, as needed.

As part of the remediation control activities, a photographic record will be maintained. As examples, photographs should be taken of initial conditions, sampling locations, remediation processes, and final constructed features. Photographs will be identified by the project number, date taken, and a brief description. This will be done individually on the back of the photographs. In addition, album photographs must be provided with individual descriptions and dates taken.

Appropriate remediation control test, survey, and material installation data forms will be prepared and each form will include the applicable location (e.g., station, elevation, and field coordinates). All requested information on the form will be addressed. If not applicable, requested information will be designated "N/A." Results of field and laboratory tests will be sent to the NTR, the project manager, site supervisor and QC Engineer as soon as they are available.

Field construction verification records will be collected and maintained by the site supervisor until they are submitted to the project central file.

6.4 REVIEW OF CONSTRUCTION CONTROL DATA

The QC Engineer will review the QC data to verify that remediation specifications are met, to determine when defective material or work may require removal and/or reconstruction, and to determine when additional tests may be required to confirm the quality of material or work. The results of field tests, field inspections, receiving inspections, and surveys will be reviewed by the QC Engineer. This review will be performed to prevent the construction of new work over defective material or work which is later found to be defective.

6.5 AS-BUILT DOCUMENTATION

All appropriate documentation will be retained in the project records system. Final as-built drawings and specifications will be prepared from this information in accordance with the Submittal Register and will be retained as a permanent record of the project.

At contract closeout, record documents will be delivered to the NTR. A transmittal letter in duplicate accompanying the submittal will contain:

- Date
- Contract name and number
- Contractor's name, address, and telephone number
- Number and title of each record document
- Signature of contractor or his authorized representative

7.0 INSPECTION AND TESTING DOCUMENTATION

Records of inspections and tests performed for each shift or subcontractor operation will be signed by the QC Engineer. The original and one copy will be provided to the Government no later than the next working day.

Contractor QC reports will include, as a minimum, the following:

- Project identification
- Data on weather and any delays attributable to such weather
- Number of personnel on site (OHM and subcontractors)
- A listing of construction equipment and indication of equipment usage on the report day
- Factual evidence that continuous QC inspections and tests have been performed. This includes, but is not limited to the following data:
  - Type and number of inspections or tests performed
  - Results of inspections or tests, including computations
  - Evaluation of test results -- accept or reject work
  - Nature of defects, if present
  - Causes for rejection
  - Safety inspections/violations
  - Proposed remedial action
  - Corrective actions taken
- The records will cover both conforming and nonconforming work
- A statement that supplies and materials incorporated into the work are in full compliance with the requirements of the contract

8.0 MEETINGS/COORDINATION

8.1 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the Construction QC Plan and prior to the start of construction, the OHM Project Manager, QC Engineer and Site Supervisor will meet with the COTR and NTR to discuss the QC program required by this delivery order. The purpose of this meeting is to develop a mutual understanding of the QC details, including forms to be used, administration of on-site and off-site work, and coordination of the OHM management, production and the Quality Representatives' duties with the NTR. Minutes of the meeting will be prepared by the Project Manager and signed by both OHM and the NTR.

8.2 QC MEETINGS

After the start of construction, the QC Engineer, or his designee, will conduct QC meetings once every two weeks or as required by the NTR at the work site (or where specified, with the site supervisor). The QC Engineer, or his designee, will prepare the minutes of the meeting and provide a copy to the NTR within two working days after the meeting. The COTR may attend any of these meetings. The QC Engineer will notify the NTR at least 48 hours in advance of each meeting. As a minimum, the following will be accomplished at each meeting:

- Review the minutes of the previous meeting

- Review the schedule and the status of work:
  - Work or testing accomplished since last meeting
  - Rework items identified since last meeting
  - Rework items completed since last meeting

- Review the status of submittals:
  - Submittals reviewed and approved since last meeting
  - Submittals required in the near future

- Review the work to be accomplished in the next two weeks and documentation required. Schedule the three phases of control and testing:
  - Establish completion dates for rework items
  - Preparatory phases required
  - Initial phases required
  - Follow-up phases required
  - Testing required
  - Status of off-site work or testing
  - Documentation required
- Resolve QC and production problems
- Address items that may require a revision of the QC plan (i.e., changes in procedures)

Appendix A

Professional Profiles

GEORGE E. KRAUTER, P.E.
Program Manager

EXPERIENCE

As Program Manager for OHM's LANT DIV RAC, Mr. Krauter has total responsibility and accountability for the successful operation of the contract. Specifically, this includes ensuring effective program communications, committing company resources to accomplish program and project order objectives, receiving task orders, providing program-wide continuity for the technical direction of projects, planning and scheduling work activities, resolving workload conflicts on a program-wide basis, managing program-wide costs and contractual requirements, QA/QC, and fulfilling administrative and financial contractual reporting requirements.

Stone & Webster Environmental Technology & Services (1991 - Present)

Project Sponsor/Director, USACE - Norfolk district, Radford Army Ammunition Plant - Directs 15 personnel performing more than 25 tasks on five different FFP contract, including PA/SI, RI/FS, Remedial Design, Title II Services , public participation, NEPA compliance, and federal/state permitting. Manages technical/contractual oversight, QA/QC, and health and safety.

- Provides accountability to USACE by serving as principal point of contact for $40 million in remediation services and capital expenditures.

- Ensures effective cost and quality control by interpreting, planning, and forecasting work using proven corporate management systems and procedures.

Task Manager, CPFF Contract, DOE Savannah River - Provided management/technical expertise to complete tasks related to two CPFF contracts for DOE Savannah River (DOE-SR).

- Ensured effective planning and tracking of decommissioning tasks by developing management systems in accordance with client requirements.

- Satisfied DOE-SR's regulatory concerns by directing 20 environmental professionals in performing environmental audits to ensure compliance with RCRA, CERCLA, Clean Air Act, Clean Water Act, and NESHAP.

Project Manager, HTRW Projects - managed 25 engineers spread across five teams in developing Independent Cost Estimates for HTRW projects at three major DOE sites in Oak Ridge, Tennessee.

ICF-Kaisor (1989 - 1991)

Program Manager, DOE Richland - Directed detailed engineering, design, and construction of more than $200 million of waste management facilities for the tank farm upgrade at the Hanford reservation. Managed 40 professional and 150 craft labor, providing overall technical and administrative responsibility for a CPAF contract involving seven major tasks valued at $30 million per year.

Project Manager, DOE Feed Materials Production Center Fernald - Managed independent reviews of RI/FS reports for five operable units involving remediation of radioactive and hazardous wastes including pits, ponds, lagoons, and drum storage areas containing uranium, thorium, arsenic, mercury, TEC, waste oils, PCBs, and spent solvents.

EXPERIENCE - CONTINUED

IT Corporation (1985 - 1989)

Program Manager, Hazardous Waste Remedial Action Program (HAZWRAP) - Directed a CPFF $10 million per year contact involving more than 60 professionals and six subcontractors, including SB/SDBs, in performing SI and RI/FS at various military bases. Oversaw field investigations, drilling/laboratory subcontracts, and preparation of remedial investigation reports for contaminants including petroleum, solvents, VOCs, and PCBs. Improved project health and safety by effectively managing the implementation of a comprehensive Health and Safety Program.

Project Manager, Feed Materials Production Center Fernald - Managed the efforts of approximately 30 force account personnel in directing the construction of an automated handling system for the removal of more than 50,000 cubic feet of thorium containing dry sludges from three elevated storage silos.

- Reduced potential exposure to personnel by building the system into a standard 20-foot shipping container operated under negative pressure.

- Demonstrated strong management skills by accomplishing this $3 million project on schedule and within budget.

Project Manager, Shipping Port Atomic Power Station - Managed the efforts of 35 force account personnel in removing asbestos from radioactively contaminated areas. Removed 430 cubic yards of asbestos insulation from tanks, vessels, piping, ducting, and equipment. Identified uncertainties and critical path activities of this $3 million contract by developing detailed work procedures in accordance with OSHA and state regulations.

Project Manager, Nuclear Source Fabrication Facility - Directed 15 force account personnel in site planing and restoration. Developed the survey plan, removal plan, sampling plan, health and safety plan, detailed work procedures, and the final release of the site by the nuclear Regulatory commission. Met schedule and budget requirements.

- Supported site restoration by decontaminating equipment and facilities, removing and packaging radioactive materials, and overseeing facility demolition.

- Provided significant storage/disposal cost savings by developing an innovative method for reducing the volume of transuranic waste, yet achieving a 100 percent acceptance of "repackaged" drums.

- Managed final site restoration including backfilling and landscaping after NRC acceptance.

Program Manager, 3M Company - Managed 85 subcontractor and force account personnel in the characterization of 250 site s nationwide, including sites in Massachusetts and Rhode Island. Seventy of these sites required cleanup of polonium which had been released from faulty static eliminators.

- Effectively controlled mobilization, materials handling, and subcontractors in supporting up to eight site throughout the U.S. for this $3 million project.

EXPERIENCE - CONTINUED

- Satisfied 100 percent of client's goals by successfully completing the project under extremely tight schedule requirements.

- Met regulatory concerns by working closely with the nuclear Regulatory commission and state representatives to ensure cleanup; developed health and safety plans.

Quadrox (1981 - 1985)

Manager of Projects - Directed a staff of 30 involved in engineering, design, and installation activities in support of numerous nuclear power plant modification projects for various utility clients. These projects ranged in size up to $4 million and involved both force account and subcontractor personnel. Planned and tracked major projects by developing a management controls system (MIS) and providing training to project managers.

TRW (1979 - 1981)

Project Manager, DOE's Remedial Action Program - Managed 30 professionals to review plans for Formerly Utilized Sites Remedial Action program (FUSRAP) projects, and prepared other Program Documents for DOE. Determined remedial approach, developed schedules/estimates for remediation, and planned specialty subcontractor activities.

U.S. Naval Civil Engineers Corps (1958 - 1979)

Deputy Officer in Charge of Construction, Europe - Directed the construction of projects annually averaging $26 million and provided the design of new facilities and modifications. Held full contract authority and was senior member for selection and negotiation contract boards.

- Restructured and organized resources to accommodate an unexpected 30 percent increase in workload without requiring additional resources.

- Received Meritorious Service medal for accomplishments in design and construction.

Officer in Charge, Naval Nuclear Power Unit - Managed 25 professionals and 35 craft who directed the development of the Environmental Impact Assessment, the Safety Analysis Report, and the Removal Plan for the PM-3A reactor decommissioning.

- Completed project on schedule and within budget by managing the preparation of detailed critical path schedules an detailed work procedures.

- Ensured effective remediation by directing the removal of 5,000 square yards of contaminated soil.

ACADEMIC BACKGROUND

M.S., Physics, Naval Postgraduate School
B.S., Civil Engineering, Rensselaer Polytechnic Institute
B.S., Engineering, U.S. Naval Academy

SPECIALIZED TRAINING

OSHA 40-hour Safety Training
OSHA 8-hour Refresher Training

PROFESSIONAL REGISTRATIONS

Registered Professional Engineer, State of Pennsylvania

MICHAEL I. GILMAN
Program Quality Control Manager

EXPERIENCE

As Program Quality Control Manager for OHM's LANT DIV RAC, Mr. Gilman is responsible for the enforcement of corporate QA/QC policies and contract provisions. He works closely with the Program Manager to coordinate QA/QC activities at each site to ensure they are conducted properly. Mr. Gilman's role and responsibilities at the Program level include:

- Establishing and administering all quality matters for OHM for the LANT DIV RAC
- Designating a project QC Manager for each Delivery Order
- Reviewing and approving Delivery Order QA plans
- Authorizing stop work if work activities or planning activities violate OHM quality guidelines of LANT DIV RAC contract requirements
- Developing and implementing a Delivery Order specific quality control plan
- Interfacing directly with government Quality Assurance personnel
- Conducting daily QC meetings
- Supervising performances of site QC activities
- Ensuring that QC testing is performed in accordance with specifications, and in a timely manner
- Requiring corrective actions for any item or activity which does not meet specifications or quality standards
- Preparing required QC certifications and documentation

Stone & Webster Environmental Technology & Services (1991 - Present)

Section Manger, QC Department - Responsible for providing guidance in the implementation of all phases of the QA program for nuclear and fossil power plants, environmental assessment, management, and remediation, and government projects. These projects include:

- Department of the Navy - Newport News shipbuilding
- Department of the Navy - North Div Naval Facilities Engineering Command BRAC
- Delmarva Power & Light
- New Jersey Turnpike
- Salem Generating Station - Units 1 and 2
- Hope Creek Generating Station
- River Bend Station
- Nine Mile Point Nuclear Station - Unit 2
- Calvert Cliffs Nuclear Power Plant
- Limerick Generating Station
- Fort Calhoun

EXPERIENCE - CONTINUED

Mr. Gilman has served as the Project Manager responsible for QA and other supporting department activities for services provided to a major shipyard involved in the construction and overhaul of naval vessels.

Since joining Stone & Webster, he has been assigned to the Cherry Hill office as Supervisor, QA Department Representative, QA Engineer, and Lead Engineer, and to the Boston office as an Engineer in the Reports Group of the Quality Systems Division.

Prior to joining Stone and Webster, Mr. Gilman worked in manufacturing engineering on several government projects for GTE Sylvania, the Foxboro Company, and a plastic molding manufacturer for which his responsibilities were to provide industrial engineering support for the assembly of electronic equipment, and quality control inspection and testing.

ACADEMIC BACKGROUND

M.S., Business Administration, Drexel University
B.S., Industrial Engineering, Northeastern University

SPECIALIZED TRAINING

OSHA 40-hour Safety Training
OSHA 8-hour Refresher Training

PROFESSIONAL LICENSES AND REGISTRATIONS

American Society for Quality Control - Certified Quality Engineer
American Society for Quality Control - Member
American Nuclear Society - Delaware Valley Section - Member
American Institute of Industrial Engineers - Member

JAMES A. DUNN, JR., P.E.
Senior Project Manager

EXPERTISE

Major project and program management; municipal, industrial and hazardous waste management; design, permitting and construction of solid waste landfill facilities; underground storage tank assessment and remediation; onsite remediation technologies including sludge dewatering, stabilization/solidification

EXPERIENCE

Mr. Dunn joined OHM in 1994 with over 25 years experience in civil, structural, and environmental engineering design, estimating, supervision, and management. He has served as project manager, operations manager and construction manager for both government and private clients on projects involving solid and hazardous waste management, remedial investigations and risk assessments, environmental and geotechnical soils and groundwater investigations; implementation/construction of remedial activities at hazardous waste sites; construction of Subtitle D solid waste landfill facilities; and implementation of closure activities for RCRA hazardous waste facilities. In addition, Mr. Dunn has provided construction engineering and management services for natural gas, oil, and product pipelines (on land and offshore), pumping stations, compression facilities, and tugs and barges on an international, intrastate, and interstate basis.

As a project manager, Mr. Dunn's responsibilities include project scoping and estimating, proposal preparation and presentation, project negotiations, cost and schedule tracking and control, problem solving, project reporting, subcontractor management, and overall project profitability.

The following projects are representative of Mr. Dunn's experience:

- Project Director, Subtitle D Land Construction and Closure, Nassau County, Florida. Independent third party oversight of construction of a state-of-the-art solid waste facility and closure of three existing unpermitted sites. Assumed duties of interim County Solid Waste Director for a one-year term. Landfill construction included provision of quality assurance services for a slurry wall system, the composite liner system including natural and synthetic materials and installation of dewatering ponds. Negotiated permit variances with the state agency to allow inclusion of a major industrial wastestream into the municipal landfill facility. Siting, permitting, design and construction of a mulching composing facility for yard wastes.

- Product Director, PCB Remediation, Enron Gas Producing Company,Texas. Site investigations soil sampling and analyses, work plan development, removal of contaminated soils and debris, transport and disposal and site restoration for three facilities in Texas. Activities at one site involved decontamination and demolition of a gas conditioning/compression plant which included removal and disposal of asbestos pipe and vessel insulation. Project guidance activities included client liaison at head office and onsite participation in negotiating transportation and disposal subcontracts and assistance in scheduling of personnel.

EXPERIENCE - CONTINUED

- Project Manager, Groundwater Remediation, Cabot Carbon Super Site, Florida. Initial activities included development of Remedial Design Plan, review of Record of Decision and Consent Decree, subsurface explorations and preparation of Field Sampling Plan, Quality Assurance Project Plan, and Health and Safety Plan. Subsequent tasks included evaluation of necessity for treatability studies, preparation of project schedule, groundwater flow modeling, remedial design including cleanup goals and ARARs, complete engineering drawings, equipment specifications, assistance with regulatory reviews, bid solicitation for remedial design implementation, oversight of construction, and operation and maintenance oversight of the completed treatment system.

- Project Director, Underground Storage Tank Assessment and Remediation, Various Locations, Georgia. Contamination evaluation for four sites involving soils and groundwater contamination. Initial activities included soil sample procurement and analyses, monitor well installations, groundwater sampling and analyses, aquifer slug and specific capacitance testing, generation of plume maps and performance of risk assessment. Initial site characterization reports were prepared and submitted to Georgia EPD followed by preparation and submission of Corrective Action Plans. Subsequent activities included design and implementation of groundwater remediation systems and remediation of contaminated soils.

- Project Director, LCH Reclamation, Louisiana. Installation of pumping facilities, loading pad, and fixed air monitoring stations to permit pumping, transportation, and recycle/reclamation of more than 1.6 million gallons of product, while maintaining a water blanket for odor suppression. Follow-up activities included the removal, transportation and incineration disposal of pumpable sludges while continuing to maintain water blanket. Subsequent activities will include soil treatment (stabilization, fixation and/or removal) and design and implementation of a groundwater remedy.

- Project Director, Remediation of Power Plant Site, Texas. Cleanup activities at the site of a former power plant included formulation of work plan, health and safety plans and design specifications and implementation of remedial methods for PCB and asbestos contaminated soils and debris. Closure of a large diameter wet well included contaminated debris removal and water treatment and excavation and demobilization of underground storage tanks.

- Project Director, Closure of Wood Products Treatment Facility, Oklahoma. Overall project direction and guidance for decontamination and demolition of process equipment and attendant structures, chemical fixation of various sludges contained within lagoon.

ACADEMIC BACKGROUND

B. S. Civil Engineering, University of Texas at Arlington, 1968

SPECIALIZED TRAINING

OSHA 40-hour Health and Safety Training
OSHA 8-hour Refresher Training

PROFESSIONAL REGISTRATIONS AND AFFILIATIONS

Registered Professional Engineer, Louisiana (15901) and Texas (70647)
National Society of Professional Engineers
Louisiana Engineering Society
American Society of Civil Engineers
Georgia Society of Professional Engineers
American Welding Society
American Petroleum Institute
Technical Association of the Pulp and Paper Industry
American Society of Testing Materials

PUBLICATIONS

Dunn, Jr., J. A., "A Guide to UST Regulations," Acadiana Safety Association, Lafayette, Louisiana, 1990.

Dunn, Jr., J. A., "An Offshore Pipeline," American Welding Society Chapter Meeting, Lafayette, Louisiana, 1985.

Dunn, Jr., J. A., "Riser Installation," presented at the Offshore Pipeline Contractors Association Conference, Lafayette, Louisiana, 1984.

QC ENGINEER

CHARLES D. LAWRENCE, JR.

EXPERIENCE SUMMARY

Mr. Lawrence has significant experience in quality control operations in engineering and manufacturing firms serving both government and commercial clients. His experience includes in-process audits, inspection and test, quality planning, work package preparation and review, root cause analysis, corrective action development, and reporting. He also serves in the Corps of Engineers, Army Reserve, and has implemented environmental quality improvement programs for numerous facilities in Kentucky and Tennessee. Prior to his work as a quality engineer, he served eight years on active duty with the U.S. Army. This service included company command and overseas service in a peacekeeping force in the Middle East.

EDUCATION

UNITED STATES MILITARY ACADEMY
West Point, NY 10996

BACHELOR OF SCIENCE, 1979
General Engineering

UNIVERSITY OF DALLAS
Irving, TX 75248

MBA, 1992
Engineering Management

CERTIFICATIONS

Engineer-In-Training, Pennsylvania, 1979
OSHA, 29 CFR 1910.120, Hazardous Waste Operations Training, 1994
OSHA, 29 CFR 1910.120, Hazardous Waste Operations Supervisor Training, 1994
U.S. Army Environmental Center, Environmental Compliance Assessment Course, 1993
U.S. Army Corps of Engineers, Engineering and Housing Management Course, 1993
Process Examiner, U.S. Naval Weapons Center, 1989

EXPERIENCE HISTORY

Established and managed a detailed program of environmental quality assessments for Army Reserve facilities in Tennessee and Kentucky. Evaluated compliance with code requirements, presented training, and drafted waste management and spill contingency plans.

Selected as Procurement Quality Representative for international avionics firm serving the prime contractor for the Harpoon and Tomahawk missile programs. Performed hardware inspections, evaluated test data, and audited contracts prior to system purchases. Developed and implemented procedures to streamline product evaluation, final shipment, and invoicing.

Implemented Total Quality initiatives for engineering offices and project sites in the Southeast. Participated in Corporate ISO 9000 certification planning. Wrote project quality plans, developed business plans, facilitated client interface, performed process assessments, and conducted training.

Researched and communicated design requirements for an Army intelligence analysis facility. Supervised Directorate of Engineering drafting specialists in preparing construction plans.

Introduced assembly and test improvements in a commercial electronics manufacturing operation. Reduced defects by 90% in 1990. Presented results at Nippon Electric Corporation North American Quality Conference.

Analyzed and resolved quality issues affecting electronic components, printed circuit boards, test operations, hardware configuration, and mass soldering process control. Presented quality trends, root cause analysis, and corrective actions to senior management and government representatives.

Led two hardware audits of the Harpoon radar seeker and major ancillary components. Consolidated improvement recommendations for future designs.

EMPLOYMENT HISTORY

STONE & WEBSTER ENGINEERING, Chattanooga, TN	**1992 - PRESENT**
Senior Quality Engineer	
NEC AMERICA, INC., Dallas, TX	**1990 - 1992**
Test Supervisor	
TEXAS INSTRUMENTS, INC., Dallas, TX	**1987 - 1990**
Manufacturing Supervisor	1989 - 1990
Quality Assurance Engineer	1987 - 1989

OTHER QUALIFICATIONS

Major, United States Army Reserve, Corps of Engineers
Graduate, United States Army Command and General Staff College
Trained in Total Quality and Statistical Process Control
MIL-STD 2000, MIL-Q 9858, and ISO 9000 proficient.

Appendix B

Submittal Register

SUBMITTAL REGISTER (PART A)

Contract Number: 62470-94-B-4827 | Project Title: Remediation of Pesticide/PCB Contaminated

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 01010	SD-09, Reports	1.2.1				
2)	Work Plan	1.2.1.1	G			
3) 01010	SD-18, Records	1.3.1				
4)	As-Built Records	1.3.1.1	G			
5)	Environmental Condition Report	1.3.1.2				
6)	MIS Required Sorts	1.3.1.3				
7)	Network Analysis Diagram	1.3.1.3				
8)	Status Reports	1.3.1.3				
9)	QC Meeting Minutes	1.3.1.4				
10)	Test Results Summary Report	1.3.1.5				
11)	Contractor Production Report	1.3.1.6				
12)	QC Report	1.3.1.7				
13)	Rework Items List	1.3.1.8				
14)	Permits	1.3.1.9				
15)	Contractor's Closeout Report	1.3.1.10				
16) 01430	SD-08, Statements	1.2.1				
17)	Sample Log	1.2.1.1				
18) 01430	SD-12, Field Test Reports	1.2.2				
19)	Confirmatory Sample Analyses	1.2.2.1				
20)	Results					

* Navy Notes:
Approved by:
G: Contracting Officer
Blank: CQC Manager

* NASA Notes:
Approved by:
Blank: Contracting Officer

* Army Notes:
Classification:
GA: Gov't Approval
FIO: For Information On

Contract Number: 62470-94-B-4827 | Project Title: Remediation of Pesticide/PCB Contaminated

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Waste Characterization Sample	1.2.2.2				
2)	Analyses Results					
3) 01560	SD-08, Statements	1.3.1				
4)	Class I ODS prohibition	1.4	G			
5)	Safety program	1.6	G			
6)	MSDS	1.6	G			
7)	Health and safety plan	1.6.4	G			
8) 01560	SD-12, Field Test Reports	1.3.2				
9) 01560	SD-18, Records	1.3.3				
10)	Solid waste disposal permit	1.3.3.1				
11)	Disposal permit for hazardous	1.3.3.2	G			
12)	waste					
13) 02220	SD-12, Field Test Reports	1.3.1				
14)	Fill and backfill	3.9.2.1				
15)	Density tests	3.9.2.2				
16) 02223	SD-08, Statements	1.2.1				
17)	Disposal Facility Permit	1.2.1.1				
18) 02223	SD-18, Records	1.2.2				
19)	Shipment manifests	1.2.2.1				
20)	Delivery and disposal	1.2.2.2				

* Navy Notes:
Approved by:
G: Contracting Officer
Blank: CQC Manager

* NASA Notes:
Approved by:
Blank: Contracting Officer

* Army Notes:
Classification:
GA: Gov't Approval
FIO: For Information On

SUBMITTAL REGISTER (PART A)

Contract Number: 62470-94-B-4827 | Project Title: Remediation of Pesticide/PCB Contaminated

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	certificates					
2)	Disposal Site Decontamination	1.2.2.3				
3)	certificate					
4)	Work Site Decontamination	1.2.2.4				
5)	certificate					
6) 02610	SD-13, Certificates	1.3.1				
7)	Gravel	2.1.1				

* Navy Notes:
Approved by:
G: Contracting Officer
Blank: CQC Manager

* NASA Notes:
Approved by:
Blank: Contracting Officer

* Army Notes:
Classification:
GA: Gov't Approval
FIO: For Information Onl

Appendix C

Inspection Schedule

(To Be Furnished at a Later Date)

OHM Remediation
Services Corp.

SITE-SPECIFIC HEALTH AND SAFETY PLAN
FOR
SOIL REMEDIATION
OPERABLE UNIT NO. 1
MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-93-D-3032
Delivery Order 0062

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

March 1995

OHM Project No. 16866

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APPENDICES

1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed for United States Navy, LANTDIV, Delivery Order entitled, Soil Remediation at the MCB Camp Lejeune Operable Unit No. 1, Sites 21 and 78. 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 DESCRIPTION

Camp Lejeune is a training base for the U.S. Marine Corps, located in Onslow County, North Carolina. The base covers approximately 170 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. The remedial action area, OU No. 1, is one of 13 operable units within Camp Lejeune. An "operable unit" as defined by the National Contingency Plan (NCP) is a discrete action that comprises an incremental step toward comprehensively addressing site problems. OU No. 1, which covers an area of approximately 690 acres, is comprised of three sites: Sites 21, 24 and 78. OU No. 1 is located approximately 1 mile east of the New River and two miles south of State Route 24. The Operable Unit is bordered to the northwest by Holcomb Boulevard, to the northeast by Sneads Ferry Road, to the southwest by Main Service Road, and to the southeast by Cogdels Creek.

Site 21 is located within the northwest section of Site 78. The site is bordered by Ash Street to the southwest, Center Road to the southeast, and a wooded area to the northwest. A dirt road surrounds most of the site along with surface drainage ditches. The southern and central portions of the site (approximately 220 feet by 900 feet) include several fenced-in areas, while the northern section (approximately 500 feet long) is an open area. A water tower is located in the fenced portion of the site. Surface cover within the site consists of gravel, sandy soil, and concrete with a few vegetated areas. The southern portion of the site is periodically utilized for storage by Marine Corps reserve units. Currently this portion of the site is being used for storage of military vehicles.

Three primary AOCs were identified at Site 21. They are the Former PCB Transformer Disposal Area (AOC 1) and the Former Pesticide Mixing/Disposal Area (AOCs 2 and 3). Figure 1 shows the location of these three AOCs. The Former Transformer PCB Disposal Area is located in the northeastern portion of the site, and the Former Pesticide Mixing/Disposal Area is located in the southwestern portion of the site. With the exception of a small, slightly depressed area at the northern portion of the site, which may have been the former transformer oil disposal pit, there are no visual signs of waste disposal throughout the site. The contaminants of concern (COCs) at AOC 1 and AOC 2 are PCBs. The COCs at AOC 3 are pesticides, including 4,4'-DDD, 4,4'-DDT, and chlordane.

Site 78 encompasses the industrial area of MCB, Camp Lejeune and is bordered by Holcomb Boulevard, Sneads Ferry Road, Duncan Street, and Main Service Road. This area is comprised of maintenance shops, warehouses, painting shops, printing shops, automobile body shops, and other similar industrial facilities. Site 78 covers approximately 590 acres. With the exception of buildings, the majority of the site area is paved (e.g., roadways, parking lots, loading dock areas, and storage lots), however, there are many small lawn areas associated with individual buildings within the site and along lengthy stretches of roadways. In addition, there are several acres of woods in the southern portion of the site. Recreational ball fields and a parade ground are located in the southwest corner of the site.

One soil AOC has been identified within Site 78, a grassed area on the northeast side of Building 1502 (AOC 4).

1.2 SITE HISTORY

Site 21 has had a history of pesticide usage and reported transformer oil disposal. The site was used as a pesticide mixing area and as a cleaning area for pesticide application equipment from 1958 to 1977. This area, the Former Pesticide Mixing/Disposal Area, was reported to be located in the southeast corner of the lot (the exact location is not documented). Chemicals reportedly stored and handled at this site included diazinon, chlordane, lindane, DDT, malathion (46 percent solution), mirex, 2,4-D, silvex, dalapon and dursban. Small spills,

discharge of washout fluids, and indiscriminate disposal are believed to have occurred in this area. In 1977, before these mixing/cleaning activities were moved to a different location, overland discharge of washout fluids was estimated to be approximately 350 gallons per week. It is not clear for how long this discharge of washout fluids occurred.

The Former Transformer Oil Disposal Pit was located in the northeastern portion of the site. The pit was reportedly used as a disposal area for transformer oil during a one year period between 1950 and 1951. The pit reportedly measured 25 to30 feet long by 6 feet wide by 8 feet deep. Sand was occasionally placed in the pit when oil was found standing in the bottom of the pit. The total quantity of oil disposed in this pit is unknown. A small area, slightly depressed in elevation, which may be the former oil pit, is evident in the northern portion of Site 21.

Site 78, constructed in the late 1930s, was the first developed area at MCB, Camp Lejeune. It was comprised of approximately 75 buildings and facilities including maintenance shops, gas stations, administrative offices, commissaries, snack bars, warehouses, and storage yards. There is presently no known uncontrolled disposal of wastes related to the various industrial activities at the site. Due to the industrial nature of the site, many spills and leaks have occurred over the years. Most of these spills and leaks have consisted of petroleum-related products and solvents from underground storage tanks (USTs), drums, and uncontained waste storage areas. It appears that several general building areas within Site 78 may be potential source areas of contamination.

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; personnel and equipment decontamination facilities; utilities installation; access road construction and grading; establishment of erosion control and installation of berms; installation of fencing; and delineation of work zones.

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

- **Contaminated Soil Excavation** including PCB- and pesticide-contaminated soils to be excavated from AOCs 1 through 4 and directly loaded for transport and the trucks decontaminated prior to departure. Excavation depths are anticipated to be 1 foot. Each proposed excavation area will be handled in this manner.

- **Verification and Confirmation Sampling** for on-site and off-site analytical procedures.

- **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 ((10) 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**
Chlordane	Inhalation; ingestion; dermal contact/ absorption	0.5 mg/m^3	Tremors, excitement, loss of muscle control; gastritis; convulsions; and anorexia; liver and kidney damage
Chlorinated pesticides (DDT, DDE)	Inhalation, ingestion, dermal contact	0.05 mg/m^3* (DDT)	Tremor, dizziness, confusion; headache, fatigue; convulsions; liver and kidney damage
PCBs (Arochlor 1254)	Inhalation, ingestion, dermal contact and absorption	0.5 mg/m^3	Irritation to the eyes; chlor acne; Dermatitis; Liver damage; Cancer

*In this instance, the OSHA PEL was selected as the more stringent guideline for exposure.

Chlorinated pesticides (DDT, DDD, DDE), chlordane and polychlorinated byphenyls (PCBs) have been identified in soils at Sites 21 and 78. Soil concentrations of these contaminants were generally in ppb concentrations. The maximum soil concentration for specific contaminants were as follows:

- DDE at 36 ppm
- DDT at 16 ppm
- Chlordane at 2.2 ppm
- PCBs at 4.8 ppm

Considering the low concentration of contaminants in soil, the potential for personnel exposure during site activities is correspondingly low. Personnel will initially wear Level C protection during excavation/load-out operations and downgrade to Modified Level D based on airborne particulate air monitoring results obtained in personnel breathing using a direct reading aerosol monitor (i.e., Miniram).

Chlorinated Pesticides (DDT, DDD) were identified in soils at AOCs 3 and 4. DDT has an OSHA Permissible Exposure Limit (PEL) of 0.5 mg/m^3. DDT is a poison by ingestion and is known to cause cancer in humans. It can also be absorbed through skin. Symptoms of

overexposure include tremor, dizziness, confusion, headache, fatigue, and convulsions. Liver and kidney damage may also occur as a result of overexposure.

Chlordane has also been identified in soils and groundwater at AOCs 3 and 4. Chlordane has an OSHA PEL of 0.5 mg/m^3. Chlordane is a suspected human carcinogen which is poisonous by ingestion, and by inhalation. It is readily absorbed through the skin on dermal contact, and overexposure may produce tremors, excitement, loss of muscle coordination (alexia), gastritis, convulsions, and anorexia. Lung, liver and kidney damage may result from chronic overexposure.

Polychlorinated Biphenyls (PCBs) have been identified in soils at AOCs 1 and 2. PCBs have a PEL of 0.5 mg/m^3 (54 percent chlorine). PCBs are potent liver toxins which may be readily absorbed through skin on dermal contact. A characteristic skin rash is evident after prolonged skin contact with PCBs. Potentially chronic or delayed toxicity is significant because PCBs accumulate in fatty tissues and may reasonably be anticipated to be carcinogenic. Overexposure may also cause chronic eye, nose, throat and upper respiratory irritation, as well as a variety of neurological effects.

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. Failure to follow safety protocols will result in expulsion of an employee from the site and appropriate disciplinary actions.

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

3.3 ENVIRONMENTAL HAZARDS

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

3.3.1 Heat Stress

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

- Heat rash
- Heat cramps
- Heat exhaustion
- Heat stroke

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

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

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

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

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

- Dizziness
- Nausea
- Fainting

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

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

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

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

exceeds 110 beats per minute at the next rest period, decrease the work period by 1/3. The initial rest period should be at least 10 minutes.

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

3.3.2 Exposure to Cold

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

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

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

3.3.3 Project Hazard Communication

The purpose of hazard communication (Employee Right-to-Know) is to ensure that the hazards of all chemicals located at this field project site are transmitted (communicated) according to 29

CFR 1926.59 to all OHM personnel and OHM subcontractors. OHM's Corporate Hazard Communication Program is included in Appendix B for reference. Hazard communication will include the following:

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

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

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

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

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

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

review by on site personnel. The information pertinent to the chemical hazards will be communicated to project personnel.

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

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

3.3.4 Noise

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

3.4 TASK-SPECIFIC RISK ASSESSMENT/ACTIVITY HAZARD ANALYSIS

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

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

ask Breakdown	Potential Hazards	Hazard Control Measures
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
Access clearance 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 site contaminants and water treatment chemicals with workers before operations begin

Task Breakdown	Potential Hazards	Hazard Control Measures
Multi-Media 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
	Contact Dermatitis	• Wear PPE to avoid skin contact with contaminated surfaces or other skin irritants when sampling water treatment influent, effluent, or treatment chemicals

Task Breakdown	Potential Hazards	Hazard Control Measures
Soil excavation/Direct loadout	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 trash a minimum 15-foot buffer between the trackhoe stick and overhead electrical lines or de-energize overhead lines ?????

Task Breakdown	Potential Hazards	Hazard Control Measures
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
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.

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	
Multi-Media Sampling	Modified Level D/ Level C with tyvek	
Access Clearance, Utility Verification, Site Survey	Modified Level D/C with tyvek	
Soil Excavation/Direct Loadout	Level C/Modified Level D with tyvek	Potential for downgrade to Modified Level D with adequate air monitoring documentation
Equipment Decontamination	Level C with sarans	Pressure washing requires face shield and hearing protection
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
- 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 and direct loadout operations	1-5 ppm for 5 min. >5 ppm for 5 min.	Level C Stop operations and allow vapors to dissipate to less than 5 ppm
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.

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 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.

7.4 AIR MONITORING LOG

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

7.5 CALIBRATION REQUIREMENTS

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

7.6 AIR MONITORING RESULTS

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

8.0 EMERGENCY RESPONSE

8.1 PRE-EMERGENCY PLANNING

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

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

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

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

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

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

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

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

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

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

8.2 EMERGENCY RECOGNITION AND PREVENTION

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

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

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

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

Table 8.1
Emergency Telephone Numbers

Local Agencies All services	
Police Dept.	911 on-base (910) 451-3855 (off-base)
Fire Department	911 on-base
Ambulance	911 on-base (910) 455-9119 (off-base)
Hospital	
Onslow County Hospital	(910) 577-2240
On-Base Facilities	(910) 451-4840
USMC Hospital	
Regional Poison Control Center	800-382-9097
Federal Agencies	
EPA Region Branch Response Center	(404) 347-3931
National Response Center	800-424-8802
Agency for Toxic Substances and Disease Registry	(404) 639-0615 (24 HR)
Navy ROICC / NTR	
National Response Center	800-424-8802
Project Manager	
James Dunn	(404) 453-8072
Director, Health and Safety, Angelo Liberatore, CIH	(404) 453-7671
OHM Corporation (24 hour)	800-537-9540
Note: Additional Phone Nos's in Section 2.0 this HASP	

Routes to Hospital:

On-Base

1. Proceed north on Holcomb Boulevard and turn left.
2. Base hospital is approximately 1/2 mile ahead on right.
3. Follow signs to the emergency room entrance.

Off-Base

1. Proceed north on Holcomb Boulevard and exit MCB Camp Lejeune through the main gate.
2. Follow Highway 24 West (approximately 2.5 miles) to Western Boulevard and turn right (north).
3. Continue on Western Boulevard (approximately 1.5 miles) to the fifth stoplight and the hospital is on the left side of the street.
4. Follow signs to the emergency room entrance.

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

8.3 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS

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

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

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

8.3.1 Responsibilities and Duties

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

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

8.3.2 On-site Emergency Coordinator Duties

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

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

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

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

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

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

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

- Notify LANTDIV ROICC

- Notify OHM Project Manager

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

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

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

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

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

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

- Waste is collected and contained.

- Containers of waste are removed or isolated from the immediate site of the emergency.

- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided.

- Ensure that no waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed.

- Ensure that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.

- Notify the USEPA Regional Administrator that cleanup procedures have been completed and that all emergency equipment is fit for its intended use before resuming operations in the affected area of the facility. The USEPA Regional Administrator's telephone number is included in the Emergency Contacts.

- Record time, date, and details of the incident, and submit a written report to the USEPA Regional Administrator. Report is due to USEPA within 15 days of the incident.

- Perform post incident evaluation and response critique and submit a written report to the Regional Health and Safety Director within 30 days of the incident conclusion.

8.4 SAFE DISTANCES AND PLACES OF REFUGE

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

In the event of minor hazardous materials releases (small spills of low toxicity), workers in the affected area will report initially to the contamination reduction zone. Small spills or leaks (generally less than 55 gallons) will require initial evacuation of at least 50 feet in all directions to allow for cleanup and to prevent exposure. After initial assessment of the extent of the release and potential hazards, the emergency coordinator or his designee will determine the specific boundaries for evacuation. Appropriate steps such as caution tape, rope, traffic cones, barricades, or personal monitors will be used to secure the boundaries.

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

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

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

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

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

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

8.5 EVACUATION ROUTES AND PROCEDURES

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

8.5.1 Evacuation Signals and Routes

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

8.5.2 Evacuation Procedures

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

- The emergency signal will be activated.
- No further entry of visitors, contractors, or trucks will be permitted. Vehicle traffic within the site will cease in order to allow safe exit of personnel and movement of emergency equipment.
- Shut off all machinery if safe to do so.
- ALL on-site personnel, visitors, and contractors in the support zone will assemble at the entrance to the site for a head count and await further instruction from the emergency coordinator.
- ALL persons in the exclusion zone and contamination reduction zone will be accounted for by their immediate crew leaders (e.g., foreman). Leaders will determine the safest exits for employees and will also choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader should try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the emergency coordinator.
- Contract personnel and visitors will also be accounted for.
- The names of emergency response team members involved will be reported to the emergency spill control coordinator.
- A final tally of persons will be made by the emergency coordinator or designee. No attempt to find persons not accounted for will involve endangering lives of OHM or other employees by reentry into emergency areas.
- In all questions of accountability, immediate crew leaders will be held responsible for those persons reporting to them. Visitors will be the responsibility of those employees they are seeing. Contractors and truck drivers are the responsibility of the Site Supervisor. The security guard will aid in accounting for visitors, contractors, and truckers by reference to sign-in sheets available from the guard shack.

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

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

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

8.6 EMERGENCY SPILL RESPONSE PROCEDURES AND EQUIPMENT

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

8.6.1 Notification Procedures

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

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

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

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

8.6.2 Procedure for Containing/Collecting Spills

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

If for some reason a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the

size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or a pipeline rupture, an initial isolation of at least 100 ft. in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 ft. in all directions to allow cleanup and repair and to prevent exposure. When any spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed within the designated hazard area. If possible the area will be roped or otherwise blocked off.

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

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

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

Clean up personnel will take the following measures:

- Make sure all unnecessary persons are removed from the hazard area.
- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources, and use spark and explosion proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- If wastes reach a storm sewer, try to dam the outfall by using sand, earth, sandbags, etc. If this is done, pump this material out into a temporary holding tank or drums as soon as possible.

- Place all small quantities of recovered liquid wastes (55 gallons or less) and contaminated soil into drums for incineration or removal to an approved disposal site.

- Spray the spill area with foam, if available, if volatile emissions may occur.

- Apply appropriate spill control media (e.g. clay, sand, lime, etc.) to absorb discharged liquids.

- For large spills, establish diking around leading edge of spill using booms, sand, clay or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank.

8.6.3 Emergency Response Equipment

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

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

In addition to the equipment listed above, OHM maintains direct reading instrumentation that may be used in emergency situations to assess the degree of environmental hazard. This equipment will only be used by the Site Safety Officer or other specially trained personnel. This equipment will be stored, charged and ready for immediate use in evaluating hazardous chemical concentrations. The equipment will be located at the OHM office trailer.

EQUIPMENT NAME	*APPLICATION*
Portable H-NU Photoionization Meter	Measures selected inorganic and organic chemical concentrations
MSA Oxygen and Combustible Gas Meter	Measures oxygen and combustible gas levels
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.
- 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 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
Chlordane
DDT
Polychlorinated Biphenyls (PCBs)

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
Methane (calibration gas)
Oil (hydraulic)
Pentane (calibration gas)
Starting fluid
WD-40

Genium Publishing Corp.
One Genium Plaza
Schenectady, NY 12304-4690
(518) 377-8854

Material Safety Data Sheets Collection

Chlordane **MSDS No. 877**

Date of Preparation: 10/93

Section 1 - Chemical Product and Company Identification 42

Product/Chemical Name: Chlordane
Chemical Formula: $C_{10}H_6Cl_8$
CAS No.: 57-74-9 (pure), 12789-03-6 (technical)
Synonyms: Chlor Kil; Chlortox; dichlorochlordene; Dowchlor; NCI-C00099; Octachlor; octachlorodihydrodicyclopentadiene; 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene; octachloro-4,7-methanohydroindane; octachloro-4,7-methanotetrahydroindane; Topichlor 20; Velsicol 1068.
Derivation: By Diels-Alder addition of hexachlorocyclopentadiene to cyclopentadiene, followed by reaction with chlorine. Pure chlordane is a solid but in its commercial form it is mixed with a variety of solvents, namely deodorized kerosine. Typical concentrations are 2 to 80% chlordane.
General Use: Chlordane was used as an insecticide until its ban by the EPA in 1988. Its primary use was for termites, but was also effective on insects such as ants, cutworms, rose beetles, and grubs. A single application would provide termite protection for > 26 yr.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Chlordane, 60 to 75% vol (technical grade, alpha and gamma isomers).
Impurities: Because chlordane is found in solution, there is a mixture (25 to 40%) of ~ 26 organochlorine compounds, including heptachlor (4 to 10%), nonachlor, Diels-Alder adduct of cyclopentadiene and pentachlorocyclopentadiene, hexachlorocyclopentadiene, and octachlorocyclopentene.

OSHA PEL
8-hr TWA: 0.5 mg/m^3(skin)

ACGIH TLV
TWA: 0.5 mg/m^3(skin)

NIOSH REL
10-hr TWA: 0.5 mg/m^3(skin)

IDLH Level
Ca. 500 mg/m^3

DFG (Germany) MAK
TWA: 0.5 mg/m^3(skin)
Category III: substances with systemic effects
Onset of Effect: > 2 hr
Half-life: > shift length (strongly cumulative)

Peak Exposure Limit: 5 mg/m^3, 30 min. average value, 1/shift

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Chlordane is an organochlorine insecticide. It is a solid or a colorless to amber, viscous liquid with a pungent, chlorine odor. It was banned in 1988 by the EPA because of its toxicity and persistency and bioconcentration in the environment. Inhalation does not appear to be a significant problem at normal use levels, but high concentrations would produce effects. However, skin absorption and ingestion of even small amounts can adversely affect the central nervous system, liver, and kidneys. Numerous deaths have been associated with exposure to chlordane. The pure compound is noncombustible, but because it was produced as a solution, its flammability is dependent on the solvent used.

Wilson Risk Scale
R 1
I 3
S 2*
K 0
*Skin absorption

HMIS
H 2
F 1†
R 0

† Varies depending on the solvent(s) present. Doesn't burn when pure.
PPE‡
‡Sec. 8

Potential Health Effects

Primary Entry Routes: Skin absorption, ingestion, inhalation.
Target Organs: Skin, liver, kidneys, blood, central nervous system, respiratory system.
Acute Effects
Inhalation: Acute toxic exposures via inhalation would cause symptoms similar to those via ingestion.
Eye: Contact can be irritating.
Skin: Contact may produce irritation. This appears to have been more common prior to 1951 when a greater proportion of hexachlorocyclopentadiene was added. Chlordane can be absorbed through the skin in concentrations high enough to cause death. In one case, an accidental application caused death via respiratory failure within 40 minutes post exposure. (See ingestion symptoms)
Ingestion: Chlordane primarily affects the CNS by increasing excitability. Symptoms include confusion, agitation, tremor, incoordination, delirium, convulsions ranging from myoclonic jerking to violent seizures, and coma. Liver (enlargement) and kidney damage (no urine output due to degeneration of kidney tubules) is possible. Blood dyscrasias (imbalance in blood components) are common. Death is possible from respiratory or kidney failure.

Carcinogenicity: Chlordane is listed by the following agencies in regard to carcinogenicity: EPA-B2 (Probable human carcinogen, sufficient animal and insufficient human evidence), IARC-2B (Possible human carcinogen, limited human evidence in absence of sufficient animal evidence), DFG MAK-B (Justifiably suspected as having carcinogenic potential), and NIOSH-X (Carcinogen defined without further categorization). In animal studies there is numerous evidence that chlordane is cancerous in mice, but these studies have not been reproduced in other animal species.

Medical Conditions Aggravated by Long-Term Exposure: Liver and kidney disorders.

Chronic Effects: Because chlordane is retained in fat cells, chronic toxicity is a problem. A survey of homeowners who had their homes treated for termites with chlordane reported symptoms such as sinusitis, bronchitis, migraine, asthma, neuritis and neuralgia (pain with or without nerve degeneration, respectively) and ovarian and uterine diseases. However, it cannot be determined which and how many of these effects were due solely to exposure to chlordane.

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 for at least 15 min. *Do not* scrub! 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. *Do not* scrub because this will increase absorption risk. 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, then induce vomiting (most effective if done within 30 min. of ingestion).

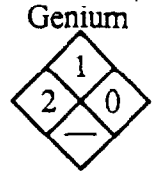
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Chlordane's metabolites oxychlordane and heptachlor epoxide are indicators useful for biological monitoring. Dialysis, exchange transfusion, and hemoperfusion are ineffective. Oral administration of cholestyramine may enhance excretion.

Special Precautions/Procedures: Do not administer adrenergic amines which may further increase myocardial irritability and produce refractory ventricular arrhythmias. For seizures: Diazepam IV bolus - 5 to 10 mg, repeated every 15 min. PRN up to 30 mg. If seizures cannot be controlled or recur, administer phenytoin or phenobarbital.

Section 5 - Fire Fighting Measures

Genium



Flash Point: 225°F (107.2 °C), in kerosine solvent. Flash point may be <100 °F (212 °C) depending on solvent. Pure chlordane is a noncombustible solid.

Flash Point Method: OC

Autoignition Temperature: 410°F (210°C) in kerosine solvent

LEL: 0.7% v/v (kerosine solvent)

UEL: 5% v/v (kerosine solvent)

Flammability Classification: Class IIIB Combustible liquid (in kerosine solvent).

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or alcohol-resistant foam.

Unusual Fire or Explosion Hazards: Container may explode in heat of fire. Vapors may travel to ignition source and flash back. Chlordane solutions pose a vapor explosion hazard indoors, outdoors, and in sewers.

Hazardous Combustion Products: Include chlorine, hydrogen chloride, phosgene, and carbon oxide gases.

Fire-Fighting Instructions: If possible without risk, move container from fire area. Apply cooling water to container sides until well after fire is out. Stay away from ends of tanks. 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 is not effective for fires involving chlordane.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against exposure.

Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material.

Large Spills

Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.

Cleanup: Mop any residue with a mild alkali solution (will release the chlorine).

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). Containers should be aluminum, aluminum clad, or high-bake phenolic enamel-lined metal.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically bond and ground all equipment used with and around chlordane.
Ventilation: Provide general or 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)
Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin, liver, kidneys, blood, CNS and respiratory system.
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 any detectable levels, use a SCBA or supplied-air respirator (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.
Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Teflon has a breakthrough time of > 4 hr and is a suitable material for PPE. 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.
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 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 - Physical and Chemical Properties

Physical State: Solid (pure), liquid (technical)
Appearance and Odor: Colorless to amber, viscous liquid with a pungent, chlorine odor.
Odor Threshold: 5×10^{-4} ppm
Vapor Pressure: 0.00001 mm Hg at 25 °F (77 °C)
Formula Weight: 409.8
Specific Gravity (H_2O=1, at 4 °C): 1.56 at 25 °C (77 °F)
Water Solubility : 9 µg/L at 77 °F (25 °C)
Octanol/Water Partition Coefficient: log Kow = 2.78
Other Solubilities: Soluble in aliphatic and aromatic hydrocarbons including deodorized kerosine. Decomposes in alkalis.
Boiling Point: 347 °F (175 °C) at 2 mm Hg
Melting Point: 203 to 204.8 °F (95 to 96 °C), *pure* solid
Viscosity: 69 P at 77 °F (25 °C)
Refraction Index: 1.56 to 1.57 at 77 °F (25 °C)
Surface Tension: 25 dyne/cm at 68 °F (20 °C)

Section 10 - Stability and Reactivity

Stability: Chlordane is stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization does not occur.
Chemical Incompatibilities: Include oxidizers and alkalis. Corrosive to iron and zinc. Attacks some forms of plastics, rubber, and coatings.
Conditions to Avoid: Exposure to heat, ignition sources, and incompatibles.
Hazardous Decomposition Products: Thermal oxidative decomposition of chlordane can produce toxic chlorine, phosgene, hydrogen chloride, and carbon oxide gases.

Section 11- Toxicological Information

Toxicity Data:*

Acute Inhalation Effects:
Cat, inhalation, LC_{50}: 100 mg/m^3/4 hr caused somnolence, excitement and convulsions or effect on seizure threshold.

Carcinogenicity: Mouse, oral: 2020 mg/kg given for 80 continuous weeks caused liver tumors.

Mutagenicity: Human, lymphocyte cell: 10 µmol/L caused mutation.

Teratogenicity: Mouse, oral: 152 mg/kg given for 1 to 19 days of pregnancy caused developmental abnormalities of the immune and reticuloendothelial systems.

Acute Oral Effects:
Man, oral, TD_{Lo}: 3071 µg/kg produced coma, difficulty breathing, and nausea or vomiting.
Human, oral, LD_{Lo}: 29 mg/kg caused fatty liver degeneration.
Human, skin, LD_{Lo}: 428 mg/kg caused tremor, ataxia, and convulsions or effect on seizure threshold.
Rat, oral, LD_{50}: 200 mg/kg

* See NIOSH, *RTECS* (PB9800000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Goldfish, TLm = 0.5 ppm/96 hr; bluegill, LC_{50} = 57 to 74.8 µg/L/96 hr; brown trout, LC_{50} = 11.1 µg/L/96 hr; mallard duck, LD_{50} = 858 ppm; pheasant, LD_{50} = 430 ppm.

Bioconcentration: Pinfish (*Lagodon rhomboides*), 96 hr BCF = 6227; frogs (*Xenopus laevis*), 96 hr BCF = 108

Environmental Degradation: Chlordane is not very mobile in soil and is not likely to leach. The degradation rate is estimated at 4.05 to 28.33%/yr with a mean half-life of 3.3 yr. It can volatilize from the surface (especially if soil is moist). In water, chlordane is not expected to hydrolyze oxidize, or undergo direct photolysis. It volatilizes with an estimated half-life of 7.3 to 7.9 hr from a river 1 m deep, glowing 1 m/sec, with a wind velocity of 3 m/sec at 73.4 °F (23 °C). In air, chlordane will react in the vapor phase with photochemically produced hydroxyl radicals with an estimated half-life of 6.2 hr.

Section 13 - Disposal Considerations

Disposal: Chlordane is a good candidate for liquid injection incineration or rotary kiln incineration. Although chlordane is decomposed by alkalis, the basic objection to this treatment is time. It could take several days to weeks to ensure complete hydrolysis. If spilled in water at > 10 ppm, apply activated carbon at 10 X spilled amount. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Container Cleaning and Disposal: Triple rinse containers and dispose of rinse water as you would other chlordane waste. If possible, return to supplier for reuse or if this is not in accordance with 49 CFR 173.28, puncture container and either ship to scrap metal facility for recycling or send to landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Organochlorine pesticides liquid, flammable, toxic, n.o.s. flash point less than 23 °C*
Shipping Symbols: –
Hazard Class: 3
ID No.: UN2762
Packing Group: II
Label: Flammable liquid, Poison
Special Provisions (172.102): –

Packaging Authorizations
a) Exceptions: None
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.243

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 1 L
b) Cargo Aircraft Only: 60 L

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

* Depending on the flash points of the solvent involved, if greater than 73 °F (23 °C), the UN No. will be 2995.

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste Number (40 CFR 261.33): U036
RCRA Hazardous Waste Classification (40 CFR 261.33): Not classified
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per CWA, Sec. 311 (b)(4)
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
SARA 311/312 Codes: 1, 2
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Threshold Planning Quantity (TPQ): 1,000 lb
OSHA Regulations:
Listed as a Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 73, 103, 124, 126, 127, 132, 133, 136, 148, 153, 168, 183, 186

Prepared By ..... M Gannon, BA
Industrial Hygiene Review ..... DJ Wilson, CIH
Medical Review ..... J Brent, MD, PhD

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Material Safety Data Sheets Collection

DDT (Dichlorodiphenyltrichloroethane)
MSDS No. 155
Date of Preparation: 10/93

Section 1 - Chemical Product and Company Identification 42

Product/Chemical Name: .... DDT (Dichlorodiphenyltrichloroethane)
Chemical Formula: ..... $(ClC_6H_4)_2CHCCl_3$
CAS No.:..... 50-29-3
Synonyms: Agritan; 2,2-bis(*p*-chlorophenyl)-1,1,1-trichloroethane; chlorophenothan; Citox; dichlorodiphenyltrichloroethane; Dicophane; diphenyltrichloroethane; Genitox; Kopsol; NCI-C00464; Neocid; Pentech; trichlorobis (4-chlorophenyl) ethane; 1,1'-(2,2,2-trichloroethylidene)bis(4-chlorobenzene), Zerdane.
Derivation: Prepared by condensing chloral or chloral hydrate with chlorobenzene in presence of sulfuric acid.
General Use: One of the most widely used contact insecticides from 1945 until its ban in 1972. Although banned in the U.S. (except for such uses as emergency health situations and for controlling body lice), it is still widely used in the tropics for control of vector-carrying diseases such as malaria, yellow fever, dengue, filariasis, louse-borne typhus, and louse-borne relapsing fever.

Section 2 - Composition / Information on Ingredients

DDT: *p'p*'DDT 70% wt + *o'p*'DDT 30% wt (technical grade)
Trace Impurities: DDD, DDE

OSHA PELs
8-hr TWA: 1 mg/m^3 (skin)

ACGIH TLVs
TWA: 1 mg/m^3

NIOSH REL
10-hr TWA: 0.5 mg/m^3
Ca*: (Limit of quantitation: 0.1 mg/m^3)

IDLH Level
Ca*

DFG (Germany) MAK (skin)
TWA: 1 mg/m^3 (total dust)
Category III: Substances with systemic effects
Onset of effect: > 2 hr.
Peak Exposure Limit: 10 mg/m^3, 30 min. average value, 1/shift

* Ca = Carcinogen

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

DDT is a white to gray, crystalline solid. Although it has been banned in the U.S. because of its persistence in the environment and potential for bioaccumulation, DDT has not produced toxicity in workers who either manufactured or used it (even over many years). However, this lack of toxicity is based on inhalation and skin absorption. If DDT is ingested, especially in large amounts, central nervous system effects will occur with possible liver damage. DDT is considered a confirmed animal carcinogen and a suspected human carcinogen.

Wilson Risk Scale	
R	1
I	3
S	1*
K	2

*Skin absorption

HMIS	
H	2†
F	2
R	0

†chronic effects
PPE‡
‡Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin contact.
Target Organs: Central nervous system, liver, skin, peripheral nervous system.
Acute Effects
Inhalation: Inhalation does not appear to cause toxicity beyond that of minor mechanical irritation.
Eye: Exposure to 423 mg/m^3/1 hr/day for 6 days caused eye irritation.
Skin: Skin absorption may occur from some DDT solutions, but degree of absorption will depend on the solvent involved. Aqueous solutions and the powder or crystals are not easily absorbed.
Ingestion: DDT can cause a variety of central nervous system effects if ingested. Large doses generally result in vomiting, while smaller doses cause symptoms within 2 to 3 hr post-ingestion. Symptoms include tingling of the lips, tongue, and face; malaise; headache; sore throat; fatigue; tremors of the head, neck, and eyelids; apprehension; ataxia; and confusion. Convulsions and paralysis of the hands is possible in severe exposures (if vomiting does not occur). Vital signs are usually normal, but in severe poisonings, the pulse may be irregular and abnormally slow. Based on animal studies, it is expected that ventricular fibrillation and sudden death can occur at any time during acute poisoning. Recovery from acute poisoning generally occurs within 24 hr except in the most serious cases.
Carcinogenicity: DDT is considered a suspected human carcinogen by several governmental agencies. IARC-2B (possibly carcinogenic to humans, limited evidence in humans in the absence of sufficient evidence in experimental animals), NTP-2 (reasonably anticipated to be a carcinogen: limited human evidence or sufficient animal evidence), EPA-B2 (sufficient animal evidence; inadequate human evidence), and NIOSH-X (carcinogen defined without further categorization)
Medical Conditions Aggravated by Long-Term Exposure: Possibly, disorders of the central nervous system and liver.

Chronic Effects: There are conflicting reports on whether or not DDT produces chronic effects in humans. Although it is well established that chronic exposure in experimental animals produces effects including liver damage, CNS degeneration, dermatitis, weakness, convulsions, coma, and death, these effects are not confirmed in humans. Liver cancer is confirmed in animals, but has not been documented in humans. These conflicting reports appear due to the lack of documented chronic toxicity in workers and data showing that DDT and its metabolites are retained in the body fat for long time periods, thus providing a basis for the *possibility* of chronic toxicity.

Other: Solvents such as kerosine are added to DDT as a vehicle and, depending on the type involved, may be more toxic than DDT itself.

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 away any loose material and wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Carefully dispose of contaminated clothing because it may pose a fire hazard.

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. *Do not* induce vomiting. Gastric lavage should be performed promptly.

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

Notes to Physicians: Effects may be delayed; keep under observation.

Special Precautions/Procedures: Amobarbital or pentobarbital is recommended for the relief of central neurological manifestations; tribromoethanol and paraldehyde are recommended for allaying prolonged convulsions.

Section 5 - Fire-Fighting Measures

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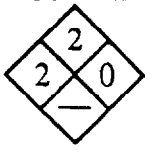

Flash Point: DDT itself is noncombustible but is dissolved in a variety of solvents. The average quoted Flash Point is 162 °F (72.2 °C) although the specific vehicle is not identified.

Flash Point Method: CC

Autoignition Temperature: None reported

LEL: None reported

UEL: None reported

Flammability Classification: Class IIIA Combustible Liquid (varies depending on vehicle)

Extinguishing Media: For small fires, use dry chemical, water spray, or regular foam. For large fires, use water spray, fog, or regular foam.

Unusual Fire or Explosion Hazards: Container may explode in heat of fire.

Hazardous Combustion Products: Chloride fumes and carbon oxide gases.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Fight fire from maximum distance. Stay away from ends of tanks.

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 fire fighters' protective clothing is *not* effective.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate area, deny entry, and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against contamination.

Small Spills: For dry spills, carefully scoop up material or vacuum (with an approved filter). Damp mop any residue. For small solution spills, take up with earth, sand, vermiculite, or other absorbent material and place in suitable containers for disposal.

Large Spills

Containment: Dike far ahead of liquid spill for later reclamation or 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. Keep dry chemical extinguishers on hand in case of fire.

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 10). *Do not* store in aluminum or iron containers.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around DDT.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below 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)

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the liver and central nervous system.

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 any detectable concentration, use a SCBA with a full facepiece and operated in pressure demand or other positive-pressure mode, or any supplied-air respirator with a full facepiece and operated in pressure demand or other positive-pressure mode with an auxiliary SCBA. 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.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets made of butyl rubber to prevent prolonged or repeated skin contact. 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.

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 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 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: White to gray crystals or powder which is odorless or has a slight aromatic odor.

Odor Threshold: 5.0725 mg/m^3

Vapor Pressure: 5.5 x 10^{-6} mm Hg at 68 °F (20 °C)

Formula Weight: 354.48

Specific Gravity (H_2O=1, at 4 °C): 0.98 to 0.99

Water Solubility : 0.0012 ppm

Other Solubilities (g DDT/100 mL): acetone 58, 95% alcohol 2, benzene 78, benzyl benzoate 42, carbon tetrachloride 45, chlorobenzene 74, cyclohexanone 116, dibutyl phthalate 33, o-dichlorobenzene 68, dichlorodifluoromethane 2, dioxane 100, ethyl ether 28, gasoline 10, isopropanol 3, kerosine 8 to 10, methylated naphthalenes 40 to 60, mineral oil 5, morpholine 75, peanut oil 11, pine oil 0 to 16, tetralin 61, tributyl phosphate 50, and xylene 60.

Boiling Point: 365 °F (185 °C)

Melting Point: 227 °F (108.3 °C)

Section 10 - Stability and Reactivity

Stability: DDT is stable at room temperature in closed containers under normal storage and handling conditions. It biodegrades very slowly.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Strong oxidizers, alkaline materials, iron and aluminum salts.

Conditions to Avoid: Exposure to heat, ignition sources, and incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of DDT can produce carbon dioxide.

Section 11- Toxicological Information

Toxicity Data:*

Eye Effects: None reported.

Skin Effects: None reported.

Acute Oral Effects:
Human, oral, LD_{Lo}: 500 mg/kg caused convulsions, cardiac arrhythmias, and respiratory changes.
Rat, oral, LD_{50}: 87 mg/kg; details not reported

Carcinogenicity: Rat, oral, TD_{Lo}: 1225 mg/kg given for 7 continuous weeks caused liver tumors.

Mutagenicity: *E. coli*: 15 µmol/L caused DNA damage.

Teratogenicity: Rat, oral, TD_{Lo}: 112 mg/kg given to a 56 day old male caused paternal effects (spermatogenesis, testes, epididymis, sperm duct).

* See NIOSH, *RTECS* (KJ3325000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Glass shrimp (*Palaemonestes kadiakensis*), LC_{50} = 2.3 mcg/L/96 hr at 69.8 °F (21 °C); Japanese quail, 2 month old male, (*Coturnix japonica*), LD_{50} = 841 mg/kg; bluegill (*Lepomis macrochirus*), LC_{50} = 28.7 mcg/L/36 hr.

Environmental Degradation: In water, DDT will adsorb strongly to sediments, significantly bioconcentrate in fish, and will be subject to considerable evaporation with an estimated half-life of several hr to almost 50 hr from certain waters. It may biodegrade when high concentrations of required microbes (*Escherichia*, *Hydrogenomonas*, and *Saccharomyces*) are present. On land, DDT will adsorb strongly and should not appreciably leach to groundwater. It may evaporate (half-life of 100 days) and is subject to photooxidation from soil. DDT may significantly biodegrade in flooded soils or under anaerobic conditions provided high populations of the required microbes are present. Half-life ranges from 2 to >15 yr. In the air, DDT is subject to direct photooxidation and reaction with photochemically produced hydroxyl radicals (est. half-life = 2 days). Wet and dry deposition are significant mechanisms for removal from air.

Section 13 - Disposal Considerations

Disposal: DDT is a good candidate for rotary kiln or liquid injection incineration (furnace with afterburner and alkali scrubber). 60 to 80% removal of DDT from contaminated soils has been achieved in 10 min. by super critical-carbon dioxide extraction. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Container Cleaning and Disposal: Triple rinse containers. Containers in good condition should be returned to the manufacturer and those that are not reusable should be punctured and transported to a scrap metal facility for recycling, disposal, or burial in a designated landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Organochlorine pesticides, solid toxic, n.o.s.
Shipping Symbols: —
Hazard Class: 6.1
ID No.: UN2761
Packing Group: III
Label: Keep Away From Food
Special Provisions (172.102): —

Packaging Authorizations
a) Exceptions: 173.153
b) Non-bulk Packaging: 173.213
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 100 kg
b) Cargo Aircraft Only: 200 kg

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

Section 15 - Regulatory Information

A Regulations:
RCRA Hazardous Waste Number (40 CFR 261.33): U061
Listed as a RCRA Hazardous Waste Classification (40 CFR 261.33)
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); and CWA, Sec. 307(a)
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
SARA Toxic Chemical (40 CFR 372.65): Not listed
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, 101, 103, 124, 126, 127, 132, 133, 136, 139, 148, 153, 167, 168, 169, 176, 180, 183

Prepared By ..... M Gannon, BA
Industrial Hygiene Review ..... PA Roy, MPH, CIH
Medical Review ..... T Thoburn, MD, MPH

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Material Safety Data Sheets Collection:

Sheet No. 683
Polychlorinated Biphenyls (PCBs)

Issued: 11/88 Revision: A, 9/92

Section 1. Material Identification

Polychlorinated Biphenyls [$C_{12}H_{10-n}Cl_n$ (n=3, 4, 5)] Description: A class of nonpolar chlorinated hydrocarbons with a biphenyl nucleus (two benzene nuclei connected by a single C-C bond) in which any or all of the hydrogen atoms have been replaced by chlorine. Commercial PCBs are mixtures of chlorinated biphenyl isomers with varying degrees of chlorination. Prepared industrially by the chlorination of biphenyl with anhydrous chlorine in the presence of a catalyst such as ferric chloride or iron filings. Except for limited research and development applications, PCBs have not been produced in the US since 1977. When large quantities of PCBs were manufactured in the US, they were marketed under the tradename Aroclor (Monsanto) and were characterized by four digit numbers. The first two digits indicating biphenyls (12), triphenyls (54), or both (25, 44); the last two digits indicating the weight percent of chlorine. PCBs' thermal stability, nonflammability, and high dielectric capability made them very useful in electrical equipment. Formerly used as additives in hydraulic fluids, heat transfer systems, lubricants, cutting oils, printer's ink, fire retardants, asphalt, brake linings, automobile body sealants, plasticizers, adhesives, synthetic rubber, floor tile, wax extenders, dedusting agents, pesticide extenders, and carbonless reproducing paper. PCBs are still used in certain existing electrical capacitors and transformers that require enhanced electrical protection to avoid heating from sustained electric faults.

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

NFPA

HMIS
H 2‡
F 1
R 0
PPE†
† Sec. 8
‡ Chronic Effects

Other Designations: CAS No. 1336-36-3, Aroclor, Clophen, Chlorextol, chlorinated biphenyls, chlorinated diphenyl, chlorinated diphenylene, chloro biphenyl, chloro-1,1-biphenyl, Dykanol, Fenclor, Inerteen, Kaneclor, Montar, Noflamol, Phenoclor, Pyralene, Pyranol, Santotherm, Sovol, Therminol FR-1

Cautions: PCBs are potent liver toxins that may be absorbed through skin. Potentially, chronic or delayed toxicity is significant because PCBs accumulate in fatty tissue and may reasonably be anticipated to be carcinogens. PCBs are a bioaccumulative environmental hazard. When burned, decomposition products may be more hazardous than the PCBs.

Section 2. Ingredients and Occupational Exposure Limits

PCBs, contain various levels of polychlorinated dibenzofurans and chlorinated naphthalenes as contaminants

1991 OSHA PELs, Skin
8-hr TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m^3
8-hr TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m^3

1990 DFG (Germany) MAK, Danger of Cutaneous Absorption
TWA (Chlorodiphenyl, 42% chlorine): 0.1 ppm (1 mg/m^3)
Category III: Substances with systemic effects, onset of effect > 2 hr., half-life > shift length (strongly cumulative)
Short-term Level: 1 ppm, 30 min., average value, 1 per shift
TWA (Chlorodiphenyl, 54% chlorine): 0.05 ppm (0.5 mg/m^3)
Category III: (see above)
Short-term Level: 0.5 ppm, 30 min., average value, 1 per shift

1985-86 Toxicity Data*
Rat, oral, TD: 1250 mg/kg administered intermittently for 25 weeks produced liver tumors.
Mammal, oral, TD_{Lo}: 325 mg/kg administered to female for 30 days prior to mating and from the 1st to the 36th day of gestation produced effects on newborn (stillbirth; live birth index; viability index).

1990 NIOSH REL
TWA (Chlorodiphenyl, 42% chlorine): 0.001 mg/m^3
TWA (Chlorodiphenyl, 54% chlorine): 0.001 mg/m^3

1992-93 ACGIH TLVs, Skin *
TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m^3
TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m^3

* These guidelines offer reasonably good protection against systemic intoxication, but may not guarantee that chloroacne won't occur.
† See NIOSH, *RTECS* (TQ1350000), for additional reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: 644-707 °F (340-375 °C)
Melting Point: 42%: -2.2 °F (-19°C); 54%: 14 °F (-10 °C)
Vapor Pressure: 1 mm Hg at 100 °F (38 °C); 10^{-6} to 10^{-3} mm at 20 °C
Molecular Weight: 188.7 to 398.5

Specific Gravity: 1.3 to 1.8 at 20 °C
Water Solubility: Low solubility (0.007 to 5.9 mg/L)
Other Solubilities: Most common organic solvents, oils, and fats; slightly soluble in glycerol and glycols.

Appearance and Odor: PCBs vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins, depending upon chlorine content.

* Physical and chemical properties vary widely according to degree and to the position of chlorination.

Section 4. Fire and Explosion Data

Flash Point: 286-385 °F (141-196 °C) OC*	Autoignition Temperature: 464 °F (240 °C)	LEL: None reported	UEL: None reported

Extinguishing Media: Use extinguishing media suitable to the surrounding fire. Use dry chemical, foam, carbon dioxide (CO_2), or water spray. Water spray may be ineffective. Use water spray to cool fire-exposed containers or transformers. Do not scatter PCBs with high-pressure water streams. **Unusual Fire or Explosion Hazards:** Combustion products (hydrogen chloride, phosgene, polychlorinated dibenzofurans, and furans) are more hazardous than the PCBs themselves. **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. Approach fire from upwind to avoid highly toxic decomposition products. Structural firefighter's protective clothing will provide *limited* protection. Do not release runoff from fire control methods to sewers or waterways. Dike for later disposal.

* Flash points shown are a range for various PCBs. Some forms do not have flash points.

Section 5. Reactivity Data

Stability/Polymerization: PCBs are very stable materials but are subject to photodechlorination when exposed to sunlight or UV (spectral region above 290 nanometers). Hazardous polymerization cannot occur. **Chemical Incompatibilities:** PCBs are chemically inert and resistant to oxidation, acids, and bases. **Conditions to Avoid:** Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition [1112-1202 °F (600-650 °C)] of PCBs can produce highly toxic derivatives, including polychlorinated dibenzo-para-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), hydrogen chloride, phosgene and other irritants.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] and NTP[169] list PCBs as an IARC probable carcinogen (overall evaluation is 2A; limited human data; sufficient animal data) and NTP anticipated carcinogen, respectively. **Summary of Risks:** PCBs are potent liver toxins that can be absorbed through broken skin in toxic amounts without immediate pain or irritation. PCBs have low acute toxicity, but can accumulate in fatty tissue and severe ..lth effects may develop later. Generally, toxicity increases with a higher chlorine content; PCB-oxides are more toxic. The toxic action on the ..ver also increases with simultaneous exposure to other liver toxins, e.g. chlorinated solvents, alcohol, and certain drugs. Pathological pregnancies (abnormal pigmentations, abortions, stillbirths, and underweight births) have been associated with increased PCB serum levels in mothers; PCBs can be passed in breast milk. PCBs can affect the reproductive system of adults. **Medical Conditions Aggravated by Long-Term Exposure:** Skin, liver, and respiratory disease. **Target Organs:** Skin, liver, eyes, mucous membranes, and respiratory tract. **Primary Entry Routes:** Inhalation, dermal contact, ingestion. **Acute Effects:** Exposure to PCB vapor or mist is severely irritating to the skin, eyes, nose, throat, and upper respiratory tract. Intense acute exposure to high concentrations may result in eye, lung, and liver injury. Systemic effects include nausea, vomiting, increased blood pressure, fatigue, weight loss, jaundice, edema and abdominal pain. Cognitive, neurobehavior and psychomotor impairment and memory loss have also been seen after acute exposure. **Chronic Effects:** Repeated exposure to PCBs can cause chloroacne; redness, swelling, dryness, thickening and darkening of the skin and nails; swelling and burning of the eyes, and excessive eye discharge; distinctive hair follicles; gastrointestinal disturbances; neurological symptoms including headache, dizziness, depression, nervousness, numbness of the extremities, and joint and muscle pain; liver enlargement; menstrual changes in women; and chronic bronchitis. Cancer, primarily liver, is also a possible result of exposure, but data is inconclusive.

FIRST AID **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Rinsing eyes with medical oil (olive, mineral) initially may remove PCB and halt irritation better than water rinsing alone. 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. *Multiple soap and water washings are necessary.* Avoid the use of organic solvents to clean the skin. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** In most cases, accidental PCB ingestion will not be recognized until long after vomiting would be of any value. Never give anything by mouth to an unconscious or convulsing person. Vomiting of the pure substance may cause aspiration. Consult a physician. **Note to Physicians:** Monitor patients for increased hepatic enzymes, chloroacne, and eye, gastrointestinal, and neurologic symptoms listed above. Diagnostic tests include blood levels of PCBs and altered liver enzymes.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, provide adequate ventilation, and isolate hazard area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. For small spills, take up with sand or other noncombustible material and place into containers for later disposal. For larger spills, dike far ahead of spill to contain for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** PCBs have been shown to bio-concentrate significantly in aquatic organisms. **Ecotoxicity:** Bluegill, TLm: 0.278 ppm/96 hr. Mallard Duck, LD_{50}: 2000 ppm. **Environmental Degradation:** In general, the persistence of PCBs increases with an increase degree of chlorination. **Soil Absorption/Mobility:** PCBs are tightly absorbed in soil and generally do not leach significantly in most aqueous soil systems. However, in the presence of organic solvents, PCBs may leach rapidly through the soil. Volatilization of PCBs from soil may be slow, but over time may be significant. **Disposal:** Approved PCB disposal methods include: incineration with scrubbing, high-efficiency boilers, landfills, and EPA-approved alternative disposal methods. Each disposal method has various criteria. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
RA Hazardous Waste (40 CFR 261.33): Not listed
RA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1 lb (0.454 kg) [* per CWA, Sec. 311(b)(4) and 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 respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. Minimum respiratory protection should include a combination dust-fume-mist and organic vapor cartridge or canister or air-supplied, depending upon the situation. 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 all skin contact. Butyl rubber, neoprene, Teflon, and fluorocarbon rubber have break through times greater than 8 hrs. **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. Segregate contaminated clothing in such a manner so that there is no direct contact by laundry personnel. Implement quality assurance to ascertain the completeness of the cleaning procedures. 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 closed, labelled, container in a ventilated area with appropriate air pollution control equipment. **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:** Inform employees of the adverse health effects associated with PCBs. Limit access to PCB work areas to authorized personnel. Consider preplacement and periodic medical examinations with emphasis on the skin, liver, lung, and reproductive system. Monitor PCB blood levels. Consider possible effects on the fetus. Keep medical records for the entire length of employment and for the following 30 yrs.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Polychlorinated biphenyls
DOT Hazard Class: 9
No.: UN2315
T Packing Group: II
OT Label: CLASS 9
Special Provisions (172.102): 9, N81

Packaging Authorizations
a) Exceptions: 173.155
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.241

Quantity Limitations
a) Passenger Aircraft or Railcar: 100 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: 34

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 163, 164, 168, 169, 174, 175, 180
Prepared by: MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy MPH, CIH; **Medical Review:** AC Darlington, MD

Marathon Oil Company

No. 1

MATERIAL SAFETY DATA SHEET PAGE 1 OF

PRODUCT NAME: PREMIUM UNLEADED GASOLINE
MARATHON MSDS NO: 124MAR001

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: 114MAR381

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA (CONT'D)

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 (CONT'D)

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: 114MAR301

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!

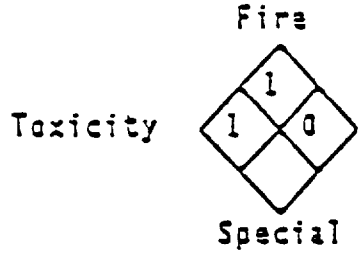
EXTREMELY FLAMMABLE

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)

KENDALL NON-DETERGENT MOTOR OIL, ALL SAE GRADES

(COMMENTS continued)

Prepared by: Robert Kellam
Title: Group Supervisor, Lubricants Testing, Maintanance, and Safety
Original Date: 05/18/81 Sent to: SCOTT DUNNBAR
Revision Date: 04/01/93 OHM
Supersedes : 04-05-90 53335 TRIANGLE PARK, SUITE 450
Date Sent : 10/21/93 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.

MSDS 2011

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 GREEN 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	Conditions		Conditions to Avoid: NONE
	Stable	XX	

Incompatibility (Materials to Avoid): AVOID STRONG BASES

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

Routes(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 DETERGENT

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, Nitrodorm, 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.

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	Nearest 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/cup 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

Hygiene Practices: Wear safety glasses. With repeated or prolonged [illegible] 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	approximately decomposes
Specific Gravity (H2O=1)	1.095
Solubility in Water	complete
pH	11.4

DATE PREPARED 1/92

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

DATE ISSUED: 09/11/92
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
07270 - 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: 100 ppm (300 mg/m3) for an 8-hour workday
BASIS: 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 gagging, 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.

No. 6

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.

F. PHYSICAL DATA

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

BOILING RANGE
160-350°C (320-662°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 still area. Minimize breathing vapors. Minimize skin contact. Ventilate confined spaces. Clean 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)

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

belief, accurate and reliable as of the date issued. Exxon does not warrant or guarantee their accuracy or reliability, and Exxon shall not be liable for any loss or damage arising out of the use thereof.

The information and recommendations are offered for the user's consideration and examination, and it is the user's responsibility to satisfy itself that they are suitable and complete for its particular use. If buyer repackages this product, legal counsel should be consulted to insure proper health, safety and other necessary information is included on the container.

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

FOR ADDITIONAL INFORMATION ON HEALTH EFFECTS CONTACT:
DIRECTOR OF INDUSTRIAL HYGIENE
EXXON COMPANY, U.S.A.
KELLOGG TOWER, ROOM 550
P. O. BOX 2180
HOUSTON, TX 77252-2180
(713) 656-2443

FOR OTHER PRODUCT INFORMATION CONTACT:
MANAGER, MARKETING TECHNICAL SERVICES
EXXON COMPANY, U.S.A.
ROOM 2255
P. O. BOX 2180
HOUSTON, TX 77252-2180
(713) 656-3349

17-325; 17-325-2; 17-325-3 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

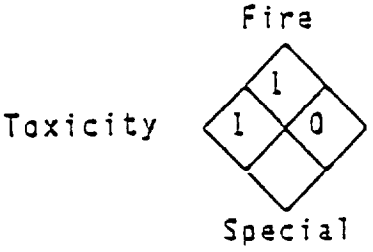
No. 8

WITCO MATERIAL SAFETY DATA SHEET

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

Product Code: 473 6752

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 Kallam

Title: Group Supervisor, Lubricants Testing, Maintenance, and Safety

Original Date: 05/20/81 Sent to: DAVID DABOIEN

Revision Date: 04-12-90 OHM CORP

Supersedes : 07-19-89 2910 WEST BEAVER ST

Date Sent : 10/30/92 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.

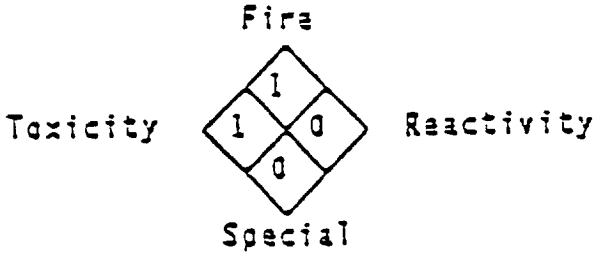
FE
No. 9

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.
Usual Fire and Explosion Hazards:
none

(Continued on next page)

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

Product Code: J63 7834

(Section III continued)

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

HEALTH HAZARD DATA---SECTION IV

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

SPECIAL PROTECTION INFORMATION---SECTION V

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

HANDLING OF SPILLS OR LEAKS---SECTION VI

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

(Continued on next page)

WITCO — MATERIAL — SAFETY — DATA — SHEET

Kendall C-915 Grease

Product Code: J63 7834

SPECIAL PRECAUTIONS---SECTION VII

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

TRANSPORTATION DATA---SECTION VIII

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

Robert Kellam

Prepared by: L.D.DROMGOLD
Title: MANAGER,NEW PRODUCTS
Original Data: 06/18/82
Revision Data: 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

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.

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 nontoxic 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

NA = Not Applicable NO = No Data NE = Not Established

This form complies with OSHA Form 174.

ISI-1.20:

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

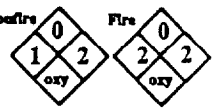
Calcium Hypochlorite Description: Calcium hypochlorite dihydrate precipitates from chlorinated lime slurry and caustic soda and is dried under vacuum to produce calcium hypochlorite. Used as a disinfectant (for swimming pools), bleaching agent (paper towels), fungicide, deodorant, oxidizing agent, bactericide,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

NFPA



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: 11/4/90

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
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 SOLUBILITY: Soluble in Water
BOILING POINT: N.D. FREEZING POINT: N.D.
SPECIFIC GRAVITY: 1.035-1.055 VAPOR PRESSURE: N.D.
MELTING POINT: N.A. 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

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

Telephone
(216) 642-6600

MATERIAL SAFETY DATA SHEET No. 12

PRODUCT NAME	CAS #
Compressed Air	N/A
TRADE NAME AND SYNONYMS Compressed Air; Air; Compressed Air, Breathing Quality	DOT ID No. UN 1002
	DOT Hazard Class Nonflammable gas
CHEMICAL NAME AND SYNONYMS See last page.	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

mpressed air at high pressures will accelerate the burning of materials to a greater rate than they burn at atmospheric pressure.

REACTIVITY DATA

STABILITY Unstable		CONDITIONS TO AVOID
Stable	X	N/A

INCOMPATIBILITY (Materials to avoid)
None

HAZARDOUS DECOMPOSITION PRODUCTS
None

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

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

N/A

ASTE DISPOSAL METHOD

N/A

RESPIRATORY PROTECTION (Specify type)
N/A

VENTILATION	LOCAL EXHAUST	SPECIAL
N/A	N/A	N/A
	MECHANICAL (Gen.)	OTHER
	N/A	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.

No. 13

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-3855

GENIUM PUBLISHING CORP.

No. 674

ISOBUTYLENE

Issued: November 1988

SECTION 1. MATERIAL IDENTIFICATION

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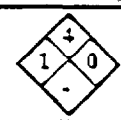
Material Name: ISOBUTYLENE

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. 3

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

	%	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-

No. 13

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 es are rapid respiration and air hunger, diminished mental alertness, and impaired muscular coordination. Continuing lack of oxygen uses 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 ximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of this material below the lower explosive limit d in section 4. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by minating 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

ferences: 1, 6, 34-94, 116, 117, 120, 122.

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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, Spectar.
Derivation: Treating propylene with sulfuric acid and then hydrolyzing or direct hydration of propylene using superheated steam. Most commonly available as rubbing alcohol (70% IPA).
General Use: As a solvent for gums, shellac, and essential oils, chemical intermediate, dehydrating agent, vehicle for germicidal compounds, de-icing agent for liquid fuels; for denaturing ethyl alcohol, preserving pathological specimens; in extraction of alkaloids, quick-drying inks and oils, and an ingredient of skin lotions, cosmetics, window cleaner, liquid soaps, and pharmaceuticals.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Isopropyl alcohol, 100% vol. Most commonly sold as 70% isopropyl alcohol (rubbing alcohol).

OSHA PELs
8-hr TWA: 400 ppm (980 mg/m^3)
STEL: 500 ppm (1225 mg/m^3) *

ACGIH TLVs
TWA: 400 ppm (983 mg/m^3)
STEL: 500 ppm (1230 mg/m^3)

NIOSH REL
10-hr TWA: 400 ppm (980 mg/m^3)
STEL: 500 ppm (1225 mg/m^3)

IDLH Level
12,000 ppm

DFG (Germany) MAK
TWA: 400 ppm (980 mg/m^3)
Category II: Substances with systemic effects
Half-life: < 2 hr

Peak Exposure Limit: 800 ppm, 30 min. average value, 4/shift

* Vacated 1989 Final Rule Limits

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Isopropyl alcohol is a highly flammable, volatile liquid. It is considered more toxic than ethyl alcohol, but less toxic than methyl alcohol. Inhalation can cause irritation of the eyes and respiratory tract and central nervous system depression at high concentrations. Repeated skin contact may cause dermatitis. Systemic toxicity appears to occur mostly in cases of heavy ingestion or inhalation. There is recent evidence that skin absorption may be more likely to cause systemic effects than previously thought.

Wilson Risk Scale	
R	1
I	2
S	2*
K	3

*Skin absorption

HMIS	
H	1
F	3
R	0
PPE*	

*See 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin contact/absorption.
Target Organs: Eyes, skin, respiratory system.
Acute Effects
Inhalation: Vapor inhalation is irritating to the respiratory tract and can cause central nervous system depression at high concentrations. Volunteers exposed to 400 ppm for 3 to 5 min experienced mild eye and respiratory irritation. At 800 ppm, irritation was not severe, but most people found the air uncomfortable to breathe.
Eye: Exposure to the vapor or direct contact with the liquid causes irritation and possible corneal burns.
Skin: Some irritation may occur after prolonged exposure.
Ingestion: Accidental ingestions have provided the most information on isopropyl alcohol toxicity. Symptoms include nausea and vomiting, headache, facial flushing, dizziness, lowered blood pressure, mental depression, hallucinations and distorted perceptions, difficulty breathing, respiratory depression, stupor, unconsciousness, and coma. Kidney insufficiency including oliguria (reduced urine excretion), anuria (absent urine excretion), nitrogen retention, and edema (fluid build-up in tissues) may occur. One post-mortem examination in a case of heavy ingestion showed extensive hemorrhagic tracheobronchitis, bronchopneumonia, and hemorrhagic pulmonary edema. Death can occur in 24 to 36 h post-ingestion due to respiratory paralysis.
Carcinogenicity: NTP and OSHA do not list isopropyl alcohol as a carcinogen. The IARC has studied IPA and has classified it as Class-3 (unclassifiable, inadequate human and animal evidence). There appears to be an association between the *manufacture* (strong acid process, rather than the alcohol itself) of isopropanol and parasinus cancer, but this may be due to the diisopropyl sulfate or isopropyl oil by-products.
Medical Conditions Aggravated by Long-Term Exposure: Dermatitis or respiratory or kidney disorders.
Chronic Effects: Repeated skin contact can cause drying of skin and delayed hypersensitivity reactions in some individuals.

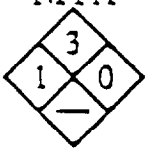
Other: Isopropyl alcohol is oxidized in the body to acetone where it is excreted by the lungs or kidneys. Some acetone may be further metabolized to acetate, formate, and finally carbon dioxide. Probable oral lethal dose is 240 mL.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Vomiting may be contraindicated because of the rapid onset of central nervous system depression. Gastric lavage is preferred.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Diagnostic test: acetone in urine.

Section 5 - Fire Fighting Measures

NFPA



Flash Point: 53 °F (12 °C)
Flash Point Method: CC
Burning Rate: 2.3 mm/min.
Autoignition Temperature: 750°F (399°C)
LEL: 2 % v/v
UEL: 12.7 % v/v at 200 °F
Flammability Classification: Class 1B Flammable Liquid
Extinguishing Media: Carbon dioxide, dry chemical, water *spray* (solid streams can spread fire), alcohol-resistant foam, or fog.
Unusual Fire or Explosion Hazards: Container may explode in heat of fire. Vapors may travel to an ignition source and flash back. Isopropyl alcohol poses an explosion hazard indoors, outdoors, and in sewers.
Hazardous Combustion Products: Carbon oxides and acrid smoke.
Fire-Fighting Instructions: If possible without risk, move container from fire area. Apply cooling water to container side until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw and let fire burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. *Do not* release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides only limited protection.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against vapor inhalation and skin/eye contact. Water spray may reduce vapor, but may not prevent ignition in closed spaces.
Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers.
Large Spills
Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use non-sparking tools to open containers.
Storage Requirements: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec 10). Install electrical equipment of Class 1, Group D.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around IPA.
Ventilation: Provide general or local exhaust ventilation systems to maintain airborne levels below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin, kidneys, and respiratory system. Be extra cautious when using IPA concurrently with carbon tetrachloride because animal studies have shown it enhances carbon tetrachloride's toxicity.
Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Nitrile rubber (breakthrough time > 8 hr), Neoprene and Teflon (breakthrough time > 4 hr) are suitable materials for PPE. Do not use PVA, PVC or natural rubber (breakthrough time < 1 hr). Wear protective eyeglasses or chemical safety goggles, 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* (NT3050000), 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 *Desulfovibrio*. Spray waste into incinerator (permit-approved facilities only) equipped with an afterburner and scrubber. Isopropyl alcohol can be settled out of water spills by salting with sodium chloride. Note: Salt may harm aquatic life, so weigh the benefits against possible harm before application. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
Container Cleaning and Disposal: Triple rinse containers.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Isopropanol or isopropyl alcohol
Shipping Symbols: –
Hazard Class: 3
ID No.: UN1219
Packing Group: II
Label: Flammable Liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) **Exceptions:** 173.150
b) **Non-bulk Packaging:** 173.202
c) **Bulk Packaging:** 173.242

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

Vessel Stowage Requirements
a) **Vessel Stowage:** B
b) **Other:** –

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste Number (40 CFR 261.21)
RCRA Hazardous Waste Classification (40 CFR 261.21): Characteristic of Ignitability
Listed (Unlisted Hazardous Waste, Characteristic of Ignitability) as a CERCLA Hazardous Substance (40 CFR 302.4) per CRA, 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

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Material Safety Data Sheets Collection:

Sheet No. 440
Methane

Issued: 7/80 Revision: A. 3/89

Section 1. Material Identification

29

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
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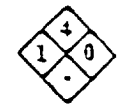
S -
K 4



NFPA

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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 fatigue, 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 HO-2A, HO-3, HO-4, HO-5 LUBRIPLATE Hydraulic Oils - HO-0, HO-1, HO-2,	FORMULA 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
Schenectady, NY 12303-1836 USA
(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 1173): 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 FOR Review

Indust. Hygiene/Safety [illegible] 12/87

Medical Review [illegible] 12/87

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.

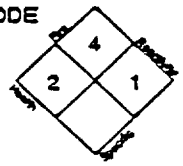
If more information is needed, please contact:

R. L. Lewis
First Brands Corporation
88 Long Hill Street
East Hartford, CT 06108
(203)728-6181

No. 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

FIRST BRANDS

Material Safety Data Sheet
PRESTONE® Engine Starting Fluid

III. HAZARDOUS INGREDIENTS

(includes IARC, NTP, OSHA and ACGIH listed carcinogens greater than 0.1%)

MATERIAL	%	CAS #	EXPOSURE LIMIT	SOURCE
Ethyl ether	40-70	60-29-7	400 ppm TWA	(3)
			500 ppm STEL	(3)
n-heptane	25-60	142-82-5	400 ppm TWA	(3)
			500 ppm STEL	(3)
Methylcyclohexane	25-60	108-87-2	400 ppm TWA	(3)
Carbon dioxide	5-10	124-38-9	10000 ppm TWA	(1)
			5000 ppm TWA	(2)
			30000 ppm STEL	(3)

NON-HAZARDOUS INGREDIENTS > 1%
None

None of the other ingredients is listed as a carcinogen or potential carcinogen by OSHA, NTP or IARC.

The source for exposure limits listed above are:
(1) OSHA Permissible Exposure Limit (effective 9/89)
(2) ACGIH Threshold Limit Value (1988-89 Edition)
(3) Both the OSHA PEL and ACGIH TLV
(4) Recommended by the Manufacturer

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT
Tag Open Cup: Not determined
Pensky-Martens Closed Cup: -49°F

AEROSOL FLAME EXTENSION
Greater than 18 inches

FLASHBACK
Yes

AEROSOL FIRE PROTECTION LEVEL
Level 3 Aerosol (NFPA 30B)

FLAMMABLE LIMITS IN AIR, % BY VOLUME
LOWER: 1.85
UPPER: 36.5

AUTOIGNITION TEMPERATURE
180°C

EXTINGUISHING MEDIA
Foam, alcohol foam, carbon dioxide, and dry chemical. Water may be unsuitable except as cooling medium.

SPECIAL FIRE FIGHTING PROCEDURES
Use self-contained breathing apparatus. Toxic fumes may be emitted.

UNUSUAL FIRE AND EXPLOSION HAZARDS
Extremely flammable contents, pressurized containers. Vapors are heavier than air and may travel or be moved by air currents and be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharges or other ignition sources at locations distant from product handling point.

V. HEALTH HAZARD DATA

EFFECTS OF SINGLE OVEREXPOSURE

SWALLOWING	May cause signs and symptoms of systemic intoxication, with incoordination, blurred vision, headache, analgesia, unconsciousness and respiratory failure due to depression of the central nervous system. Due to high volatility, may rapidly distend the stomach, causing discomfort and may make breathing difficult. May also cause pneumonitis if aspirated.
SKIN ABSORPTION	Significant absorption not expected.
INHALATION	Acts as a narcotic or general anesthetic. May cause irritation of the respiratory tract with cough and also signs and symptoms of intoxication, with incoordination, blurred vision, headache, analgesia, unconsciousness, cardiac irregularities, and respiratory failure due to depression of the central nervous system. Breathing high vapor concentrations may cause heart rate irregularities, possibly fatal, particularly in persons with heart disease.
SKIN CONTACT	May cause mild irritation, experienced as local redness.

EYE CONTACT	Exposure to liquid or high concentrations of vapor may cause irritation, experienced as redness, excess tearing, and possible swelling of the conjunctiva.

EFFECTS OF REPEATED OVEREXPOSURE

Repeated skin exposure can cause cracking and drying. Repeated inhalation may cause loss of appetite, exhaustion, headaches, drowsiness, dizziness, cardiac arrhythmia, central nervous system excitability, and psychic disturbances.

OTHER EFFECTS OF OVEREXPOSURE

May cause albuminuria and polycythemia.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE

Because of its irritating and defatting properties, this material may aggravate an existing dermatitis. Existing cardiac conditions may be aggravated if inhaled in high concentrations and may be fatal as a result of serious arrhythmia and cardiac decompensation.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARDS

None currently known.

EMERGENCY AND FIRST AID PROCEDURES

SWALLOWING	Give at least 2 glasses of milk or water if the patient is conscious. Do not induce vomiting. Call a physician immediately.
SKIN	Wash with soap and water.
INHALATION	Remove to fresh air. Give artificial respiration if not breathing. CPR may be required if cardiac arrest occurs. Oxygen may be given if necessary. Call a physician.
EYES	Immediately flush eyes with plenty of water for least 15 minutes. Seek medical attention, preferably an ophthalmologist.
NOTES TO PHYSICIAN	May produce arrhythmia, especially in a person with an irritable myocardium. Because of possible arrhythmogenic effects, sympathomimetics should be used with caution. Avoid the use of epinephrine.

There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition. Artificial ventilation may be required if coma is deep and breathing shallow.

VI. REACTIVITY DATA

STABILITY Stable.

HAZARDOUS POLYMERIZATION
Will not occur.

CONDITIONS TO AVOID Heat, sparks and open flames.

INCOMPATIBILITY (Materials to Avoid)
Strong oxidizing agents.

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS
Extremely flammable. Will burn to form carbon dioxide, carbon monoxide. May form oxides of nitrogen.

VII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
Wear appropriate personal protective equipment and remove all sources of ignition. Contain spill using absorbent material and collect material for disposal in a container suitable for flammable waste. See Section IV, "Unusual Fire and Explosion Hazards."

WASTE DISPOSAL METHOD
Waste material is a RCRA hazardous waste due to ignitability if discarded in its purchased form. Incineration, treatment or landfilling should be carried out in accordance with applicable RCRA Federal, State, and Local regulations.

VIII. SPECIAL PROTECTION INFORMATION

(for manufacturing and bulk spill cleanup)

RESPIRATORY PROTECTION
Use NIOSH/MSHA approved chemical cartridge respirator for operations which may result in employee exposure above the Permissible Exposure Limit (PEL).

VENTILATION Use local exhaust ventilation for operations which may result in employee exposure above the PEL.

PROTECTIVE GLOVES None required under normal use. PVA (polyvinyl alcohol) gloves are recommended for operations which may result in repeated skin contact.

EYE PROTECTION Safety glasses are considered adequate for normal use.

OTHER PROTECTIVE EQUIPMENT
None required

IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

- DANGER: Extremely flammable. Do not store near heat, sparks or open flame.
- Do not inhale vapors; use in well ventilated area.
- Avoid eye and prolonged skin contact.
- Do not drink or swallow contents.
- Contents under pressure; do not store at temperatures above 120°F.

OTHER PRECAUTIONS

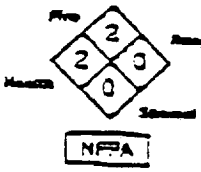
Observe all requirements of plant, company or government regulations.

KEEP OUT OF REACH OF CHILDREN.

No. 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)	Information:	(619) 275-1400
	P.O. Box 80607	Chemical Name:	Organic Mixture
	San Diego, California 92138-9021	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	
Incompatability:	Strong oxidizing materials	
Hazardous decomposition products:	Thermal decomposition may yield carbon monoxide and/or carbon dioxide.	
Hazardous polymerization:	May occur	Will not occur X

VII. SPILL OR LEAK PROCEDURES

Spill Response Procedures

Absorb small quantities with sand, earth, sawdust. Large quantities pump into tank.

Waste Disposal Method

Incinerate liquid, bury saturated absorbent in land fill. Dispose of in accordance with local, state and federal regulations.

VIII. SPECIAL HANDLING INFORMATION

Ventilation:	Sufficient to keep solvent vapor less than TLV.
Respiratory Protection:	Advised when concentrations exceed TLV.
Protective Gloves:	Advised to prevent possible skin irritation.
Eye Protection:	Approved eye protection to safeguard against potential eye contact, irritation or injury.
Other Protective Equipment:	None required.

IX. SPECIAL PRECAUTIONS

Keep from open flame, do not take internally. Avoid excessive inhalation of spray particles. Keep from children.

X. TRANSPORTATION DATA

Domestic Surface

Description:	Petroleum Distillate Mixture
Hazard Class:	Combustible Liquid
ID No.:	UN 1268
Label Required:	NONE, for containers less than 100 Gallons

Domestic Air

Description:	Petroleum Distillate Mixture
Hazard Class:	Combustible Liquid
Label Required:	NONE, for containers less than 110 Gallons

SIGNATURE: R. Miles R Miles TITLE: Technical Director

REVISION DATE: March 1990 SUPERSEDES: April 1988

NA = Not applicable 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 Corporation

ACCIDENT/INJURY/ILLNESS REPORT FORM

Form 0004
H & S Dept.
6/91

☐ Accident	☐ Injury	☐ Illness
Property Damage	☐ Yes	☐ No
Vehicle Involved	☐ Yes	☐ No

Health & Safety Use Only

Case # _____
☐ First Aid Only
☐ Medical Treatment
☐ Lost Workdays – Restricted Activity
☐ Lost Workdays – Away from Work
☐ Fatality

xact 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

ROJECT IDENTIFICATION (Project Related Incidents Only)

Project No. _____ Project Start Date _____ Completion Date _____

ocation (Full Address) _____

Telephone _____ Project Manager _____

MPLOYEE INFORMATION

Employee's Full Name _____ Employee No. _____

☐ Regular Full Time ☐ Regular Part Time ☐ Temporary ☐ Non-Employee

Home Address _____

Date of Birth _____ Age ____ Social Security No. ____ – ____ – ____ Sex ☐ M ☐ F

Job Title _____ Department _____ Date Hired _____

Length of Employment ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs. Time in Job Class ☐ In Training, ☐ ____ Mos. ☐ ____ Yrs.

Name of Employee's Direct Supervisor _____

Supervision at Time of Accident ☐ Directly Supervised ☐ Indirectly Supervised ☐ Not Supervised

Specific Location Where Incident Occurred _____

_____ ☐ OHM Facility ☐ Project Site ☐ Other _____

To Whom Was Incident Reported? _____ When? _____

Witness Name/Address _____

Witness Job Title/Reason in Area _____

Describe Employee's Job Duties Being Performed When Injured _____

_____

_____

Describe Fully the Events Which Resulted in the Accident/Injury/Illness _____

_____

_____

PLEASE CONTINUE ON BACK OF THIS FORM

(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 _____

Are You Reporting This Incident as an Industrial Injury/Illness? ☐ Yes ☐ No

Signature _____ (Employee) Date _____

Signature _____ (Supvr/Manager) Date _____

Signature _____ (Safety Officer) Date _____

Signature _____ (Proj. Manager) Date _____

Signing This Report does Not Constitute Certification of an Industrial Claim

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 Corporation

Form 0065
H & S Dept.
6/91

INJURY/ILLNESS STATUS REPORT

Employee _____ Social Security No. ____ - ____ - ____

Home Address _____ Phone _____

Job Title _____ Home Division _____

Date/Time of Injury/Illness _____ ____ a.m. Location: ☐ OHM Facility ☐ Project Site

____ p.m. ☐ Other _____

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 Corporation 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 _____

PHYSICIANS OR MEDICAL PERSONNEL TO COMPLETE REMAINDER OF FORM

WORK STATUS

☐ Patient may return to work with no limitations

_____
Date

☐ Patient may return to work on _____
Date
with limitations indicated. These restrictions are in effect until _____ or until Reevaluation
Date

on _____
Date

Patient may work _____ hours in a work day.

☐ Patient 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 pounds 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 patient 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. Patient may use hands for repetitive:
   ☐ Single grasping ☐ Pushing & pulling
   ☐ Fine manipulation
3. Patient may use feet for repetitive movement as in operating foot controls:
   ☐ Yes ☐ No
4. Patient is able to:

	Frequently	Occasionally	Not at All
a. Bend	☐	☐	☐
b. Squat	☐	☐	☐
c. Climb	☐	☐	☐

PHYSICIANS REPORT

Diagnosis _____

Prognosis _____

Other _____

_____

☐ Referred to company physician
☐ Patient referred/admitted:

To Whom _____

Address _____

Phone _____

Date _____ Time _____

Date of this Report _____ Physician's Signature _____

Address _____ Phone _____

White – OHM
Canary – Clinic Copy

16406 U.S. Route 224 E. • P.O. Box 551 • Findlay, OH 45839-0551 • (419) 425-6064

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:						

AIR MONITORING INSTRUMENT
(LEL/0_2/PID/FID/HCN/H_2S)
CALIBRATION/MAINTENANCE LOG

Type Instrument:_____ Date:_____

Model Number:_____ Performed By:_____

OHM or Serial No:_____

Battery Check:_____

Instrument Zero:_____

Alarm Check/Set:_____

Maintenance Performed:
., sensor, lamp, battery replacement)

_____

_____

_____

_____

Comments:

_____

_____

_____

_____

_____

Calibration Data

Calibration Standard:_____

Instrument Response:_____

Calibration Respone:_____

Span Setting (PID/FID):_____

0_2 Calibration Setting:_____

Notes:

General Condition of Instrument:_____

_____

Battery Last Charged:__/__/__Duration of Charge:_____

Other:

_____

_____

_____

_____

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 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

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:		

OHM Remediation Services Corp.'s
" CARDINAL " SAFETY RULES

- No failure to report Accidents/ Injuries immediately; No misrepresenation of injuries
- No failure to comply with all safety requirements, procedures or policies
- No illicit drugs/alcohol
- No fighting
- No horseplay
- No malicious destruction of company property
- No firearms

Failure to comply with these rules will result in immediate discharge.

HAZARD ANALYSIS

ACTIVITY _____ ANALYZED BY/DATE _____ REVIEWED BY/DATE _____

Principal Steps	Potential Hazards	Recommended Controls
Identify the principal steps involved and the sequence of work activities	Analyze each principal step for its potential hazards	Develop specific controls for each potential hazard
Equipment To Be Used	**Inspection Requirements**	**Training Requirements**
List equipment/machinery to be used in conducting the work activities	List inspection requirements for the equipment/machinery listed	Determine requirements for worker training, including hazard communication